UNIVERSITY OF CAMBRIDGE

Conference Proceedings

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Design Management Conference
7-8 September 2011

NEW THINKING IN DESIGN MANAGEMENT

Conference Proceedings

Contents

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Design Management Group
Institute for Manufacturing
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Conference Organisers

IfM Education and Consultancy Services Ltd
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Programme Overview

Wednesday 7 September 2011	
09.00	Registration and refreshments
10.00	Conference opening and welcome
10.15	**Keynote presentation** ***Jeanne Liedtka*** *Professor of Business Administration, Darden School of Business*
11.00	Refreshment break
11.15	Session 1
12.45	Lunch
13.30	Parallel Sessions 2
15.00	Refreshment break
15.15	Parallel Sessions 3
16.50	**Keynote presentation** ***Ralf Beuker*** *Dean, Faculty of Design, Muenster University of Applied Sciences*
17.30	Sessions close
19.00	for 19.30 Conference dinner at Corpus Christi

Thursday 8 September 2011	
08.15	Refreshments available
08.30	**Keynote presentation** ***Dirk Snelders*** *Associate Professor, Department of Industrial Design, Eindhoven University of Technology*
09.15	Refreshment break
09.30	Parallel Sessions 4
11.00	Refreshment break
11.15	Parallel Sessions 5
12.45	Lunch
13.30	Parallel Sessions 6
15.00	Refreshment break
15.15	Sessions 7
16.15	Conference conclusions and close

Keynote Speakers

Jeanne Liedtka

Professor of Business Administration, Darden School of Business

Jeanne Liedtka is a Professor of Management at the Darden Graduate School of Business at the University of Virginia. Formerly the Executive Director of the School's Batten Institute, a foundation established to develop thought leadership in the fields of entrepreneurship and corporate innovation, Jeanne has also served as Chief Learning Officer for the United Technologies Corporation (UTC), headquartered in Hartford, Connecticut, and as the Associate Dean of the MBA Program at Darden. Jeanne's current teaching responsibilities focus on design thinking, innovation, and organic growth in the MBA and Executive Education Programs at Darden.

Jeanne's current research interests focus on exploring how design thinking can be used to enrich our ability to create inclusive strategic conversations about organizational futures. Her book, The Catalyst: How You Can Lead Extraordinary Growth, co-authored with R. Rosen and R. Wiltbank, was based on a three year study of operating managers who excelled at producing revenue growth in mature organizations. Published in March 2009, The Catalyst was named one of Business Week's best innovation and design books of 2009. Her most recent book, Designing for Growth: A design toolkit for managers was published in June, 2011.

Jeanne joined Darden in 1989, having received her DBA in Management Policy from Boston University and her MBA from the Harvard Business School. She has been involved in the corporate strategy field since beginning her career as a strategy consultant for the Boston Consulting Group.

Ralf Beuker

Dean, Faculty of Design, Muenster University of Applied Sciences

Ralf Beuker holds a diploma in Business Administration from the University of Paderborn, Germany; beside his business projects he is a Professor for Design Management and Dean of the Design School at the University of Applied Sciences in Münster, Germany. Ralf's professional background is based on the areas of strategy consultancy, design management research and understanding the broader impact of design in business & society.

His most recent book/article contributions comprise "This Is Service Design Thinking" (M. Stickdorn/J. Schneider, bis publishers, 2010), "Brand Driven Innovation" (E. Roscam Abbing, ava academia, 2010) and "Two Faces of Social Media: Brand Communication and Brand Research" (R. Beuker/E. Roscam Abbing, DMI Review, 2010).

Ralf has taught Strategy, Brand and Innovation Management at all leading design management programs in Europe. These days Ralf is a guest lecturer at TU Delft, NL (http://bit.ly/TU-Delft), EURIB Institute, Rotterdam (http://eurib.org), HGK Lucerne, Switzerland (http://designmanagement.hslu.ch) and the Open University, United Kingdom (http://bit.ly/OU-Strategy). Since 1998 he runs http://design-management.de, the first blog worldwide dedicated to the field. Other than that he can be found as @iterations on twitter.com as well as on Linkedin (http://linkd.in/ralfbeuker) for business contacts.

Dirk Snelders

Associate Professor, Department of Industrial Design, Eindhoven University of Technology

Dirk Snelders is associate professor at the Department of Industrial Design at Eindhoven University of Technology in the Netherlands, and visiting professor at the International Design Business Management (IDBM) program at Aalto university in Finland. His background is in psychology and marketing, and in teaching business related topics to design students. His current research interests focus on the importance of design for management, especially in processes of competition and innovation. Dirk Snelders has published earlier on consumer judgements of design, the role of novelty and surprise in products, the management of design, and service design. His articles have appeared in Design Issues, Design Studies, and the Journal of Product Innovation Management, among others.

Index of Papers

Index of Authors

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Design in Science: Case Studies

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Keywords: Collaboration, Multidisciplinary, Design, Science

This paper describes the findings of a series of 8 case studies in which designers collaborated with scientists at Cambridge University by supporting their research activities. It reflects on the designers' contribution to the research and highlights barriers and enablers to collaboration. In addition to the expected contribution of designers to supporting the commercialisation of technology, the study demonstrated the potential of design to have an impact on research itself. When involved earlier in research, designers can help to conceptualise applications for new technology, steer research directions, align contingent technologies and support scientists in demonstrating and communicating their work.

INTRODUCTION

Evidence suggests that the early involvement of industrial design expertise in the development of new technology can improve its potential for future application (e.g. Kotler and Rath1984, Lorenz 1994, Black & Baker 1987, Roy 1999, Gemser 2001, Hertenstein et al 2001). These studies are focussed on the development of technology in industrial settings, which is characteristically driven by commercial goals.

Despite the attention paid to the role of designers in industry, there has been surprisingly little work exploring the potential impact that design might have on scientific research. In contrast to industrial R&D, scientific research may be focussed on the generation of new knowledge.

In 2006 the UK Design Council supported a pilot scheme, in partnership with the EPSRC and UCL Ventures, to bring design consultancies into scientific research (Design Council, 2006). They aimed to explore how 'design' could add value to technologies at early stages of development. A follow-on study conducted in 2009 saw a number of consultancies paired with technology transfer offices from several of the UK's leading universities (Design Council, 2009). These consultancies provided design mentoring to scientific teams.

Participants in these studies reported several benefits of working with designers as summarised in Table 1.

Chris Rust also provides examples of collaboration between designers and scientists (Rust, 2004, 2007). He summarises the designers' contributions to research, discusses issues which may arise and suggests how designers might approach collaborations with scientists to overcome these issues. A summary of his findings are also included in Table 1:

Table 1 Findings of previous studies.

How can industrial designers contribute to scientific research?	• Speeding up the process of commercialisation. [a] • Bringing a perspective of potential users and the market place. [a] • Raising awareness of future applications. [a] • Making scientists aware of the process of commercialisation. [a] • Helping to communicate ideas between research collaborators and potential investors in an exciting and credible way. [a] • Shaping the direction of the intellectual property being developed. [a] • Visualising scenarios of use. [b] • Prototyping for quick testing of ideas. [c] • Challenging scientist's perception of their research. [c] • Applying scientists' underlying theories. [c] • Producing artefacts to aid understanding and stimulate ideas. [c] • Assisting with communication and dissemination of research. [d]
What barriers may affect collaboration between designers and scientists?	• Collaborators may not recognise designers' contribution. [c] • Designers' self image. [c] • Lack of a shared formal language. [d]
What enablers may affect collaboration between designers and scientists?	• Designers should be confident in the validity of their research contributions. [c] • Collaborators should have mutual respect for and knowledge of each others' disciplines. [c] • Designers should seek open minded collaborators. [c]

Note: [a] Design Council, 2006; [b] Design Council, 2009; [c] Rust 2004, [d] Rust 2007.

Although the results of the Design Council's exploratory case studies are encouraging, they were not recorded in sufficient detail to be conclusive. Additionally, the mentoring provided was in some instances focussed more on business strategy than on traditional industrial design skills.

Rust offers an interesting perspective on collaboration between designers and scientists but does not present empirical evidence to support his claims. Nor does he comment on how the role of design may vary depending on the context of scientific research.

This paper will aim to address the gap in empirical evidence of this phenomenon by describing a series of case studies in which designers collaborated with scientists by supporting their research activities. In each case, we asked what contribution (if any) the designers had made to the research, and what factors had either acted as barriers or enablers to the collaboration. In this way, it is hoped that a better understanding of the underlying dynamics of collaboration might be obtained so that design input can be targeted to address specific research goals.

METHODOLOGY

The research was conducted by an industrial designer and a product designer, who hereafter are referred to as the design team. The design team undertook a series of case study design projects with scientists from the University of Cambridge. Case study partners were selected to represent a variety of disciplines and stages of scientific development.

This study focussed on the natural sciences (e.g. chemistry, physics, and biology) and the applied sciences (engineering and medicine) as defined by Pierce in his outline classification of the sciences (Vehkavaara, 2001). This is because it was felt that design engagement would have more impact on the more 'tangible' sciences than on the formal and social sciences.

The case studies were split into 2 phases; in the first phase, case study partners were chosen from a selection offered by university's technology transfer office (Cambridge Enterprise). This is because it was felt that it would initially be easier to persuade scientists to participate in the study if they were actively pursuing commercialisation of their research. In the second phase of the study, the design team identified collaborators working on early stage scientific research. This was achieved by speaking to departmental 'entrepreneurship champions' who had a broad view of research being conducted at the university. The designers were able to demonstrate their capabilities to these scientists using the outputs of the phase 1 case studies. The chosen projects are summarised in Table 2:

Table 2 Summary of case studies.

Phase 1	Phase 2
• Design of an oxygen mask with an anaesthetist from the local hospital. • Development of a fluid handling system for a common lab test with two biological chemists. • Scaling down a manufacturing process for multistable materials to produce a prototype with a structural engineer. • Manufacture of technology demonstrators for structural colour materials with a team of physicists.	• Production of a range of visualisations and prototypes of Biophotovoltaic devices with a team from the Chemical Engineering and Biotechnology, Plant Science and Biochemistry departments. • Development of a piece of electronic lab notebook software with a team of stem cell biologists. • Application exploration for polymer wood composites with a team from the Chemistry, Engineering and Architecture departments. • Application exploration for products and systems which employ novel signal processing techniques with an engineer.

The cases in each phase were conducted in parallel, with phase 1 lasting approximately 12 months and phase 2 lasting around 18 months. The cases were recorded using a combination of notes, sketches, visualisations, photographs, models, voice recordings and videos. Table 3 provides a summary of the design tasks performed in five of the cases. The first three cases are discussed in detail in the author's 2011 paper (Driver et al, 2011).

This is followed by the results section in which a description is provided of each of the case studies, including a table summarising the design contributions and the barriers and enablers to collaboration as perceived by the designers.

Table 3 Summary of design tasks for each case study.

Case	Design Task	Participants	Duration
Structural colour materials	Initial meeting	D, S, TTO	½ day
	Draft project proposal	D	½ day
	Observation of forming process	D, S	½ day
	Manufacturing experimentation	D	4 days
	Brainstorm	D	1 day
	Conceptual design	D	4 days
	Concept presentation	D, S, TTO	½ day
	Manufacturing experimentation	D, S	½ day
	New application meeting	D, S, TTO	½ day
	Total		**12 days**
Biophotovoltaics	Initial meeting	D, S	½ day
	Briefing meeting	D, S	½ day
	Draft project proposal and visualisation	D	2 days
	Brainstorm	D, S	½ day
	Laboratory visit	D, S	1 day
	Concept design for poster	D	10 days
	Prototyping algae device	D	10 days
	Testing 1	S	1 day
	Amendments algae device	D	6 days
	Testing 2	S	1 day
	Write moss table funding application	D, S	2 days
	Write magazine article	D, S	1 day
	Write research proposal	D, S	3 days
	Prototype moss device	D	10 days
	Testing	S	1 day
	Prototype moss array	D	4 days
	Design moss table	D	5 days
	Total		**58.5 days**
Regenerative medicine	Initial meeting	D, S, TTO	½ day
	Draft project proposal	D	½ day
	Lab observations	D, S	2½ days
	Visualisation	D	4 days
	Concept presentation	D, S	½ day
	Tool mock-up 1	D	5 days
	Feedback meeting 1	D, S	½ day
	Tool mock-up 2	D	10 days
	Feedback meeting 2	D, S	½ days
	Total		**24 days**
Polymer wood composites	Initial meeting	D, S, A	½ day
	Draft project proposal	D	½ day
	Lab observation	D,S	½ day
	Brainstorm	D, S, A	½ day
	Concept development	D	8 days
	Total		**10 days**
Signal processing	Initial meeting	D,S	½ day
	Brainstorm	D,S	½ day
	Concept development	D	4 days
	Concept presentation	D,S	½ day
	Total		**5.5 days**

Note: D=Designer(s); S=Scientist(s); TTO=Technology transfer officer(s); A=Architect

RESULTS

Oxygen mask

An anaesthetist carrying out research into oxygen therapy identified a need for a mask which provides a near perfect seal with the patient's face. The design team helped to develop a prototype mask based upon a sealing principle devised by the scientist for user testing. The prototype did not perform as well as hoped, which lead the scientist to reconsider the sealing principle.

Table 4 Findings of oxygen mask project.

Designers' contributions to research	• The scientist was made aware of various user and market considerations which would have to be addressed by the device. • The manufacture of models and prototypes helped the scientist and the design team to quickly evaluate ideas and gain a better understanding of the mechanics of sealing to the face.
Barriers to collaboration	• The scientist conducted his own design work independently of the design team and occasionally modified their designs (this was partly because the designers were not allowed to be present during testing).
Enablers of collaboration	• The scientist carried out thorough testing of the prototypes to evaluate each design change.

Fluid handling device

A pair of biological chemists researching drug diagnostics had an idea for a novel fluid handling principle which had the potential to reduce the time taken to perform a common laboratory test called an immuno assay. The design team manufactured a prototype fluid handling device which allowed the scientists to gather test data for a funding application. They were subsequently awarded £150k of which £25k was used to employ an external design consultancy to carry out the detail design of the device. The external consultants were identified by the design team who then handed over their work. One of the scientists is now working full time to take the device through laboratory trials.

Table 5 Findings of fluid handling device project.

Designers' contributions to research	• Prototyping enabled quick testing of ideas and comparison with competing technologies. • The scientists were made aware of user and market considerations which the device would have to address. • The device has the potential to significantly reduce the time taken for many researchers to perform experiments.
Barriers to collaboration	• The scientists' description of the immuno assay procedure was complicated and included many technical terms. The design team missed a key piece of information, resulting in a prototype being produced unnecessarily.
Enablers of collaboration	• The design team created a visualisation of the immuno assay process to help them relate technical terms to graphic elements. This was checked by the scientific team to make sure that the immuno assay process had been understood. • The scientists were fully engaged in the design process with review meetings becoming mini brainstorming sessions. Design decisions were made by consensus.

Multistable materials

A structural engineer was carrying out research into techniques for forming multistable materials. Market research had identified potential applications, some of which were dependent upon the development of contingent technologies and so could not be immediately exploited. With the aim of finding a quick route to market, the scientists wanted to manufacture a demonstrator for a fashion application. To achieve this, the design team agreed to experiment with scaling down a sheet metal forming process. The designers soon realised that they would not be able to perform this task, and suggested instead the scientist focus on the development of a different forming process. They offered to manufacture test pieces if provided with a range of physical parameters by the scientist, but he claimed that this would require research which he did not have the resources to perform.

Table 6 Findings of multistable materials project.

Designers' contributions to research	• The scientist was made aware of a potential new route to commercialisation.
Barriers to collaboration	• The designers did not make their capabilities and limitations clear to the scientist, and they had no experience of this kind of project, which led to them accepting a task that they did not have the skills to fulfil. • The scientist held a senior position, and had too many teaching commitments to carry out a new piece of research himself.
Enablers of collaboration	• The scientist provided the designers with equipment, materials and space to experiment with the manufacturing process.

Structural colour materials

A team of physicists were developing a processing technique for structural colour polymers, which were manufactured in their raw form by an overseas partner company. They commissioned market research which identified 3 key potential applications. However, the scientists found that their material samples failed to stimulate enough interest from commercial partners to encourage them to invest in development. The scientists asked the designers to develop technology demonstrators for each of the product categories, so that investors might more clearly see the potential of the material.

The design team were shown the manufacturing process by a member of the scientific team and given material samples to experiment with. After some unsuccessful tests in the workshop, the designers concluded that new samples would be required to manufacture the demonstrators. The scientist explained that developing these samples would require significant investment.

Following a brainstorming session, the design team generated a range of lighting concepts which they felt would showcase the dynamic properties of the material whilst being relatively easy for the partner company to develop. They also suggested that a material 'swatch book' be created, including samples of similar materials and product visualisations to excite investors. The scientist subsequently requested new samples from the partner company, but these were again not suitable for the production of models and prototypes.

Table 7 Findings of structural colour materials project.

Designers' contributions to research	• Conceptual design and prototyping highlighted desirable material properties. • The scientists were made aware of a potential new route to commercialisation.
Barriers to collaboration	• There was a mismatch between the scientists' perception of the readiness of their material for application, and that of the designers. • The scientists were dependent upon their partner company to supply them with material, so they were less able to respond to the designers' suggestions.
Enablers of collaboration	• The designers were able to meet frequently with a member of the research team.

Biophotovoltaics

A team of scientists from the Chemical Engineering and Biotechnology, Plant Science and Biochemistry departments were collaborating on the development of Biophotovoltaic (BPV) technology. Biophotovoltaic devices generate energy from the photosynthesis of living organisms such as algae or moss. They had produced a device in the laboratory and were focussing their research efforts on characterising the system in order to obtain repeatable results so that they could publish papers. The scientists estimated that a commercially viable device was 10-20 years away.

The design team were able to arrange an initial meeting with the scientists by offering to help with the design of an exhibition stand for a science festival. The designers suggested that the scientists participate in a brainstorming session to generate future product concepts, which they then visualised for inclusion in a poster for the exhibition stand. These concepts included an algae solar panel, a floating 'lily pad' power station and a table incorporating a BPV device.

The design team suggested that they manufacture the algae solar panel so that the scientists could demonstrate to investors how the technology might be embodied. To achieve this, they worked with a member of the scientific team who was then able to test the device. Following the success of this collaboration, the designers proposed that they manufacture the BPV table and exhibit it at design shows to generate publicity for the project. The scientists agreed, and a successful funding application was made to produce the table.

The scientist asked the design team if they would be willing to contribute to a joint research proposal with an overseas university to develop a floating device. The proposal was co-written by the designers and the scientist, but the project did not go ahead as the partner university pulled out for financial reasons. The designers and scientist also co-wrote an article about the technology for a science magazine following an enquiry made at the science festival.

The design team then worked in the lab with the scientist to develop a moss device which would form the basis of the table. The table will be exhibited at the London Design Festival in 2011.

Table 8 Findings of Biophotovoltaic project.

Designers' contributions to research	• The concept visualisations stimulated the scientist to take his research in new directions. He was able to identify a series of research questions that would need to be addressed for each concept. • The poster produced for the science festival generated publicity for the project. • The manufacture of prototypes posed new challenges for the scientist in terms of scaling up the technology, and gave insights into phenomena such as the production of water at the cathode. • Funding proposals were enhanced by the inclusion of design and manufacturing expertise.
Barriers to collaboration	• The scientists were initially sceptical as to how the designers to contribute to their research.
Enablers of collaboration	• The designers' use of visualisations helped them to understand how the devices worked and were configured. These visuals acted as useful tools for communication with the scientists, as well as non-scientific stakeholders. • The scientist was fully engaged with the designers in the design process. In his own words, he considered the collaboration to be a major part of his research.

Regenerative medicine

The design team met with a senior scientist who was conducting research into the development of embryonic stem cells. Although the scientist had no immediate need of a designer, he was intrigued to see whether the team could identify any design opportunities in his research. He invited them to participate in a weekly lab meeting, and to shadow researchers in the laboratory.

The design team identified information handling as being a significant issue within the lab. New members of the research team had a huge amount of information to assimilate, meaning that some experiments were not being properly performed and recorded. This amounted in some cases to weeks of wasted time and effort.

At a feedback meeting the design team suggested that they attempt to map the research activities of the lab in order to make their processes more transparent. The map could also be used to record the development of embryonic stem cells, to which the work of the lab was closely linked. The designers then worked with a member of the scientific team to record a protocol in detail, which they then developed into a set of graphics that formed the basis of the research map.

The design team created a digital mock up of a piece of mapping software, which could be used by the scientists to plan, perform, record and share the results of their experiments. At a feedback meeting it became clear that the software concept was similar to an Electronic Lab Notebook (ELN), albeit with a more visual interface. Realising this, the designers organised a meeting with an expert in ELNs who saw value in the visual interface that had been developed, but warned against developing something from scratch, as existing systems were complex and had been in development for many years.

Table 9 Findings of regenerative medicine project.

Designers' contributions to research	• As a result of the intervention, the scientists have been able to reflect on aspects of their research practises, such as communication.
Barriers to collaboration	• The designers struggled to understand the science, it being too far removed from their normal experiences.
Enablers of collaboration	• By visualising a research protocol, the designers were able to elicit tacit knowledge from a scientist about his experimental techniques. This would otherwise have remained hidden to researchers attempting the protocol for the first time.

Polymer wood composites

A team or scientists and academics from the departments of Chemistry, Engineering and Architecture were collaborating on the development of polymer wood composites to enhance the physical properties of natural timber. An architect was leading a project to design a tall timber tower with the aim of identifying desirable properties of polymer wood composites. Meanwhile, chemists were producing small (~1cm length scale) test samples which were being analysed by the engineering department.

The designers invited the research team to participate in a brainstorming exercise to generate future product concepts for the polymer wood composites. They reasoned that it would be easier for the scientists to manufacture samples on a product scale than on a building scale. The concepts included ultra-thin wooden chairs and wooden mobile phone shells.

Table 10 Findings of polymer wood composites project.

Designers' contributions to research	• The process of brainstorming allowed the scientists to reflect on small scale applications that could feasibly be prototyped in the laboratory.
Barriers to collaboration	• The scientist was far from being able to produce samples which the designers could work with, so no practical design work took place.
Enablers of collaboration	• The research team had experience of multidisciplinary collaboration and so were open to new ideas coming from other fields.

Signal processing

An engineer researching signal processing techniques had been making use of a small electronic device to remotely monitor physical properties in sportsmen and women for exercise management and recovery. It had been suggested to her that there might be other applications for the technology, so she agreed to take part in a brainstorming exercise with the design team. The technology could be adapted for a variety of sensors, so the designers suggested that they try and map out a 'concept space' with applications on one axis and sensor types on the other. This approach allowed them to identify new applications in areas of medical monitoring and ergonomics. The designers created visualisations of key product concepts and identified a series of research questions which would have to be addressed to achieve each application.

Table 11 Findings of signal processing project.

Designers' contributions to research	• The concept space map provided the scientist with a comprehensive and structured overview of potential application areas. • The process of working backwards from a product concept or 'back casting' suggested a structure for future research and practical steps that could be taken.
Barriers to collaboration	• The scientist was busy developing the exercise management system, and so did not pursue any of the application areas identified by the designers.
Enablers of collaboration	• The designers' use of the concept space map helped to engage the scientists in the brainstorming process.

Table 12 Summary of key case study findings

Designers' contributions to research	
• Scientists were made aware of user and market considerations and routes to commercialisation. • Conceptualising future applications of new technology helped to steer research directions by providing a means of 'back casting' to identify a sequence of research questions that would need to be addressed. These concepts also helped to identify contingent technologies at an early stage. • Visualisations and prototypes helped to inspire and excite scientists, investors and the general public by demonstrating the potential applications of new technology. • The production of models and prototypes allowed ideas to be quickly evaluated and compared with competing technologies, and provided scientists with practical challenges for their research to overcome. • Experimenting with new materials technologies highlighted desirable physical properties. • Designers assisted with the communication and dissemination of research by creating visual interpretations of scientific research which could be understood by a wider audience. • Funding applications were enhanced by more effectively communicating the goals of research and including provision for design and manufacturing support to help achieve those goals. • The practise of research was enhanced by developing lab equipment and reflecting on the procedures and processes used.	
Barriers to collaboration	***Enablers of collaboration***
Scientists may be sceptical about designers' ability to contribute to scientific research.	Designers should demonstrate their capabilities and limitations using examples of previous work. Inspirational visualisations and prototypes can act as catalysts for collaboration.
Scientists may not be familiar with designers' skills and areas of expertise, and with the design process.	Scientists should be encouraged to participate in the design process.
Designers may have difficulty assimilating scientific knowledge if the concepts are outside of their normal experiences and they are unfamiliar with technical terms.	Designers can use visualisations and models to help them understand scientific concepts and link technical terms to visual elements. These interpretations can be used by designers to confirm with scientists that they have grasped key principles. Designers can use visualisations and models to elicit tacit knowledge from scientists.
There may be a mismatch between scientists' perceptions of the readiness/appropriateness of a technology for application and that of designers.	Designers can use models and prototypes to demonstrate practical capabilities and limitations of technology to scientists, and identify desirable research outcomes.
Designers may find that senior scientists are too busy to engage in collaboration.	Senior scientists may be able to delegate collaboration to other members of the research team.

DISCUSSION

Some of the cases can be grouped into the following categories:

1. Product development projects which sat at the periphery of the scientist's research (oxygen mask, fluid handling device).
2. Technology projects which were at the stage of trying to attract industrial funding for application development (multistable materials, structural colour materials)
3. Early stage scientific research projects which were far from application (Biophotovoltaics, polymer enhanced wood)

The relationship between the designers and scientists in the first category was very similar to that of designers and clients in industrial settings; the designers provided a design service to the scientists and were not asked to contribute to the research directly. There was potential for the design work to feedback into the scientist's research indirectly, by for example contributing to an academic paper about the mechanisms of sealing to the face. However, the scientist did not find the time to pursue this idea, indicating that his interests lay chiefly with developing the product.

The cases in the second category were both characterised by having struggled to stimulate investors to fund development of the technology. Both were hindered by their dependence on the development of contingent technologies; the multistable material for example had one clear application with a very large market, but it relied upon the development of another technology which the scientists estimated would take 5-10 years to reach maturity. The scientists working on the development of structural colour materials were reliant on their partner company to manufacture the raw material, so they did not have the control they desired over the samples they could produce.

Both projects seemed to suffer from the lack of a "killer application" with a large enough market to justify the financial risk of development. The scientists were interested to see if the design team could influence the manufacturing process in some way, but the designers did not have the skills or knowledge to fulfil this role. Instead, they shifted their focus to other aspects of the scientist's research which they felt showed potential. For example, the designers suggested that the scientist working on the multistable material project provide them with some parameters to produce samples using a new forming technique. The scientist stated that this would require PhD expertise for a short but not insignificant amount of time, which meant that he could not divert current students onto the task or offer something attractive enough to employ somebody to complete the work.

In the case of the structural colour materials, it seemed that the scientific team and the partner company needed to coordinate their efforts to produce samples which could be used by the designers. It transpired that the partner company, with many other commercial concerns,

were not prepared to invest in scaling up their equipment to manufacture samples of a larger size, and so the scientists found they could not move the project forward.

The cases in the third category provided the greatest opportunity for designers to directly influence scientific research. However, it was initially difficult to persuade scientific teams working on early stage science to participate in the study, as the designers could not easily define what their role would be. In addition, and the scientists admitted to being sceptical about what sort of contribution a designer could make without detailed knowledge of the science. However, the designers were able to assist with the design of an exhibition stand in exchange for the scientists' cooperation.

In contrast to the other cases, the amount of information that the designers were required to assimilate to contribute to these projects was very large, and required a significant investment of time from the scientists. The designers used visualisations to abstract the scientific information, and then communicate it back to them to make sure they had understood the key principles. These translation artefacts could be used to communicate the principles of the technology to other non-scientific stakeholders.

The brainstorming sessions held with both sets of scientists helped to elicit ideas from them as to how their technologies might be embodied. These ideas were then 'fleshed out' by the designers in their visualisations, which acted both to stimulate excitement in the project, and to make the technology elements of each concept clear. In this way, the visualisations acted as a tool for identifying a sequence of research questions which would have to be addressed by successive demonstrators in order to achieve the end application. This included parallel questions to be asked of contingent technologies.

There is no doubt that in the case of the Biophotovoltaic project, that design engagement had a significant impact on the direction and outputs of the research. The reader may wonder to what extent this success and other failures were dependent upon personal relationships between the designers and scientists. This study has not been set up to answer that question, which may form the basis of further work.

The scientist working on the signal processing project was focussed on one particular application of exercise management. The designers felt that her primary motivation at the time of the project was conducting her research rather than pursuing commercial exploitation, and that she agreed to participate in the study to see if the designers could identify any new application areas. This didn't cause a problem for the designers, and the scientist was left with a set of concepts which could be returned to at a later date or included in funding applications. It does however highlight the fact that the scientist's motivations may play a significant role in how the collaboration progresses.

It is interesting to note that in the only case study in which there were no preconceptions about how the designers might contribute to the research that the designers ended up looking at the practise of research itself. This may reflect the fact that stem cell research is concerned with interactions on a microscopic scale in which designers no not normally operate. In the

time available, the production of visualisations could only provide the designers with an insight into the processes of the lab and a top level view of the research areas of the lab – the actual science remained out of the designers' reach.

CONCLUSIONS

The study has provided an insight into the types of contributions industrial and product designers might be able to make to scientific research at different stages of development. If one compares the findings in Table 12 with those of previous studies in Table 1, many similarities can be found. However, in addition to providing the first empirical evidence of this phenomenon, the greatest contribution of this study has been to explore collaboration between designers and scientists working on early stage scientific research. Here we have seen that design has the potential to play a vital role in conceptualising applications of new technology, helping to define research milestones and aligning development of contingent technologies.

We have also seen how designers can support the commercialisation of technology by considering user and market requirements, identifying routes to market, producing prototypes and demonstrators and enhancing funding proposals. And finally we have seen how designers can play a role as interpreters, representing scientific research in new ways which can be used as tools of communication and inspiration for investors, industrialists, academics and the general public.

This study has been limited to a low number of case studies, although an important finding has been that the design engagements took place over a much longer period of time than expected – in some cases the work is still ongoing after 18 months and shows no sign of stopping. It is hoped that the body of case studies will continue to grow. Also, this paper represents only the opinions of the designers, so future work will aim to capture the scientists' perceptions of the nature of the collaborations and the impact that design engagement had on their research.

Further work will also aim to expand upon the classification of the cases using a model of scientific research developed earlier in the study. It is hoped that this could form the basis of a tool for identifying what design contributions would be most appropriate at different stages of research, and what factors might influence collaboration at these stages.

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Designing a Tool for Analysing the Current State of a Company's Co-Creation Approach

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Value co-creation is highlighted in the modern business thinking, and therefore it is also central to service design. In value co-creation customers engage in the processes of both defining and creating value. However, adopting the co-creation approach is not an easy process. The shift from a conventional supplier company centric approach to a customer centric co-creation approach is fundamental and requires more investication. The purpose of this study is to increase the knowledge of value co-creation by developing a tool for analysing the current state of a company's business approach.

INTRODUCTION

Customers' role in service settings has changed dramatically (Voima et al. 2010). Traditionally, two typical customer roles in the service settings have been 'Customer as Resource' and 'Customer as Co-producer', i.e. customers bring input resources to the service production and they usually produce parts of the service on their own and/or together with the service provider (see Ojasalo 2003). Today, customers are taking a more active role in value creation (Grönroos 2008), and the focus of the value creation processes is rapidly shifting from a conventional supplier company centric view to a more customer centric approach that aims to support customer experiences and joint value co-creation (see e.g. Voima et al. 2010; Ojasalo 2010). In the value co-creation, the service company and its customer are together creating value for the customer and financial and other value for the service company (Gupta & Lehman 2005, Ramaswamy & Gouillart 2010). Companies and their informed, networked and active customers are increasingly designing new ways that enable value co-creation, and consequently the interaction between the customer and the service provider is becoming the locus of value creation. Thus, there is an apparent shift away from the conventional business

approach that sees value embedded in products and services (value-in-exchange) to a new approach where value is embedded in personalized experiences (value-in-use) (e.g. Prahalad and Ramaswamy 2004).

Still, relatively little is known about how customers engage in value co-creation (e.g. Payne et al. 2008). In a large ranking of service research priorities (Ostrom et al. 2010), the issue of "Enhancing the Service Experience through Cocreation" is now on the top tier of research interests. Both service practitioners and service researchers need a deeper understanding of the concepts related to co-creation, and new approaches and tools that recognize the interdependencies between the customer and the service organisation (e.g. Ostrom et al. 2010). Therefore, this study will focus on this scientific and managerial knowledge gab. This study aims at increasing the knowledge of value co-creation by developing a tool for analysing the current state of a company's business approach. The study is based on an extensive literature analysis and an empirical study conducted in three case companies. Based on literature and a co-creation framework (Ojasalo 2010), the group of researchers has designed a set of interview themes focusing on central features of value co-creation and the conventional business approach. The interview themes have been tested in the three case companies; both the service providers and their business customers have been interviewed. Based on the results of the interviews and several workshops among the researchers, a tool for analysing the current state of the co-creation approach was developed and it is introduced in this paper.

The paper is organised in four sections. First, the value co-creation is studied through a focused literature review. Second, the research method is described. Third, the findings of the study (i.e. the tool) are shown. Then, the final conclusions are drawn.

VALUE CO-CREATION

From co-production to value co-creation

The classic characteristics of services highlighted in early service research have been intangibility, heterogeneity, inseparability (simultaneous production and consumption), customer participation, and perishability (e.g. Shostack 1977). Most importantly, service production has been characterised by the complexity of relationships that exist between the service provider and the customer, due to the involvement of the customer as a potential input and co-producer of the service (e.g. Lovelock & Young 1979; Goodwin 1990; Grönroos & Ojasalo 2004). In other words, customers are often both present and active participants in service production. Due to customers' increasing opportunities to participate in and put demands on the process of producing a service, the boundaries of the service organisation are expanded, including the customers inside these boundaries as temporary participants (Storbacka 1994). Customers bring input resources to the service production and they typically produce parts of the service on their own and/or together with the service provider. Four types of provider-customer relatioships have been identified (Gummesson 1993 &

1994): (1) The provider may produce the service in isolation from the customer, (2) the customer may self-serve, (3) the provider and the customer may produce the service in interaction with each other, and (4) the customers may produce the service between themselves. Co-production of services can be defined as "the degree to which the customer is involved in producing and delivering the service" (Dabholkar 1990, 484). Consequently, the challenge of managing customers and the complexity of relationships that exist between the service provider and the customer in the service production process have been central issues in service research (see Bendapudi & Leone 2003).

In different variations of customer participation in service co-production, the service company has typically still been in charge of the overall management of the process and its outcome. Recently, the meaning of value and the value creation process have been rapidly shifting form the conventional supplier company centric view to customer experiences (e.g. Prahalad and Ramaswamy 2004), and consequently the distinction between the term "co-production" and "co-creation" has been discussed in literature (see Ordanini & Pasini 2008; Ostrom et al. 2010). For example, Vargo and Lusch (2006, 44) view that the term "co-producer" is somewhat tainted with connotations of a conventional logic in which value is understood to be embedded in products/services (value-in-exchange). They point out that the customer is always a co-creator of value: "there is no value until an offering is used" (value-in-use). Also Ballantyne and Varey (2008) differentiate "co-production" and "co-creation". According to them, co-production proceeds along pre-specified guidelines and the results are specified in advance, but co-creation aims to create something new and unexpected and it includes learning something new together.

Prahalad and Ramaswamy (2004) suggest that the transition from the conventional company centric view to a co-creation approach means major changes in companies. Customers determine what they value-in-use and the supplier can only offer value propositions (Ballantyne & Varey 2008). Thus, the change is fundamental. Value becomes a joint function of actions of the provider and the customer but it is always determined by the customer (Vargo & Lusch 2006). Customers engage in the processes of both defining and creating value, and the co-creation experience of the customer becomes a very basis of value (Prahalad & Ramaswamy 2004). Consequently, the role of the service company shifts from being a producer of value to a supporter of value, and it is important to understand the value co-creating activities of the customer.

Value co-creation in a business strategy

The transformation to the value co-creation focused business approach puts demands for changes in the business strategy. Companies need new kinds of strategic thinking for an effective value co-creation (see e.g. Lusch, Vargo & O'Bien 2007). A strategy defines a clear vision about a company's goals, provides direction for growth and success, and prioritises investments. The new strategic thinking aims to influence organisational attitudes and culture towards the co-creation of value.This means that a service company needs to understand value

creation processes of itself, its customers and customers' customers (Ojasalo & Ojasalo 2009). While a conventional business strategy views that value is embedded in the products or services (value-in-exchange) and delivering value means selling to customers, a co-creation based strategy focuses on comprehensive customer solutions and value co-creation in the consumption stage (value-in-use), and it emphasizes the service as a relational, co-creative process of creating benefits (see Järvensivu 2010). In value co-creation, the formulation of a strategy starts by understanding the customer's value creating processes and selecting which of these processes the service company wishes to support. The customer's value creation process can be defined as "a series of activities performed by the customer to achieve a particular goal" (Payne et al. 2008). The positioning within the customer's processes defines the support and thus the scope of the value proposition. In other words, planning for co-creation is outside-in as it starts from an understanding of the customer's value creating processes, and aims at providing support for better co-creation of value (Payne et al. 2008). When value is co-created, the service company's contribution is a value proposition that can support customer's value creation processes, and the customer contribution is the value actualization (Gummesson 2008). In stead of making, selling and servicing, it is important to listen to the customers and learn together with them (see Ojasalo 2010).

Value co-creation in customer interactions and relationships

The co-creation approach focuses on customer-company interaction as the locus of value creation. Interactions are situations where the service company and its customer are involved in each other's processes, and have opportunities to influence each other (Grönroos 2008). Customers interact with service companies through diverse channels in complex environments characterized by physical elements, processes, and people (Ostrom et al. 2010). There can be multiple points of interaction anywhere in the system and all the points of customer-company interaction are critical for value creation. All points of interaction between the provider and the customer are opportunities for value creation (Prahalad & Ramaswamy 2004). Companies can provide diverse platforms that allow customers to interact and share their experiences (Ramaswamy & Gouillart 2010).

In the value co-creation approach, both the service company and the customer are active, alter their roles, improve their capabilities, and contribute their own resources to the value creating process (Michel et al. 2008). Dialogical interaction may results in unique value often started with spontaneous idea. Value is co-created in learning together, and dialog operates as an active interactive process of learning (e.g. Ballantyne & Varey 2008). The co-creation approach puts also demands for new management and leadership practices. New processes, roles, responsibilities and skills are needed to operate the new or changed service (Ojasalo & Ojasalo 2009). Instead of seeing transactions as an ultimate driver for financial value, value co-creation approach focuses in building long term customer relationships (Ojasalo 2010).

Value co-creation in service design

In service design, the value proposition and service processes are developed (cf. Moritz 2005). Designing value propositions that can support customer's value creation processes requires a deep, long-term development partnership with customers (Ojasalo 2009). In co-creation, customers are in a proactive role and involved at every stage of service development. A major challenge for service organisations is to integrate customers into the development process as early as possible. Two customer roles can be distinguished in service design: 'Customer as Informant' and 'Customer as Co-designer' (Ojasalo 2009). Customers are an essential source of information, innovation and creativity. By interacting and spending time with customers, deep customer insights may emerge. It is important to develop a comprehensive understanding of what creates value for the customer in general and anticipate customers' latent needs in particular. Latent needs are here defined as "opportunities for customer value of which the customer is unaware" (Narver et al. 2004). Focusing on latent needs may offer a high potential in terms of differentiation and competitiveness. When customers are invited to share all kinds of experiences and knowledge in an active dialog, customers' latent needs can be discovered and understood. By sharing the service experiences, service companies are able to learn something new together with customers which may result in new service propositions (see Payne et al. 2008).

In addition to being sources of information and ideas, customers may also be directly involved to specifically design new value propositions, i.e. co-design is one form of co-creation (see Flint & Mentzer 2006, Ojasalo 2010). Customers are no longer seen only from an observational perspective when service companies innovate and design services directly with their customers and customers are active partners in every stage of the service design process (c.f. Moritz 2005).

METHODOLOGY

This study is based on a case study approach because the purpose of the study is to investigate the co-creation phenomenon in depth (see Yin 2009). The study started by an extensive literature analysis. The purpose of the analysis was to specify a knowledge gab, to define the concepts, and to capture the theoretical basis to be able to design the first interview themes to be used in the three case companies. Based on the literature analysis and a co-creation framework (Ojasalo 2010), the group of researchers designed the interview themes in several meetings and workshops. In the first workshop, four main interview themes were identified: (1) Company's strategy, vision, aims and business environment, (2) Developing a service offering, (3) Delivering the service offering and (4) Customers. Then, several more specified questions were designed under each of the four themes. These questions were based on sets of themes and questions that each researcher had constructed individually before the workshop based on the theoretical knowledge. These themes and questions were combined and discussed over in the second workshop. Finally, the themes were further evaluated and specified in the third workshop.

The interview themes were tested in three case companies representing the knowledge intensive service (KIBS) sector. The three case companies were all medium-sized companies offering business-to-business services. After the first interviews, short researcher meetings were kept to explore the experience gained and to specify the questions. All together 27 semi-structures interviews were conducted: 21 interviewees worked in the case companies and 6 interviewees were their business customers selected by the case companies. The interviews were tape-recorded and transcribed by the research group and a research assistant.

In the following workshops among the researchers, the focus was to identify categories and criteria to analyze the interview data. The categories identified during the process were (1) Strategic thinking and business model, (2) Customer interactions and relationships, (3) Service design processes (see Table 2). Under each category, five more specified themes were identified. After this, the data was analyzed in terms of systematic coding and categorization of description and statement given by the interviewees, as well as the formation of the synthesis, which grasps these empirical evidences. Next, the findings show the co-creation tool that was developed during this study. To sum up, this tool is based on the interview themes tested in the case companies and the researcher workshops during the whole study.

FINDINGS

As a result of this study, a tool for analysing the current state of the co-creation approach was developed, and it will be next introduced. The tool consists of three components. The first component (see Table 1) is the data gathering tool including a set of basic interview themes. In other words, this component starts the analysis of the current state of company's business approach. Based on the interview themes tested in the case companies, this component includes a more simplified set of interview themes divied into three main themes: (1) Company's strategy, vision, aims and business environment, (2) Customer interactions and relationships, and (3) Service design processes. Each of the three main themes includes five more specific sub-themes.

Before starting the interviews, the key persons to be interviewed need to be identified. It is also useful to interview the company's customers by using the same interview themes slightly modified. Then the focus is on the customer's understanding of the target company's strategies, business models etc. The themes guide the discussion in the interviews, and the interviewer naturally asks more specified questions (e.g. how, why, when) when discussing the themes. It is important to let the interviewees speak freely because the key findings are ofter expressed indirectly "between the lines". Interviews typically last about one hour.

Table 1. The first component of the tool for analysing a company's co-creation approach: Interview themes for data gathering

1. Themes related to the company's strategy, vision, aims and business environment
Strategy process (how, who, how often, etc.)
The goals of the company
Value and value creation processes (incl. pricing)
Core resources, competences
Position in the value chain / value network
2. Themes related on customer interactions and relatioships
Company-customer relationships
Knowing the customer
Nature of customer interactions, customers' roles
Amount of interactions
Customers' access to information and other resources
3. Themes related on service design processes
Gathering customer insight
Processing customer information
Developing a value proposition
Testing a value proposition
Launching a value proposisiton

The second component of the tool for analysing a company's co-creation approach is called a co-creation continuum (see Table 2). This tool is used to analyse the interview data. In line with the interview themes, the value co-creation approach is analysed from three different (still partly overlapping) angles: (1) Strategic thinking and the business model, (2) Customer interactions and relationships, and (3) Service design processes. Each of the three angles has five more specified viewpoints.

In the continuum, there are two extremes in each of these viewpoints. At the other end of the continuum, the co-creation approach is not at all evident, meaning that a company is currently applying the pure conventional business approach. At the other end of the continuum, the company's business approach is led by the co-creation approach. As a result of analysing the interview data by using this tool, company's current state of the business approach is defined so that the more specified areas where co-creation is not yet apparent can be identified.

Table 2. The second component of the tool for analysing a company's co-creation approach: Co-creation continuum

A) Strategic thinking and business model	Co-creation continuum	
	Co-creation approach not evident in strategic thinking	**Business strategy led by co-creation approach**
A1. Strategy process	Top-down / Inside-out	Down-top / Outside-in
A2. Business goals	To make and sell services and products / Value-in-exchange	To jointly create comprehensive customer solutions / Value-in-use
A3. Value creation processes	Focus on own value creation processes	Focus on customers' and customers' customers value creation processes
A4. Resources	Focus on own competences and other resources, own processes and technologies	Focus on shared resources / customers' resources
A5. Position in value chain / value network	Focus on one part of the value chain, not in the business network	Focus on value networks
B) Customer interactions and relationships	Co-creation continuum	
	Co-creation approach not evident in customer interactions and relationships	**Customer interactions and relationships led by co-creation approach**
B1. Company-customer relationship	Transaction oriented	Focus on long-term customer relationships
B2. Customer insight	Segmented by size, industry and other demographic factors	Deep customer insight – knowing in person
B3. Nature of customer interactions	Passive / reactive (selling)	Proactive/ dialogue
B4. Amount of interactions	Only at the moment of exchange	Active/ two-way Anywhere / anytime
B5. Customer access to information and other resources	Very limited	Transparent
C) Service design processes	Co-creation continuum	
	Co-creation approach not evident in service design processes	**Service design processes led by co-creation approach**
C1. Gathering customer insight	Structured methods	Participatory methods, listening and learning together
C2. Processing customer information	Within the company	With customers
C3. Developing the value proposition	Top-down / Inside out	Down- top with the customers
C4. Testing value propositions	Inside	With customers
C5. Launching value propositions	Selling services/products	Providing solutions

The third component of the co-creation analysing tool is illustrated as a co-creation tree (see Figure 1). It contains the same three categories and 15 criteria that were presented in the second component. The three main roots of the tree highlight the three categories in the co-creation continuum and 15 criteria are the sub roots. The 15 circles stand for the 15 criteria, and they are the seeds of the tree. The bigger the circles are, the more evident the co-creation approach is in a company. Each circle contains a symbol to grab the meaning of the criteria. The aim of this co-creation tree is to show the current state of company's business approach more coherently and inspirable way.

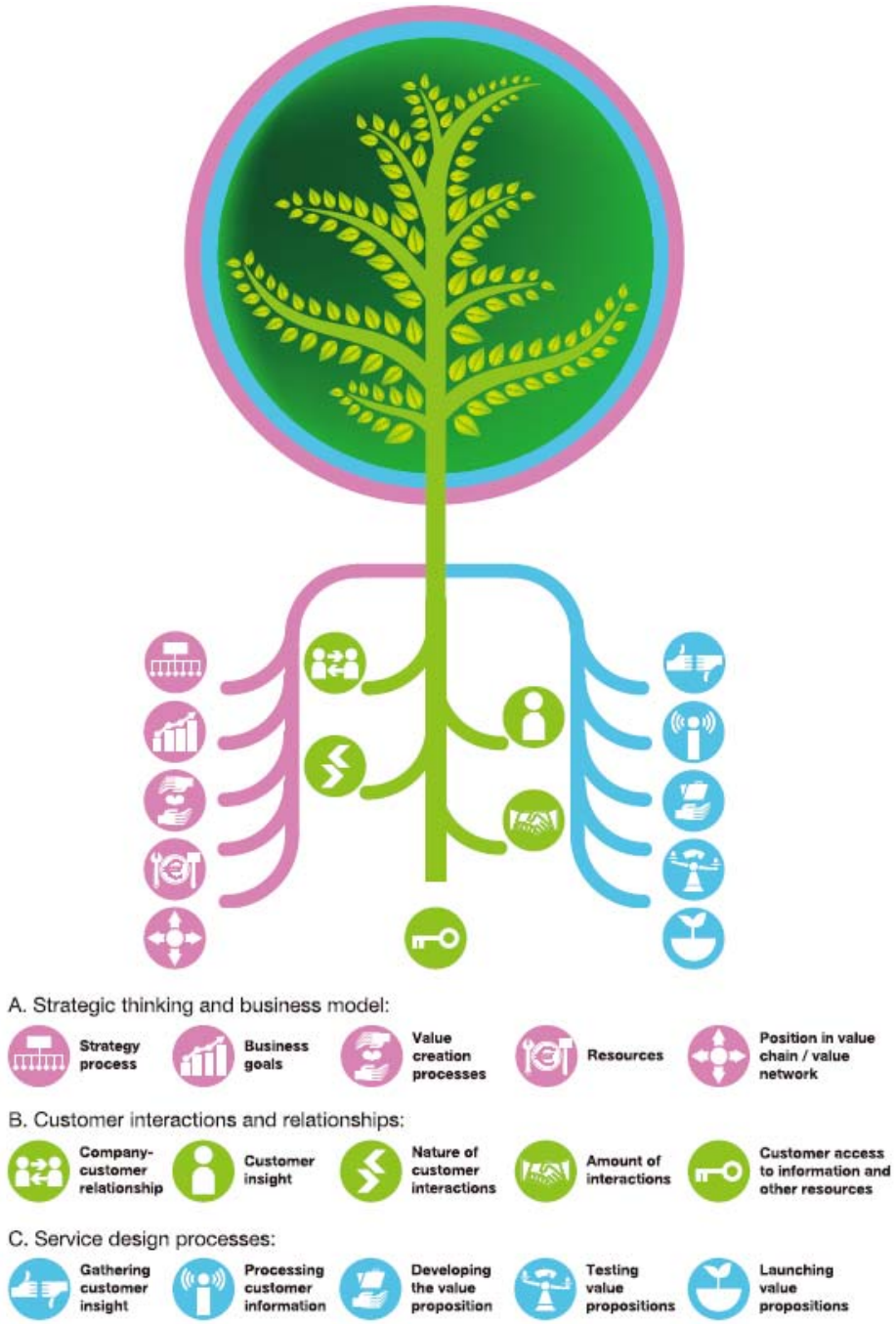

Figure 1. The third component of the tool for analysing a company's co-creation approach: The co-creation tree

CONCLUSIONS

This study contributes to the scientific discourse by enlightening the central features of value co-creation approach in a form of a tool for analysing the co-creation approach in a company. The tool is composed of three different components: (1) Data gathering tool, (2) Co-creation continuum, and (3) Co-creation tree. All the components view value co-creation from three angles: (1) Strategic thinking and the business model, (2) Customer interactions and relationships, and (3) Service design processes. The components of the tool have been developed and tested in the three case companies. Based on preliminary analyses of the data collected in this study, the tool seems to be useful and rather easy to apply. For industry, the tool enables companies to analyse their current state of value co-creation approach and helps them understand and develop their business. Since, these are the first case companies analyzed with this tool, it is evident that this tool still needs to be further developed.

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Design Process: A Path to Develop Sustainable Product Service Systems in Small And Medium Enterprises

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This paper presents the results of ongoing exploratory research into the development of sustainable Product Service Systems (PSS) in Small and Medium Enterprises (SMEs). The purpose of the research is to build understanding of how the adoption and use of Information and Communications Technologies (ICTs) can produce changes in the Design Process of SMEs that could contribute to developing sustainable PSS. Five types of relationships between Product Design and ICTs in different PSS are shown and a reference model refined after a previous study with a group of SMEs is presented. The paper outlines the preliminary analysis of a case study with Leather Manufacturing SMEs in Colombia where the role of the design process was explored through semi-structured interviews with the companies. Finally the implications of considering the design process as a path to achieve the development of sustainable PSS are discussed.

1. INTRODUCTION

Sustainable business development is a relatively new area and the penetration achieved especially in Small and Medium Enterprises (SME) is limited. Halen and Cramer (2002) highlight that a lack of knowledge, awareness and investment are barriers for moving towards sustainable practices and more responsible business in SMEs. Moreover, Ciliberti et al. (2008) include the lack of infrastructure, poor communication channels between stakeholders, low savings rate and the lack of mentorship as additional problems in developing economies. Therefore alternatives to support the strategic development of sustainable SMEs are needed. Product Service Systems (PSS) moving the focus of

businesses away from producing and selling physical products to offering systems of services and products to satisfy the user needs in innovative ways is one alternative approach, (Manzini and Vezzoli, 2003). The literature shows that if the system is designed to be sustainable benefits can arise such as dematerialization, better consumption patterns through innovative scenarios of use, new market opportunities, more efficient use of resources and cost savings, (Mont, 2002; Omann, 2007). However some of the barriers for developing sustainable operations in SMEs are also barriers to developing sustainable PSS. More efficient firms with higher innovation capacity, flexible operations and better communications skills are part of the benefits of a sustainable PSS but are also part of the competences required to develop one.

However, the rapid evolution of ICTs could give SMEs the competences required to develop sustainable PSS and transform them into sustainable businesses. Though research into the relationship between ICTs and sustainable development is very new, when ICTs are oriented to build sustainable business there are key areas of opportunity and benefits, these include development of smart products, improved stakeholders communication, dematerialisation, increased social inclusiveness and consumer empowerment (Ryan, 2004; Pamlin, 2002; Erdmann et al., 2004; Langrock et al., 2002). Despite the potential of using ICTs and developing sustainable PSS little is known about the conditions needed to enable this integration. Therefore the main hypothesis of this research is that the design process could be the bridge to connect the advantages of using ICTs with the conditions needed to develop sustainable PSS in SMEs.

2. THEORETICAL BACKGROUND

2.1. Product Service Systems

According to Manzini and Vezzoli (2003) a PSS is a strategic decision to move from designing and selling physical products to designing and selling systems of products and services that together can satisfy the user needs. It demands high levels of innovation and the capacity to change structural aspects of the organisation (Roy, 2000; Tukker and Tischner, 2004; Maxwell and Van der Vorst, 2003). However a PSS can represent for the producer a better strategic position closer to customers and for clients more flexible and convenient offers. Overall PSS could bring environmental benefits related to dematerialisation, reduction of materials' flow, decrease of energy consumption, longer product life cycles, less waste and more efficient use of products, (Mont, 2002; Tukker and Tischner, 2004). Additionally, social benefits associated with the creation of collaborative networks, more diverse markets, awareness of the stakeholder's roles and access for poor people to basic services through communal systems have been identified, (Omann, 2007;

Ness, 2007). Finally in economic terms the benefits are related to new market opportunities, increased competitiveness, more efficient operations and strong innovation focus (Omann, 2007).

Between the possible combinations of products and services and the purposes of a PSS different authors have mentioned three main types: product oriented, use oriented and result oriented (Tukker, 2004; Mont, 2002; Cook et al., 2006). *Product oriented PSS* where the main aspect of the offer is a product complemented with a set of services and where in general the ownership of the product remains with the customer, *Use oriented PSS* where the product is the property of the producer and the customer pay for a specific use of the product and services of the system. It implies generally a use for a determined period of time or service units. Finally *Result oriented PSS* where the producer owns the product and there is an accorded result for what the customer will pay. In this case the products and services that the producer uses to produce the result are not the main issue, the principal point is to achieve and deliver the predefined result, (Tukker, 2004).

Despite the potential benefits there are also barriers and difficulties identified to deploy these kinds of systems, (Cook et al., 2006; Mont, 2002; Tukker, 2004). Mont (2002b) mentions for example organisational resistance, problems to balance environmental goals with customer satisfaction, prevention of diversification, public acceptance, relationships with other stakeholders and lack of demand for these systems. Some of these barriers have to do with the balance between the change in the ownership of the offer and the level of customers' satisfaction. That balance has a strong relation to how products and services are designed and integrated into the system. According to Creusen (2011) one main issue for further research in PSS is the consistence and mutual support that products and service should have in a PSS. It means designing products and services that work together lo satisfy the customer without producing rebound effects that erodes the potential environmental and social benefits or the economical attractiveness.

These barriers mentioned by Mont (2002b) and the challenges presented by Creusen (2011) could be part of the reason why the number of examples of PSS is still low. According to BCSD-UK (2008) the concept of PSS is not totally new, but it has been not achieved *momentum* in its development. It means that despite the benefits, the fact that service economies are stronger, technology is changing rapidly allowing more complex offers and that there is a general awareness of the environment there is not a clear trend of PSS development.

Additionally, there are not many methodologies to develop PSS. Halen et al. (2005) present MEPSS (*Methodology for Product Service Systems*) that for its structure is more oriented to medium and large firms than to small companies. They claim the methodology is suitable to

be applied in all kinds of firms but competences required such as multidisciplinary team building and the ability to engage other stakeholders make the process difficult for small businesses, especially for small business in developing economies. Ciliberti et al. (2008) say for example that the lack of mentorship and skills transfer, the lack of support networks, poor infrastructure, low savings rate and the difficulties accessing financial capital are common weaknesses in SMEs in developing economies. Previously Halen and Cramer (2002) had mentioned lack of awareness about environmental legislation and social impacts derived from industrial activity as obstacles to develop sustainable business in SMEs. These weaknesses make difficult the application of methodologies that could be very demanding for a SME such as MEPSS.

Taking into account the lack of instruction oriented to SMEs in developing economies to develop these systems, the approach explored in this research investigates the design process as possible path to develop sustainable PSS in these firms.

2.2. Designs in SMEs

According to March-Chorda et al. (2002) and Mascle and Zhao (2008) successful product design in time of development and level of innovation is a determinant factor on firm's competitiveness. Up to 80% of the costs associated to product development, manufacturing and use are established during the design stage, (Mascle and Zhao, 2008). In terms of business strategy Borja and Kim (2009) highlight that managers should value design skills as *"rare, inimitable and non-substitutable"*. They consider design as a core competence that gives superior value to customers and is an organisational asset. Moultrie et al. (2007) present a series of arguments why design is an important competence particularly for SMEs. They mentioned for example how product design can give company differentiation, can encourage innovative aptitudes, can contribute to strength commercial relationships and communicate value to customers. Despite these benefits Moultrie et al. (2007) also highlight how product design is often undervalued in small companies and its potential benefits lost. This marginalization of design is manifested by unclear design practices, unskilled design professionals doing design tasks and managerial resistance.

Finally in relation to the development of sustainable PSS, Manzini and Vezzoli (2003) summarize the role of design with the term strategic design *"it is intended a design activity aiming at an integrated system of products, services and communication, based on new forms of organisation, based on the roles reconfiguration of different companies, clients and other stakeholders; a design developing a strategy linking long term goals with existing trends and based on new systems of values and new market opportunities"*. This vision is shared by Esslinger (2011) who mentions the important role of designers to articulate

customers' needs and aspirations with technology and innovation toward sustainable solutions. In this context the challenge presented by Creusen (2011) can be approached by understanding what aspects of the design process in SMEs and of the resulting products can be modified in order to contribute to develop sustainable PSS. The mechanism being considered to produce these modifications in the design process and in the resulting products in SMEs is the adoption and use of ICTs.

3. APPROACH

3.1. Product Design and ICTs in PSS

The relationship between ICTs and PSS has been mentioned previously in the literature. Mont (2002) highlights the potential of ICTs to contribute to achieve organisational efficiency and communication skills required to develop a PSS. Roy (2000) defined that relationship in terms of the possibilities that new technologies can bring to make PSS more practical and economical viable. Finally, Manzini and Vezzoli (2003); Tukker and Tischner (2004) and Mont (2006) mentioned how ICTs can help to build measures and performance indicators for these systems. Despite these relationships having implications for product design there is no existing work specifically oriented to understand in detail this integration.

In order to build that understanding thirty-six examples of commercial PSS some of them referenced earlier were examined. The criteria to select these examples were that the systems were developed by a company, that they were present in the market at the moment of the selection or recently, and that the companies described the systems including environmental or social benefits. A representative sample of cases was not selected and the analysis was not used as a classification method. Each example was analysed looking in the description of the systems given by the companies how the use of ICTs and Product Design were linked to each other and to the main value proposed by the system. Five different relationships were identified: Product Design Based, ICT Based, Product Design and ICT as Supporters, Integrated Product Design and ICT, and Product Design and ICT in Large Solutions. These groups characterised the relationship between ICT and Product Design in different PSS and not the purpose of the PSS as in the classification by Tukker (2004). In figure 1 we present examples of each relationship.

Product Design Based In this first group the relationship is based on products designed especially to fulfil the purpose of the PSS. The product design involves high technology and specialised production techniques. ICTs act as means to establish commercial relationships with customers and to deliver the product. Examples of PSS where this relationship is presented can be *Loop by the Yard* and *Heim Housing System*.

ICTs Based ICT articulate the system and enables its existence. In this kind of relationship ICTs can be embedded in the products but demanding just small modifications in the product design. Examples can be *ZIPCAR* and *Call a Bike*.

Product Design and ICT as Supporters Both product design and ICTs are supporters of the system. The main value of the system is not directly attached to them but they are part of the offer. It means systems where products could be generic and not designed specifically for the PSS and where ICTs are used generally only for commercial purposes. *Pallet Renew* and *Farm Fresh to You* are examples of this kind of relationship in a PSS.

Integrated Product Design and ICT There is strong relationship of ICTs and Product Design in the PSS. Here products are designed exclusively for the PSS and ICTs articulate the system connecting customers to products. The flow of information between customers and products through using ICTs is fundamental for the system. Examples of this integration could be *Motiva* and *Pay-per-Wash.*

Product Design and ICT in Large Solutions This relation is similar to the one described in the first case, but despite that the products are designed involving high technology and specialised production techniques they are not necessarily designed because of the systems but integrated into it and complemented by the use of ICTs to articulate the relationship with the customer. This relationship was founded particularly in PSS developed by large firms. *NorLux LED Light Systems* and *Ashland Solutions* can be examples of this relationship.

Figure 1: Types of relationships between Product Design and ICT in different PSS

3.2. Reference Model

Taking into account the previous considerations a reference model was built to explore the elements relevant to develop the research and to give structure to the hypothesis proposed. These elements came from the understanding of previous literature and the analysis of the set of commercial PSS presented above. First, ICTs have been identified as a transforming agent and engine of organisational changes (OECD, 2004). Davenport and Short (1990) mentioned particularly the capacity of ICTs to transform the process of product development. Later, authors such as Kotelnikov (2007) and OECD (2004) mentioned how in the case of SMEs the adoption and use of ICTs increases competitiveness, reduces transactions cost, increases speed and reliability of operations, improves communication between stakeholders and relationships with customers. More specifically, ICTs can contribute to develop sustainable business. According to Ryan (2004); Pamlin (2002) and Cohen (2002) smart green products, servitization, green buying, e-commerce, virtualization and energy efficiency are some of the contributions from ICTs to develop sustainable business. In this sense ICTs and sustainable business development were the first two elements included in the reference model.

Despite the relationships mentioned by Mont (2002); Roy (2000); Tukker and Tischner (2004) and Manzini and Vezzoli (2003) between PSS and ICTs there is no clear methodology to enable the integration of these concepts. Moreover, there is no evidence or previous work trying to develop the relationships identified in the analysis of the examples. For this reason sustainable PSS was also included in the reference model. Finally design process as connector of the other three was the last element added to the model.

The inclusion of the design process to make this integration is a key contribution. Taking into consideration the importance of product design in developing PSS (Creusen, 2011), and also the arguments mentioned in the previous section, it is clear that design process could be the element to connect ICTs and the development of PSS following a structured methodology. In this sense a methodology to develop sustainable PSS based on the contribution of the changes that ICTs can produce in the design process and in the resulting products is needed. Particularly one that is oriented to SMEs in developing economies. Following this intention the reference model with the four elements mentioned was built. A simplified version of the reference model is presented in figure 2. This model was refined with the results of an on-line survey carried out with 38 SMEs belonging to different industrial sectors. These companies were selected in a cooperation scheme with the Colombian Ministry of ICTs from an ICT implementation project. The survey explored the perception of these firms about PSS, sustainable business development, use of ICTs and the role of the design process. Then the reference model refined was used to lead a series of semi-structured interviews with a second group of Colombian Manufacturing SMEs all of them from the Leather Industry. This second selection was done again in cooperation with

the Colombian Ministry of ICTs from the same project. In the next section the main findings from this study with the Leather Industry Colombian SMEs are presented.

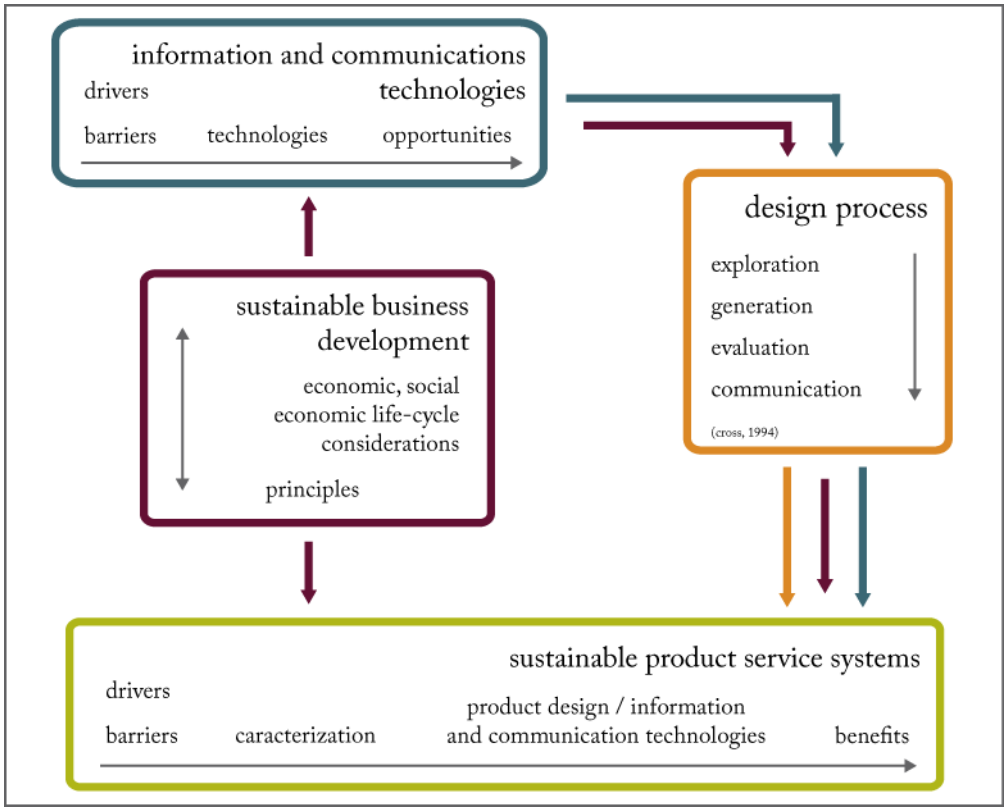

Figure 2: Reference model to lead the exploratory research

4. KEY FINDINGS

4.1. Leather Industry, Colombian SMEs

In cooperation with the Colombian Ministry of ICT SMEs from the leather industry, mainly shoemaking factories, who had previously been involved in an ICT implementation project, were contacted. Semi-structured interviews were carried out in 16 companies with the owners or general managers to explore mainly the role of the design process in relation to the subjects identified in the reference model proposed to lead this exploratory research. These SMEs were selected to insure they were using ICTs in their daily activities as one main element in the reference model and the starting point for the hypothesis. Additionally it was important to work with firms that went through a similar process of adoption and use of ICTs. This process as an organisational experience allows comparisons to be made between the firms.

A large part of each interview was dedicated to understanding the design process followed by these firms. Just few SMEs described their design as a process following certain logic, the majority recognised activities done to fabricate the shoes and embedded some stages of decisions about the design of their products. This attitude is aligned with the analysis presented by Moultrie et al. (2007) where design tasks in SMEs are often execute by people who have been not trained as designers usually production engineers that usually locate design activities into the production process.

In general terms the design process followed by all the SMEs interviewed is very similar. This generic process is presented in figure 4. The process starts by looking for ideas to design a collection, this search mainly goes on through the internet looking for products (shoes) from other companies in other countries, the ones mentioned were Italy, Brazil and the United States. Few companies mentioned complementing this search by looking for initial ideas in other means such as magazines or working with suppliers' advice and sales feedback.

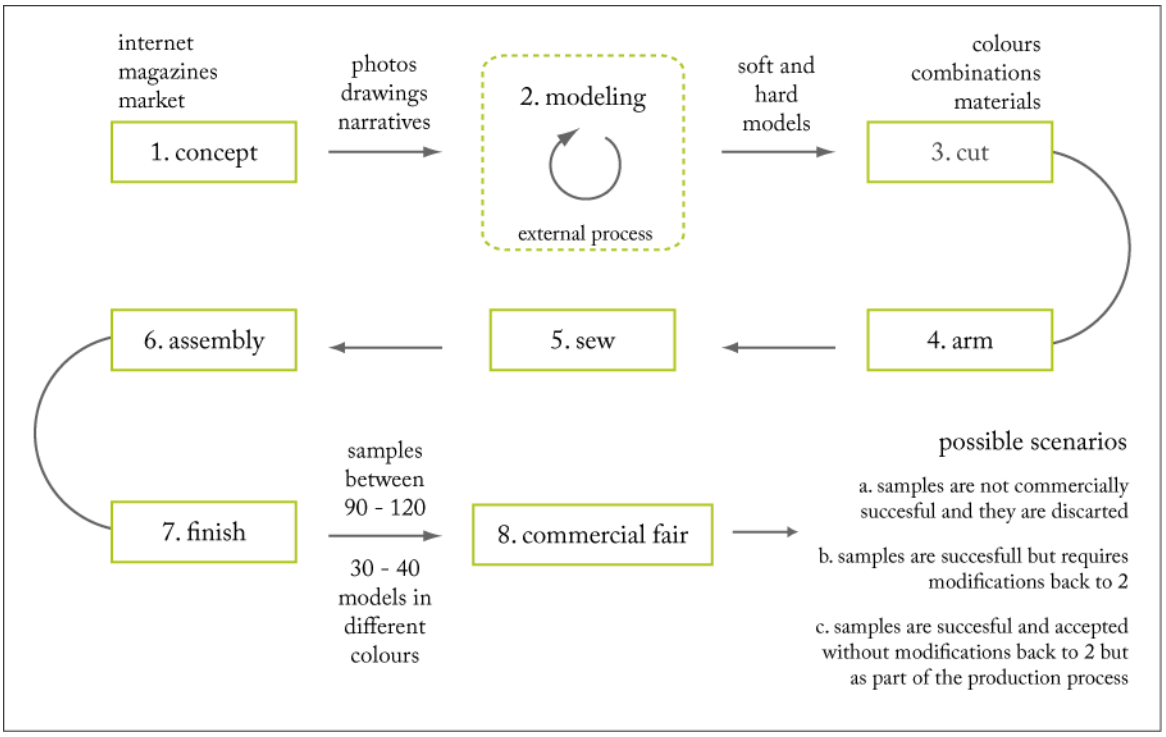

Figure 4: General design process of Shoemaking SMEs in Colombia

The main output of this stage of the process for the majority of the companies are photos with small modifications to accessories, clasps and heels but keeping a large proportion of the initial design. Just three companies described this first stage as doing drawings and sketches of the product design from original ideas. These photos or sketches are delivered to an external party, generally one person who creates the models. Just two firms undertook the

modelling process themselves. This stage of the design process consists of translating the images of the product into a model that will be the basis of cutting and sewing the final product. This modelling is an iterative process between the person in charge of design in the SMEs and the model maker.

The output of the modelling stage is a soft model in cardboard that is then copied into metal sheets. This activity is done within the SMEs and it is considered part of the modelling process. The hard model (metal) is then used to cut the pieces of what will be the final shoe. At this stage colours and combinations of materials are selected to produce the samples. These decisions are the last taken about the design of the product until the commercial fair where the samples are assessed by the clients and could be accepted without changes, accepted with modifications that requires the fabrication of new samples or rejected. In average each of the SMEs interviewed designs thirty different models for each commercial fair and using two or three different colours and combinations they present approximately 120 - 140 samples at the fair.

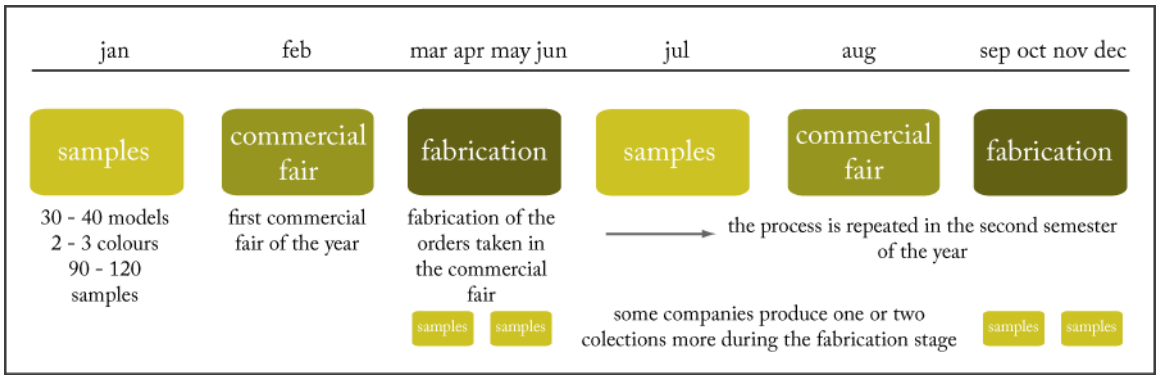

Figure 5: Design and Production Dynamic of Shoemaking SMEs in Colombia

All the SMEs work under the same process and their schedule is in large scale attached to the development of the commercial fairs in the country. The dynamic of one year of work for these SMEs is presented in figure 5.

4.2. Preliminary analysis of the design process

From the descriptions of the design activities in the SMEs the first perception was that the product design is limited to products already on the market. The owners and general managers interviewed mentioned the importance of designing and producing shoes that are consistent with the fashion trends of the country and even with the fashion trends of the cities. In this sense the majority of the firms keep the same line of design, transforming products already on the market in other countries into national trends changing colours, accessories and materials. It means following trends more than working to create new ones.

"My boss, what she does is to search for designs on the computer. Then if she likes a particular design in order to make it new she gives it a personal touch. She changes something in it, if it has three straps, then she maybe will put two and one crossed", Explanation of the beginning of the design process. Manager Assistant Company I.

Another characteristic of the design process is that it is mainly a manual process that in some cases could even be described as a handcrafted process. Because of this the modelling stage that is done by an external model maker is considered fundamental and relies on the experience of the model maker. A couple of companies declared to have used some design software for the modelling but this failed because of the lack of precision and inflexible results obtained. Model makers are people specialised in translating photos and sketches of finished products modified by the SMEs into patterns that allow the SMEs to produce the samples that later they will present at the commercial fairs. Model makers working with a pantograph are able to reproduce the patterns and scale them to a specific shoe size in which the samples are produced.

"The designer, the model maker make the majority of it (the model) by hand, I think 80% is very manual, very handcrafted", Explanation of the design process, Owner Company A.

Finally, the design process relies mainly on the owners of the SMEs. They search for initial ideas for the collection and then they decide colours, combinations and materials. This responsibility makes them very close to the model makers, however it appears that the modelling process is a black box and SMEs depend largely on this external process. They even describe the relationship with the model maker in terms of time as working together and attributes such as honesty being important. The fact that the design process relies on the owners of the company makes the design process in some companies very closed where just few people can intervene.

"I take the photo to the model maker that I have for several years, then I tell him what I need, then he makes it, he designs the shoe in agreement.", Explanation of the relationship with the model maker, Owner Company A.

5. IMPLICATIONS FOR THEORY AND PRACTICE

The identified design process in the group of shoemaking SMEs in Colombia reflects a very traditional way to design and develop their products. Despite the adoption and use of ICTs, these technologies have not been embedded into the design process except for the initial search of ideas through web sites from other producers. This use is not necessarily the most positive for the design process. A lack of knowledge of possible technologies to design the products was identified such as software for sketching, developing the models or producing

different prototypes (colours, combinations, materials), also communication technologies to develop collaborative design between the SMEs and the model makers, or between the SMEs and clients during and after the commercial fairs. This lack of knowledge is made worse by a resistance to using technology resulting from bad experiences and the results in comparison with the traditional methods (model makers using pantograph).

The dynamic of the SMEs shows a high resource demanding industry. SMEs produce in average 120 - 140 samples that they present at the commercial fairs and also on average only 10 - 20 of these samples are sold to be produced in large scale. The other 100 - 120 samples are rejected and usually disposed of. This behaviour generates a waste of resources and unnecessary efforts. In this case ICTs can affect the design process through technologies that allow producers to decrease the number of samples produced each season moving physical samples into virtual samples that can also change and improve the relationship with the customers giving more flexibility to the process of assessment of samples in the commercial fairs. These changes to the design process could also enrich the relationship between the SMEs and the model makers.

These initial possible contributions of ICTs to the design process can also lead to a transformation to sustainable PSS in terms of the possible services between the actors involved in the design process and how the SMEs produce their samples. Going further the use of ICTs could change the dynamic of the industry and the behaviour of some actors such as the model makers, that taking advantage of their knowledge and experience, could move their business from producing models to offering services with reduced use of resources and better experience for their clients (SMEs). All these ideas and potential contributions need a structure to be developed, and it is in this lack of structure that our proposal is based on. The next step of the research is to keep analysing the interviews focusing on the relationships between the elements of the reference model and transforming that analysis into possible strategies that contribute to form that structure needed.

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Design Management Absorption Model – A Framework to Describe the Absorption Process of Design Knowledge by SMEs with Little or No Prior Design Experience

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Keywords: Design management in SMEs, absorptive capacity, design and design management absorption process and model

The introduction of new design knowledge or design resources in companies with little or no design experience has been at the core of design support programmes in different countries. Scholars investigated the use of design and identified different design and design management capabilities to deploy design effectively in companies of all sizes. However, how design and design management capability is built in SMEs with little or no prior design experience is insufficiently investigated. Based on the absorptive capacity construct from the broader field of innovation studies, this paper proposes that the absorption of new design knowledge or resources is an organisational learning and capability building process. It introduces a comprehensive design management absorption model that includes design and design management capabilities that enable design absorption in SMEs with little or no prior design experience as well as indicators to measure the progress of absorption. The model allows for analysing the process companies go through when using design as a strategic resource for the first time.

Introduction

Using design as a strategic resource to differentiate products, manage design projects more effectively or build brand value has been common since the mid-sixties (Farr, 1965; Kotler & Rath, 1984; Lorenz, 1987; Topalian, 1979). Since then, scholars have been intent upon defining and positioning design management as a management function in its own right. Design management has been described from different perspectives such as definitions and goals (Blaich & Blaich, 1993; Farr, 1965; Gorb, 1990b), organisational place and level (Borja

de Mozota, 2003; Cooper & Press, 1995), people deploying design (Gorb, 1990b), their management and leadership responsibilities (Turner & Topalian, 2002), or their tasks (Topalian, 1979). Design management has been viewed as a process from the analysis of customer needs through to the market launch of new products or services (Topalian, 1979); it has also been conceptualised as a coordinator between functions, departments and an integrator of stakeholders (Bruce & Bessant, 2002).

Other than marketing, which developed at around the same time (Gorb, 1990a) design management failed to be widely adopted as a management function (Sun, Williams, & Evans, 2011). Only lately, the debate on design thinking and the ensuing inclination of renowned companies such as P&G (Martin, 2009) to include design knowledge into their value-creating and innovation processes has sensitised more organisations to design. Although the notion of design thinking is ambiguous and has provoked mixed reactions in the community of design practitioners as well as design scholars (Hassi & Laakso, 2011) the "hype" has mostly been restricted to larger organisations.

Many SMEs are still unaware of design as a strategic resource; some because they are technology-driven and are making "silent design" decisions (Gorb & Dumas, 1987) or doing engineering design (Blaich & Blaich, 1993); some because barriers such as limited human and financial resources, less formal or nonexistent product development and innovation processes (Fueglistaller, 2004), lack of access to design resources (Cox, 2005) or poor design understanding (Moultrie, Clarkson, & Probert, 2007) etc. make it difficult to integrate a design management function.

With national design programmes, design councils or other knowledge brokers such as universities, a shift towards engaging with SMEs can be observed because they represent most organisations in Europe by number[1]. Regional design centres have been facilitating matchmaking between designers and SMEs or launching design support programmes. There has been a move towards more substantial knowledge transfer including the business and leadership role of design and the promotion of innovative tools as well as design management methods (Boult, 2006).

However, there are many reasons for the gap between design and management. To acquire and to manage new design knowledge can be difficult (Bruce & Jevnaker, 1998) - for large firms as well as for SMEs. Because:

1. Design knowledge has rarely been part of management education and, thus, is an alien resource to many managers (Boland Jr. & Collopy, 2004; Jevnaker, 1998; Martin, 2009) as well as to engineers (Jahnke, 2009).
2. Design is an "experience good" (Commission of the European Communities, 2009). Confidence in design as a resource grows, once there have been positive experiences with and observable effects of the use of design (Perks, Cooper, & Jones, 2005). Furthermore,

[1] http://ec.europa.eu/enterprise/publications/index_en.htm

design knowledge is personalised (in form of individual design expertise) and heterogeneous (Jevnaker, 1998).

3. A "design attitude" (Boland & Collopy, 2004) has some irritating "ingredients" for management teams such as an insistence on fluid and iterative processes of searching, experimenting and prototyping, zooming in and out of the problem while maintaining a holistic view (Conley, 2004), accepting high levels of uncertainty (Jevnaker, 1998), while evaluating multiple alternatives (Conley, 2004), and being led by a human-centred design ethos stressing empathy with user needs as a starting point for innovation (Brown, 2008).
4. Also the tacit dimension of design knowledge that is embodied in products as well as in people has been mentioned (Jevnaker, 1998).

From these few observations it can be concluded that starting to use design as a strategic resource involves a learning process on the side of SMEs on how to tackle and to manage this new knowledge or strategic resource. While, as stated before, much of the design management literature has focused on definitions, goals, responsibilities and tasks, little attention has been given to the question of how companies with little or no prior design experience build the capabilities to execute design management. A task-based or functional perspective of design management describes how design management operates in a company on a day-to-day basis. A focus on capabilities and how they are built, however, uses a perspective of organisational learning and the configuration of resources.

Based on the *absorptive capacity construct* (Cohen & Levinthal, 1990; Zahra & George, 2002) from the broader field of innovation studies, this paper introduces a model that describes the absorption of design knowledge as an organisational learning process of *acquisition*, *assimilation*, *transformation* and *exploitation* together with indicators to assess the success of the individual phases of the process. Design management and design leadership capabilities are viewed as organisational capabilities that have the potential – on one hand – to create competitive advantage, and – on the other hand – to change the company to a dynamic and flexible organisation. The outcome of the design and design management absorption can be the *dynamic capability* of a company, a concept that has been described in strategic management studies (Helfat et al., 2007; Teece, Pisano, & Shuen, 1997). More precisely, design management itself can act as a dynamic capability, which is even more probable in SMEs with short communication channels and flexible structures (Fueglistaller, 2004).

In prior applied research (Acklin, 2011) a first Design Management Absorption Model (DMAM) to *evaluate* a company's absorption processes was developed and the progress of five SMEs was analysed with it. In this paper, a more comprehensive version will be presented; it includes design management and design leadership capabilities that enable design management absorption together with indicators to measure the progress of the absorption process in SMEs with little or no prior design experience.

The main goal of this paper is the presentation of the theory behind the DMAM. It firstly reviews and extends the theory that led to the model; secondly, based on prior research and

preliminary insights from an on-going applied research project, further observations concerning absorption processes and obstacles, as outlined in the model, are described.

Literature and definitions

The key concepts to understand design management as an organisational capability yielding competitive advantage and strategic flexibility can be traced back to Edith Penrose's "The theory of the growth of the firm" (1959) and to ensuing concepts of strategic management such as the resource-based view (RBV) or the dynamic capability construct (DC). It is also needed to take a look at the absorptive capacity (ACAP) construct of the innovation studies that conceptualises innovation as a result of organisational learning and capability building. These core concepts include answers to the questions: What are resources? What are (organisational) capabilities? How do organisations absorb new knowledge and build design management capabilities? And how do they create competitive advantage?

Organisational resources, capabilities and capacities

A company can be viewed as a bundle of productive *resources* with an "autonomous administrative planning unit" (Penrose, 1959, p. 14) or management team deciding how to deploy them to make a profit. These resources can be physical such as plants or equipment, but they can also be intangible such as the human resources available to the firm. However, "it is never resources themselves that are the 'inputs' in the production process, but only the services that the resources can render" (p. 22). Services are seen as an "activity" (p. 22) to put these resources at work. And: "As we shall see, it is largely in this distinction that we find the source of uniqueness of each individual firm" (Penrose, 1959, p. 22).

Penrose's ideas had little impact on the classical economic theory of her time (Pitelis, 2009), which mainly described the firm as interplay between market demand and a company's offer; but some 40 years later these ideas were picked up by the resource-based view and by the dynamic capability construct (DC) explaining sustained competitive advantage. The resource-based view (RBV) defines resources as all assets, capabilities, organisational processes, firm attributes, information, knowledge etc. It's resources that are valuable, rare, imperfectly imitable and non substitutable that create a competitive advantage for a company (Barney, 1991).

On top of that the DC emphasises the notion that companies need "dynamic capabilities" to exploit existing internal and external firm-specific competences to address changing environments (Teece et al., 1997). Companies should *dynamically* adjust to the changing business environment of a "Schumpeterian world" and strategic management should be capable to appropriately adapt, integrate, and reconfigure internal and external organisational skills, resources, and functional competences to match the requirements of a changing environment (Teece et al., 1997).

In evolutionary theory, Nelson and Winter (1982) came up with the term "routines" – certain "regular and predictable behavioural patterns" of firms (p. 14) – comparing routines to the

role genes play in biological evolutionary theory. They are persistent, heritable, and selectable. Nelson and Winter (1982) anticipated the critique made by authors of the RBV who warned against the danger that resources might become sticky, meaning that firms can get stuck with what they have and might have to live with what they lack (Teece et. al. 1997), unless they develop the dynamic capability to continuously extend their resources.

Teece, Pisano and Shuen (1997) stress the point that "skill acquisition, the management of knowledge and know-how, and learning become fundamental strategic issues" (p. 514). Dynamic capabilities are about change, entailing the process of identifying an opportunity, formulating a response to it and purposefully implementing a course of action (Helfat et al., 2007).

Amit and Schoenmaker (1993) make a distinction between *resources* and *capabilities* that echo the one mentioned above by Penrose's (1959): *Resources* are stocks of "available factors that are owned or controlled by the firm" (p. 35). *Capabilities* are the capacity to deploy them. Like resources these capabilities are firm specific and are developed over a longer period of time through learning processes. They are information-based, tangible and intangible processes and they "can abstractly be thought of as 'intermediary goods' generated by the firm to provide productivity of its resources, as well as strategic flexibility and protection for its final product or service" (p. 35).

A *capacity* is the ability to perform a certain task in a minimally acceptable manner (Helfat et al., 2007). To qualify as a capability the capacity to execute a specific task needs to have a *patterned element*, a company needs to be able to repeatedly perform a certain task in a minimally acceptable manner.

Design resources, design management capabilities and design capacities

Also design can be viewed as a bundle of resources. Based on Barney's (1991) definition of company resources, design can be regarded as a resource in several ways: Design is a process and can be viewed as an organisational "routine" (Nelson, 1982); design is a specific form of knowledge (2011); design can be an asset, e.g. in form of an in-house design team or a design alliance (Bruce & Jevnaker, 1998); and it is a set of design management capabilities ("intermediary goods") to enable the deployment of design resources (Gorb, 1990b) in a way to harvest the benefits "these services can render" (Penrose, 1959).

Borja de Mozota's (2006) defines three key characteristics of design resources or of the "powers of design": 1. Design is a differentiator (of products, services etc.). 2. Design is an integrator (of different functions and team members). 3. Design is a transformer. 4. Design is "good business" through increased ROI, higher margins, revenues, market share etc., which describes the results of the use of design in a company.

In past research many other design management scholars (Bruce, Cooper, & Vasquez, 1999; Chiva & Alegre, 2009; Dumas & Whitfield, 1990; Kotler & Rath, 1984; Perks et al., 2005) investigated the use of design and identified different design and design management

capabilities to deploy design effectively in companies of all sizes. Some of this research extracts specific design capabilities from product development processes (Perks, Cooper & Jones, 2005) or from the design management use of design-oriented companies (Borja de Mozota, 2006).

However, the terms task, skills or capabilities are used ambiguously. They mostly describe a specific design management function or person and his/her tasks and abilities. The shift to viewing design management as an organisational capability is a relatively new one. Jevnaker (1998) lists the following component capabilities in organising design and its management: 1. Resourcing capability, the ability to acquire and manage profitable design resources. 2. Combinative capability, the ability to configure design resources. 3. Organisational learning capability, which is an absorption capability. 4. Innovation capability. 5. Design-strategic capability, capability to integrate design into business strategy. 6. Protecting capability of design-based advantages (p. 21).

Absorptive capacity and design complementarity

Critical to innovation or to the development of new offerings is the capacity of companies to absorb new external knowledge. According to Cohen and Levinthal (1990) absorptive capacity (ACAP) is "the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends" (p. 128). Although the APAC construct, in its beginning, has been focusing on the acquisition of technological and scientific knowledge through the R&D function of a firm, Cohen and Levinthal (1990) also name other business units such as manufacturing, design or marketing as the beneficiaries.

Referring to the resource-based view (Barney, 1991) and to the dynamic capability concept (Helfat et al., 2007; Teece et al., 1997), Zahra and George (2002) re-conceptualise ACAP as a set of organisational routines and processes, and connect it to the dynamic capability concept by viewing ACAP as a dynamic capability that impacts on the resource base of a company to provide a company with multiple sources of competitive advantage. They suggest that there are four organisational capabilities: knowledge acquisition, assimilation, transformation, and exploitation.

Drawing on insights from cognitive behavioural science, Cohen and Levinthal (1989, 1990) state that prior knowledge helps to value new information and to assimilate it. In spite of an already existing memory (of knowledge) new knowledge might be acquired, but often not utilized well because individuals do not possess the appropriate knowledge to put the new knowledge into context. Zahra and George (2002) integrate this insight from cognitive behavioural science by distinguishing potential capacity (PACAP), the ability to acquire and assimilate knowledge, from realized capacity (RACAP), the ability to transform and exploit new knowledge. While PACAP makes a company susceptible to learning, RACAP enables the company to leverage PACAP.

It's a common experience of design practitioners and of past and ongoing applied research of the author of this paper (Acklin, 2010; Acklin, 2011; Acklin & Hugentobler, 2008) that

SMEs will reject or often abandon the idea of integrating design into their innovation and new product development projects early on. This is explained by time or money constraints by the SMEs, but often points to a deeper chasm between engineering and design or management and design values and their ways of "handling things". This points to the question, whether design knowledge is more difficult to absorb than other forms of knowledge.

An empirical study with French companies from the clothing and the construction business researched the difference of design knowledge from engineering or marketing knowledge during the absorption process in new product development and came up with an enlightening list of typical attributes (Abecassis-Moedas & Mahmoud-Jouini, 2008): 1. Companies perceived design as related to an individual designer/architect rather than embedded to a collective as in their firms. 2. Design relies strongly on tacit rather than explicit knowledge, the latter being more present in e.g. manufacturer or retailer's knowledge. 3. Designers are inclined to use divergent thinking rather than convergent. Designers rather strive on creative exploration, while e.g. engineers work on well-specified problems. 4. Designers keep to a peer-orientation giving more importance to their peer's opinions than to the one's commissioning the project.

While the gap between design and engineering or management and the difficulty to relate design knowledge to prior organisational knowledge can be a problem, the complementarity between manufacturing and design or retail and design knowledge can be a critical aspect for the successful absorption process. Abecassis-Moedas and Mahmoud-Jouini (2008) come to the conclusion that - if the source knowledge as represented "through the archetypical figure of the architect or the fashion designer" (p. 474) is at the same time related and diverse and if it is combined effectively with the recipient's knowledge (firm) - positive effects can be observed on NPD performance such as process efficiency (cost) and product effectiveness (quality).

On the recipient side, however, an organisation's absorptive capacity is not the achievement of any single individual inside a company, but depends on the links across individual capabilities. New knowledge must actively be socialised and shared (Zahra & George, 2002) in order to be exploited by the organisation.

Conceptual model

Based on innovation and design management studies, the Design Management Absorption Model (DMAM) conceptualises design management as an organisational capability that facilitates the absorption of new design resources and leverages design knowledge to achieve competitive advantage. The absorption process and design management capability building can be supported by the use of *design approaches* and *tools* as well as by (sustained) collaboration with external designers. If the absorption of design management and design management capabilities move from potential to realised absorptive capacity through socialisation and diffusion of design knowledge inside the company, design management can

yield external outcomes as well as internal effects such as strategic flexibility and, ultimately, act as a dynamic capability (see Figure 1).

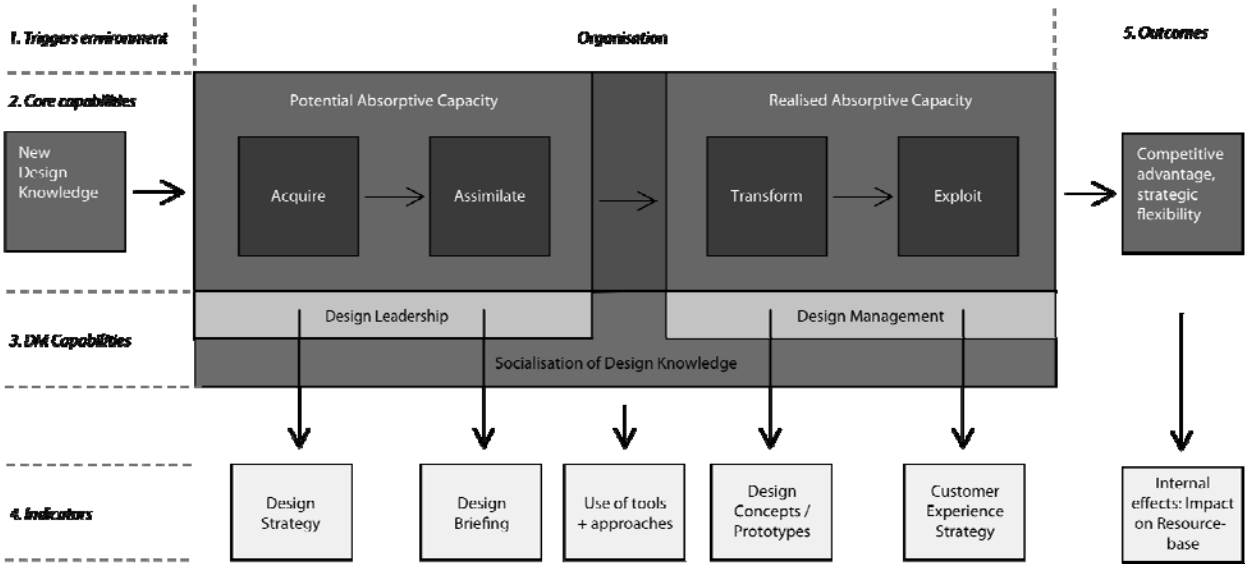

Figure 1: Design Management Absorption Model (based on Zahra & George, 2002)

1. Triggers

One of the central questions is, how new design knowledge finds its way into the company. According to Zahra and George (2002), internal or external triggers such as an organisational crisis or performance failure or technological shifts or radical innovations that occur outside the company activate the absorption of new knowledge. It has also been mentioned that the firm's motivation is key to the willingness to absorb new knowledge (Abecassis-Moedas & Mahmoud-Jouini, 2008).

2. Core capabilities of design knowledge absorption

Following Zahra and George (2002), design management absorption is divided into the four organisational capabilities of *acquiring*, *assimilating* (PACAP), and *transforming* and *exploiting* (RACAP) new design knowledge. *Acquisition* consists of identifying a specific design contribution to the company's bottom line. *Assimilation* entails a deeper commitment to the new design knowledge by combining it to engineering or marketing processes and projects and by establishing to work with either complementary sources of design knowledge. During *transformation*, the new design knowledge has to be deployed effectively to improve offerings such as products, brands, services, communication, or efficiently to manufacturing or innovation processes. *Exploitation*, involves the company-wide implementation of design resources through integrating them into relevant processes, coordinating functions, aligning core values, training staff etc. and through delivering a coherent customer experience at all touch points. Since absorption processes mainly take place during concrete work assignments and projects, the DMAM follows a prototypical development process.

3. Design Leadership and Design Management Capabilities

In this paper a distinction between strategic or leadership and operational design management capabilities is made (Borja de Mozota, 2003; Cooper & Press, 1995; Topalian, 1979; Turner & Topalian, 2002). This distinction is useful to connect the DMAM to SMEs, which are strongly controlled by the owner/founder of the company (Fueglistaller, 2004; Mintzberg, 1979). He or she is the "gatekeeper" as described by Cohen and Levinthal (1990) and determines whether design knowledge classifies as useful or not. In the model, acquisition and assimilation are related to design leadership capabilities and transformation and exploitation to design management capabilities, although the notions blur into each other (Turner & Topalian, 2002); this also because of the fact that owners of SMEs are involved in strategic as well as in operational work (Fueglistaller, 2004). The DMAM refers to design management capabilities as described by different authors (Jevnaker, 1998; Perks et al., 2005; Topalian, 1979) putting them into an order suitable for the absorption process and complementing or omitting elements to match the situation of SMEs (Table 1).

Acquire	Assimilate	Transform	Exploit
Design Leadership capabilities		Design management capabilities	
Defining hypothesis for new business opportunity; formulating a design strategy as part of company strategy (Jevnaker, 1998)	Sourcing design expertise and combining it with in-house team expertise (Jevnaker, 1998); briefing of external partner (Perks, Cooper, & Jones, 2005); contracting and allocating resources	Facilitating project development (Topalian, 1979); managing different stakeholders out- and inside company	Aligning corporate values and project outcome; coordinating functions, processes etc. to achieve coherent customer experience

Table 1: Design leadership and management capabilities connected to design management absorption capabilities

Socialisation of design knowledge

Design knowledge in the context of this paper entails design processes, approaches such as human-centeredness, visualisation, experimentation, prototyping, etc., and tools as well as an attitude towards creation of innovative solutions. While the cooperation with external designers will trigger a learning process, SMEs can absorb design knowledge themselves. Jonas (2010) re-conceptualises the notion of design in the following way: "Design is a *process*, which uses *knowledge* to generate new *forms* and new *(forms of) knowledge"* (p. 1). Design knowledge contains tacit dimensions (Rust, 2004) using tools such as future customer personas, user scenarios, or customer journeys to convert tacit into explicit knowledge (Nonaka, 1994). Since SMEs are close to their customers they have a wealth of tacit knowledge to inform designer's solutions once it is made explicit. In addition, the use of

these tools by company members is a vehicle to introduce how designers work, to socialise design knowledge throughout the company.[2]

4. Indicators

Indicators are evident outcomes to support the description and measurement of the progression of the design management absorption process. The first indicator is an often-sketchy (nevertheless explicit) *design strategy* or *hypothesis* of where a process and the absorption of design knowledge connected to it should take the enterprise. It triggers search and knowledge creation activities to understand the envisioned business opportunity. A *design briefing*, the second indicator, constitutes the assembled knowledge at this point in time, the direction and the scope of the design work. The briefing can be in a written or oral form and represents the condensation of strategic intent communicated to and re-worked by designers. Indicators of a successful collaboration with a complementary design knowledge source are *concepts* and *prototypes* of future product / service outcomes. Finally, an indicator for a holistic understanding of design management as a multi-layered activity to achieve touch point orchestration is a *customer experience strategy* that might initiate a long-term transformation and exploitation of design knowledge throughout the company.

5. Outcomes

Zahra and George (2002) described ACAP "as a dynamic capability pertaining to knowledge creation and utilization that enhances a firm's ability to gain and sustain a competitive advantage" (p. 185). The same can result from absorbing design and design management knowledge if design resources are connected to value creating process of SMEs. Consequently, an external outcome of absorbing new design knowledge can be competitive advantage achieved through improved offerings and customer experiences. There can be an internal outcome as well, which might be even more important because it has the potential to change a firm into a dynamic and flexible entity. Although scholars mention that measuring dynamic capability is difficult (Ambrosini & Bowman, 2009; Helfat et al., 2007), the DMAM proposes that an indicator for design management as a dynamic capability is a change of the resource-base of a company such as altered innovation processes or company structures that include designers or design managers. There also needs to be a "patterned element" (Helfat et al., 2007) in the way a company handles strategic as well as operational routines.

Observations from application

Based on findings from prior research (Acklin, 2011) and preliminary insights from an on-going applied research project, the last part of this paper introduces additional observations concerning absorption processes and obstacles as outlined in the model. The *valuation* of design as a complementary form of knowledge is the very first part of the absorption process. However, many stereotypes of design hinder the *acquisition* of new design knowledge in

[2] See also the notion of "design infusion" as describe by (Dumas & Mintzberg, 1989).

SMEs, before the possibility for a purposeful form of acquisition opens up. Knowledge brokers such as design support programmes or knowledge transfer programmes of universities play an important role in the sensitisation of SMEs together with company peers, which already use design and demonstrate its effectiveness.

Has the entry barrier been overcome, the *acquisition* of design knowledge is supported by making design a strategic issue and raising it from a styling or problem-solving activity to the level of company objectives. During this phase, it is important that design knowledge can be related to prior knowledge or company rationale, e.g. to brand strategy, to product development goals etc. While early in the adoption process this often is a "hypothetical exercise" with little foundation in experience, the prospect of potential financial gains through process or product improvements will drive SMEs. An obstacle of the *assimilation* phase is the difficulty to gain an overview over the offer of the creative industries and to identify the "right designer" for the project. During *transformation*, design knowledge connected to the doing of things (iterative processes), some of it tacit such as the concept of product language or aesthetics, has to be absorbed. This phase can result in confusion, miscommunication between designers and company stakeholders and even distrust.

In the *exploitation* phase concepts such as, the orchestration of all touch points to create a coherent customer experience, need to be understood. At this point in time, it becomes obvious to SMEs that design is not a one-time activity but will have to become a company strategy to enfold its full potential. This might include more investment of financial as well as human resources. If exploitation of design knowledge is taken seriously, it is probable that the new design knowledge, overtime, will shape routines and that design management will become a dynamic capability.

While a sustained relationship with designers will support a more profound understanding of designerly ways of knowing and doing things, design management capability on the side of the SMEs will leverage design knowledge in a way appropriate to a company's specific context and challenges. The relationship between company and external design knowledge source becomes richer. This is, to some extent, in contrast to debates that have promoted design thinking as a silver bullet without a complementary design management function. The author of this paper posits that design management capabilities connect to prior company knowledge because they are managerial in nature. Since they are also close to design, design management capabilities are instrumental for SMEs to leverage design resources as a new complementary form of knowledge.

Conclusion

For SMEs with little or no design experience to gain competitive advantage through design, a process of acquisition, assimilation, transformation and exploitation of new design resources has to take place. This organisational learning and capability building process needs partly to be done in collaboration with external design partners and partly by the company itself through building up design management capabilities that fit its context and specific

necessities. Although there has been prior applied research to test the model, one limitation of this direction of research lies in the fact that design and design management capabilities are built over time. Longitudinal studies would be necessary to trace the success of design management absorption on the level of competitive advantage and even more so to see design management in action as a dynamic capability. Nevertheless, the DMAM can be used as *guidance* for the design support community, for practising designers who cooperate with companies, or for companies who want to monitor their own learning progress and enrich their resource base through new design knowledge.

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Managing Early Stage Product Development within the Medical Device Industry

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Abstract

Innovation is becoming a critical factor in ensuring commercial success within the area of medical diagnostic technology. Biotechnology and healthcare developments require huge financial and resource investment, in-depth research and clinical trials. Consequently, these developments involve a complex multidisciplinary structure which is inherently full of risks and uncertainty. In this context early technology assessment and proof of principle is often sporadic and unstructured. Existing design processes aimed at managing the medical healthcare industry are predominantly suited to the later phases of development and favour detail in optimisation, validation and regulatory approval. Currently there is a lack of technical guidance in the area of feasibility and as a result there needs to be a more consistent approach. This research provides practical instruction in improving development efficiency within the front- end phases of healthcare product development. It attempts to gain insight into the activities which occur when establishing confidence within the core science and technology, prior to substantial commercial investment. This qualitative research comprises of three provisional investigational studies, analysing recent innovations within leading medical organisations. The findings of this empirical study have shown that front-end planning continues to lack both technical guidance, robust data, technically related regulatory consideration and underestimate the importance of preliminary technology assessment.

Introduction

Globally the medical device industry is valued at over £65 billion (Russell and Tippett, 2008). Biotechnology and healthcare development requires huge investment, long lead times and involves a complex multidisciplinary structure which is inherently full of risks and uncertainty (Pietzsch and Pate-Cornell, 2008). In this context, technology feasibility and proof of principle are frequently poorly executed. There are certain key factors that need to be addressed on project initiation; these include, where and how the engineering or scientific team begin to ensure technical success will be achieved and also identify what defines the technological direction and what investigational structure should be adopted to ensure technical success. Applied science and technical research is at the core of the medical industry sector (Sutton, 2009) and the area of feasibility and early technology research, due to its nature, has limited guidance in these respects. Similar to other high tech industries, the medical sector has huge incentives to increase development efficiency, reduce time to market, and to increase profits. Unique differences within the medical industry include, considerable science and technology management, and also considerable testing and regulatory control. Furthermore, development may include significant clinical trials and it is imperative to gain confidence within the technology, before investing in this costly and time consuming activity.

Aim of this study

The existing generic development models are not ideally suited to the medical sector which encompass a high degree of scientific research and regulatory requirements. No definitive technology biased feasibility (front end) guidance exists within the medical sector. The objective of this empirical study is to identify the characteristics of effective front end product management and identify factors which influence successful science and technological confidence within a multidisciplinary environment. The final aim of this study, is to develop prescribed guidance within the front-end of development listing activities that can be expected during this early stage of medical product development. This structured guidance may encourage confidence within front-end planning, technical management guidance, promoting proof of concept and incorporating early consideration of technical regulatory requirements. This paper first outlines the challenges within the medical industry, then discusses existing principles used within the medical development, and finally presents the findings of three exploratory case studies.

Challenges in medical device development

Recent work published by the regulatory bodies, including the Food and Drug Administration (FDA) suggests that there is a recurring problem in the commercialisation of new scientific ideas, the idea-pipeline and regulatory submissions within the medical device industry (FDA, 2004). ‘The industry faces very low success rate in new product development; the vast majority of investigational products that enter initial trials fail’ FDA (2004, pii). The FDA outlines further effort is required to create more effective tools for developing medical technology. For this reason, several organisations are beginning to address this issue, creating

initiatives to improve the process in which ideas are transformed from invention to compliant diagnostics. This includes the National Institute of Health's (2002) 'Roadmap Initiative', FDA, 2004) 'Critical path initiative' and launched in 2010 'Fast-Track', a joint collaboration between the FDA and the National Institute of Health (NIH, 2010). These attempt to not only improve the efficiency of product development, but also streamline the regulatory submission process associated with radical technology. These initiatives hope to accelerate the process of developing scientific breakthroughs into new innovation for patients. In addition to the regulation awareness, several authors and published articles share the view that there is currently a problem with the front end activities and idea pipeline in the medical industry. Russell and Tippett (2008) suggest significant opportunities to increase commercial revenues can be achieved, by improving the initial development process within the medical device industry. This opinion is shared by Phillips and Van Bebber (2006) who also attribute this problem to the front-end phase. Pietzsch and Shluzas (2009) also state the need for pre-development activities and early planning within this sector. Regulatory guidance: Within today's medical healthcare sector, the way in which medical devices are developed, verified, tested and validated is controlled by rigorous regulatory legislation. The two main global regulatory bodies are the Food and Drug Administration (FDA) US regulations and the European Medical Device Directive. Any medical device marketed in the US or Europe must conform to the regulations stipulated within the country's control guidance. These regulations cover products including medical devices, consumer diagnostics, pharmaceuticals/drugs, biotechnology, applications of bioscience, medical instrumentation, healthcare aids and consumables. Although these industries and products vary in relation to the technological complexity, they all conform to similar regulatory requirements. Within the existing literature these two regulatory bodies have seen substantial progression in terms not only of verification and validation, but also design controls, development and production (the latter phases of development). However it should be noted that the regulations have a distinct lack of guidance within the area of front-end feasibility.

Technical uncertainty

Having briefly discussed the challenges and regulatory requirements of the medical device industry, the following section begins to define early stage technical uncertainties. Branscomb and Morse (2000, p9) suggest "risk is the price of doing something that appears to be worthwhile". These scholars add that "risks are undertaken because of the potential rewards by meeting those opportunities; by canceling a project, the risks are reduced, however the rewards are also lost". The term 'risks' has different meanings for a number of authors. Moriarty and Kosnik (1989) consider this term to include market uncertainty and technological uncertainty. Souder and Bethay (1993) consider risks in terms of business, market, and technical aspects. Technology assessment means "answering the questions of whether the concept can be developed and what technical solutions will be required" (Cooper, 1988). Branscomb and Morse (2000) describe uncertainty as "the absence of sufficient information to predict the outcome of a project", stating that "uncertainty provides

motivation to create potential options", whereas "risk offers great harm; uncertainty offers great opportunity". In technology development, potentially it is impossible to make decisions without appropriate information. Relevant knowledge must be obtained in order to reduce these risks and uncertainties (Moenaert 1995; Mullins and Sutherland 1998). If the technical risks can be reduced during the front-end process of development, the higher the chance of success in relation to meeting expected requirements in later development (Herstatt, Verworn et al., 2004). However technical risks are difficult to identify, the process is chaotic, as true technical risks and unknowns rely on an insight into scientific research and typically only develop through experimentation, testing and data analysis, (Branscomb, 2000) and discovery (Kucklick, 2006). However, within early technology development, it is difficult to achieve this pre-technical assessment as there are multiple unknowns and a certain amount of experimentation is required. Song, et al., (2007) argue that when attempting to clarify technical uncertainty and risks, decisions cannot be defined without a true understanding of the technological obstacles and unknown factors. Due to these unknowns and ambiguities, certain factors can not be predicted and in some cases stakeholders are inclined to make crucial decisions without adequate knowledge or relevant data.

What can be done to mitigate these risks

These unknown factors have been discussed by Wheelwright and Clark (1995) within the area of technology research; suggesting it is the planning of these activities in identifying technological risks and uncertainties which cause front-end ambiguity. Pietzsch and Pate-Cornell (2008) suggest that these technical uncertainties can be reduced, if an early technical assessment is completed during the early decision phase. This view is shared by Branscomb (2000); Pietzsch and Pate-Cornell (2008). Research by Verworn (2006) states that reducing uncertainty using technology assessment is a critical activity, before outlaying significant resources to development. Although various technical factors needed for planning may be unidentified, these uncertainties may be reduced by systematically identifying the technical unknowns (Balachandra and Friar, 1997) and initial technical management (Song, et al., 2007). It is understood that when these technical objectives are clear, the initial technical planning has direction (Verworn and Herstatt, 2000).b Technology uncertainties should be reduced during the front-end of development. This is particularly important within the medical device industry, where project schedules last for between 3 to 10 years and require significant investment. Especially as it is undesirable to complete a lengthy project to find the technology was not viable, or could not gain regulatory approval. Hence, creating structure and mitigating technical uncertainty and maximizing confidence in the early phases is critical.

Existing medical stage-gate process

A recent article by Pietzsch, et al., 2009, attempts to structure the entire development process of medical devices. The theoretical model was created using best-practices and interviews with 85 companies, including leading practitioners working within the medical device

industry. It attempts to correlate the stages and activities across individual disciplines and is laid out in a sequential linear process. Adding to this, it attempts to manage the entire development cycle more effectively, addressing phases such as initial opportunities to product launch. This theoretical linear stage-gate process resembles the basic principle proposed by Cooper (2006). Work by Mehta (2009) endorses the stage-gate process as a valuable planning tool for the development of medical devices. However, these stage gate models only include vague titles such as 'concept selection'. It could be argued that in order to select a concept, many prior steps must be considered and completed. Within the article (Pietzsch, et al., 2009) the authors suggest "the iterative process of medical device development does not always follow this idealised linear model, but rather involves fuzzy boundaries". Work by Russell and Tippett (2008) and Whitmore (2004) also make claims, arguing that the process of research and development within the medical device industry rarely follows a sequential linear model and does not accurately reflect the true complex nature of the process. It may also be suggested, that linear models may not suit scientific projects which encompass vast experimentation and multi-disciplined environments; nor do these provide guidance, list expectations, or provide instructions on how to perform each development phase. One such principle which attempts to capture the complex nature of these requirements and provide guidance in the form of expected deliverables for each development cycle is called technology readiness levels.

Medical technology readiness levels

Technology readiness levels provide a scale (1-9) in which developments can be managed and evaluated. One use of this principle has been applied to the biomedical industry proposed by Maryland (2007) lists deliverables of the technology at key phases of development. Essentially, this scale provides structure for technology management and highlights greater detail in terms of technical and regulatory expectations; it also provides the team with both objectives and expected outcomes. Yet, the process lacks associated test requirements and guidance on how to conduct each activity.

Literature review summary

- The medical device industry is experiencing difficulty in front end effectiveness.
- It is widely understood that front end planning has a profound effect on success.
- Regulations lack front end guidance, favouring detail in conformance.
- Generic development models do not list specific requirements of the medical sector.
- Medical models identify some unique aspects, though offer little technical detail.
- Limited literature exists addressing front-end development within the medical sector.
- Medical development rarely follows the idealised linear process.

Research Methodology

To address the proposed research questions, a broadly interpretive approach is adopted, to gain a preliminary understanding of current working practices and observe technology

feasibility management within the medical sector. The objective of this work is to identify both the characteristics of effective technology feasibility and identify factors which influence successful technology confidence. Given that this research attempts to develop an understanding and insight rather than validate theory, the case study method proposed by Yin (2009) is selected. Yin (2009, p22) suggests, "[A case study] is an empirical inquiry that investigates a contemporary phenomenon within its real life context using multiple sources of evidence". By analysing case studies, an understanding can be developed and insight can be gained by asking questions about specific occurrences, rather than proving a theory. Baharein (2008, p1602) suggests that the "case study is not intended as a study of the entire organisation, rather it is intended to focus on a particular issue". By using multiple case studies to focus on specific areas, comparisons can be identified across different organisations offering a broad understanding and strengthening the validity of the data. For this reason a multiple case study approach is an appropriate research methodology to gain an understanding within a particular industry. The case study interviews will include both open-ended and structured questions. This approach is considered a suitable method to identify unknowns within research and is particularly true in the field of management investigation (Yin 2008). This study aims to gain insight into aspects such as planning, thought rationale and the decision justification relating to technology feasibility within specific projects. For this reason, the targeted interviewees will be predominantly responsible for: technical management, key technical decisions and influencing the direction of technology feasibility. The preliminary investigation includes three case studies involving a single interview for each organisation. This number of three case studies will enable each project to be investigated in sufficient detail, but also gain a broad understanding across several organisations and working procedures.

Visual data capturing

The research seeks to identify specific activities which are conducted during the early phases of product development and to correlate these with perceived levels of technical confidence. The purpose of the interview is to provide a platform for the research participants to discuss the design process of a particular application. The study hopes to identify the following key factors:

- Identify specific activities and tasks during the initial design phases.
- Identify where the activities occur within the sequence.
- Identify what effect activities have on technical confidence.

It would be challenging to correlate the relationship between all factors in a semi-structured interview. Therefore, in order to capture the required data within one session, respondents were invited to produce a visual graph to enable multiple functions to be simultaneously recorded. Work by (Meyer 1991; Hanrahan 2007; Shrinivasan, Gotz et al. 2009; Sloan 2009) advocates the use of graphics as a suitable means of communicating information about

multidimensional attributes and conveying relationships. The information that participants provide, can be quickly identified, and trends can be easily recognised (Hanrahan 2007) and provide the interviewee the opportunity to visualise the entire process. The graph will assist in triggering decision justification and reasoning for procedures along the development cycle, rather than being prompted with a list of predefined activities. The graph will enable the interviewee's own insights and recollections of progression to be established (Srinivasan, et al., 2009). It will provide a visual interpretation of technical confidence in relation to specific tasks and activities, focusing on items of interest and prioritising groups of activities (Hanrahan 2007).

Case study companies

The preliminary investigation includes three case studies involving a single interview for each organization. This number of three case studies will enable each project to be investigated in sufficient detail, but also gain a broad understanding across several organisations and working procedures. Companies were selected on the basis that they had recently undertaken aspects of technology innovation within the medical device sector.

Example	Project	Company details	Role	Outcome
1	Surgical device	Medical innovation company Medium size business, <100 employees, part of a larger national group	Head of medical technology	Launched
2	Consumer diagnostic, Immune assay	Global medical diagnostic company, Medium size business, < 200 employees, part of a larger global group.	Project leader	On hold
3	Consumer diagnostic, Electro chemistry	Medical technology company, Small size business, <50 employees, part of a larger global group.	Technology R&D project leader	Closed

Data collection and analysis

For the preliminary studies, the information gained throughout the interviews provided qualitative written accounts, which were recorded and transcribed. The transcribed data regarding specific questions is grouped into themed categories, enabling findings to be systematically categorised and patterns to be identified. The following preliminary studies provide an understanding of the process of early development and identify various activities which are conducted during the development of a medical device. For reasons of confidentiality, all organisations wish to remain anonymous as the context of this research addresses commercially sensitive information.

Exploratory study 1

The first company is an organisation set up to develop innovations within the healthcare industry. It specialises in commercialising ideas from clinicians, doctors, consultants and nurses. The research was organised by the CEO of the company; the participant for the interview was the head of medical technology. This case study involves the development of a surgical device. The apparatus enables lung isolation enhancing surgical access and preventing contamination. It is envisaged that approximately 500,000 devices will be used within surgical procedures each year, the project duration was three years. The diagram below represents the data gained during the interview and plots the development activities in relation to the technology confidence.

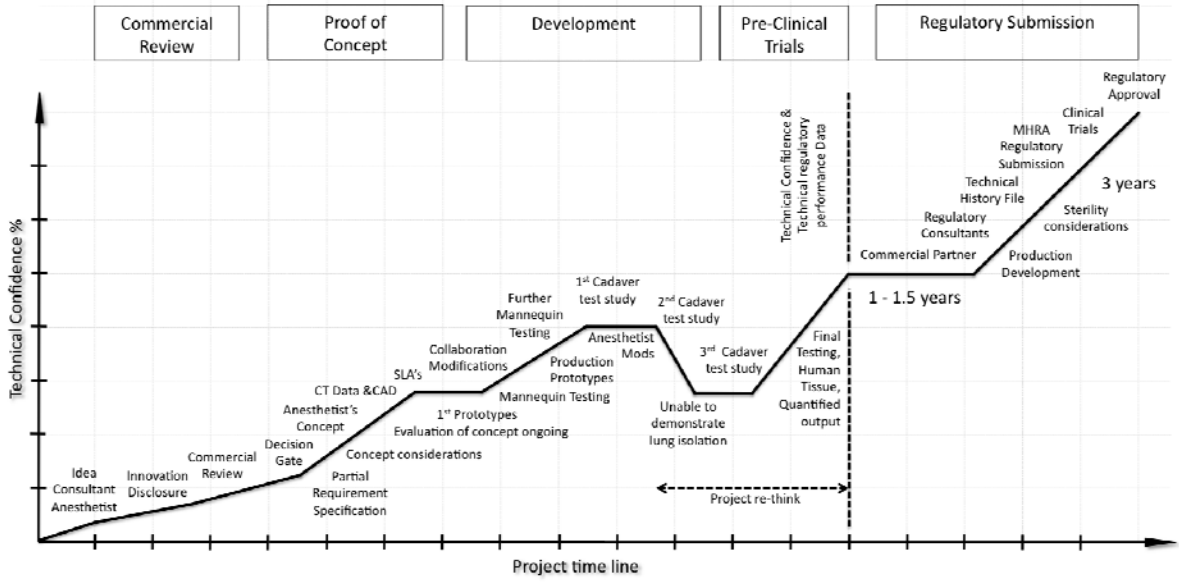

Figure 1: Exploratory case study 1

The organisation had an outlined process for development in place, this included a defined front-end phase. The initial stage of this process involved a commercial review, which enabled aspects to be evaluated, such as potential market size, intellectual property, but little technical risk consideration. Throughout this project, the design process initiated evaluation at each key phase. This proved successful, as pass criteria had been established. Although regulatory assessment was considered during the initial commercial review, this lacked consideration for verification and quantifiable performance data. This obstacle occurred during development, where stringent controls are in place, causing difficulty in implementation. This re-think took time in sourcing a viable test method, causing significant project delays. The proof-of-concept phase should have attempted to identify a viable method of testing which was equivalent to human tissue, but this was not considered.

Exploratory study 2

The second investigational interview involved a world leader in the research, design, production and supply of consumer diagnostics. The research was organised by the programme director and the case study interview was conducted with the associated project manager. This project involves a recent development of a consumer diagnostic device, utilising a biochemistry immunoassay, fluid sampling and optical electronics. As part of the case study interview, the objective was to gain an understanding of early project management to identify both the sequence and activities within the early phases of development. The following diagram represents the data gained during the interview and plots the development activities in relation to the technology confidence.

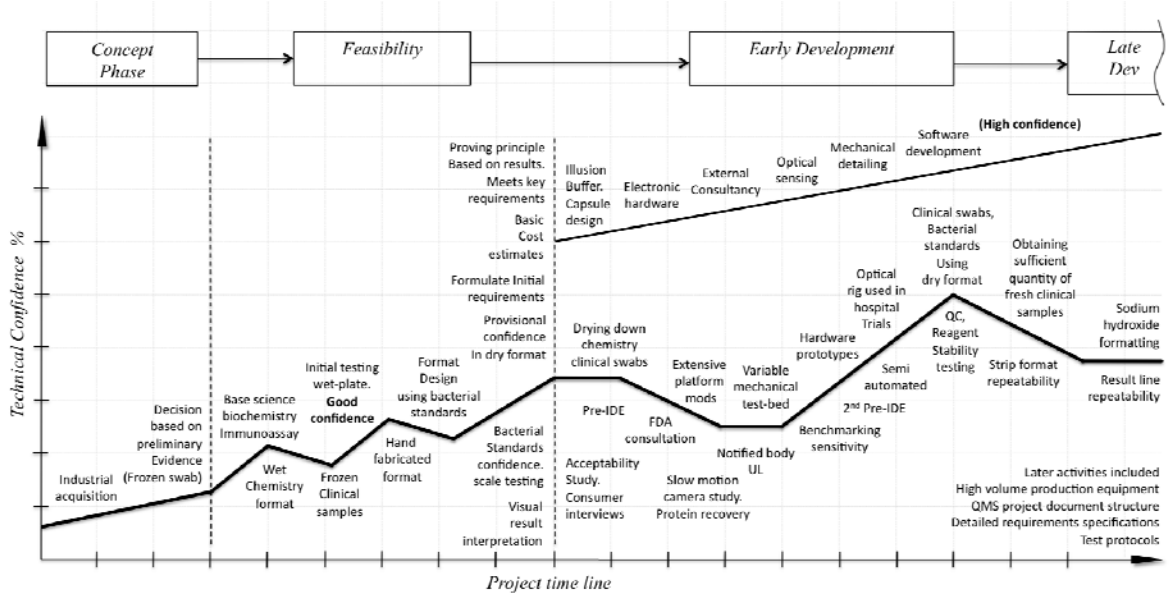

Figure 2: Exploratory case study 2

The main underlying technical challenge within this case study, was the difficulty observed when attempting to dry down the wet chemistry into a dry fluidic format. This challenge was not solved throughout the 4 year project and should have been identified as the key technical challenge within the feasibility process, before commissioning secondary activities within development. The decision was taken to progress into early development based on preliminary testing, which lacked vital credible data. Although a design process was used within this project, the process itself was restricted to development phase titles without any further detail. It lacked clarity in terms of expected activities, testing requirements and outcomes of each phase of the process. The synthetic standard used within testing did not replicate human samples. This was understood and research continued to resolve this issue, however, no solution was found throughout the four years. This should have been identified as a key technical challenge, requiring a reliable method of testing replicating human bacterial samples; the process did not consider this topic. Early prototypes were hand-fabricated, time-consuming to produce and dimensionally inaccurate. This challenge should

have been resolved by introducing low volume production equipment and inspection qualification; however, the process did not consider this factor. Obtaining a sufficient number of fresh swabs proved difficult. This should have been identified within the early phases of the project/design process and subsequent measures considered. An optical test-bed platform was created in late development, which enabled fresh swabs to be tested within a hospital environment. Initial results were visually interpreted, the optical test-bed enabled results to be digitally quantified. This was a critical piece of equipment and would have proved invaluable, had it been produced within the feasibility phase.

Exploratory study 3

The third company develops a series of diagnostic devices utilising micro-fluidic based systems. These assist in the diagnosis of diseases and enable more efficient monitoring of human health. The interview was organised by the project leader of technology within R&D. The specific case study involves a Class II patient self-test diagnostic device, using electrochemistry, biotechnology sensing and fluid sampling. The figure below represents the data gained during the interview and plots the development activities in relation to the technology confidence.

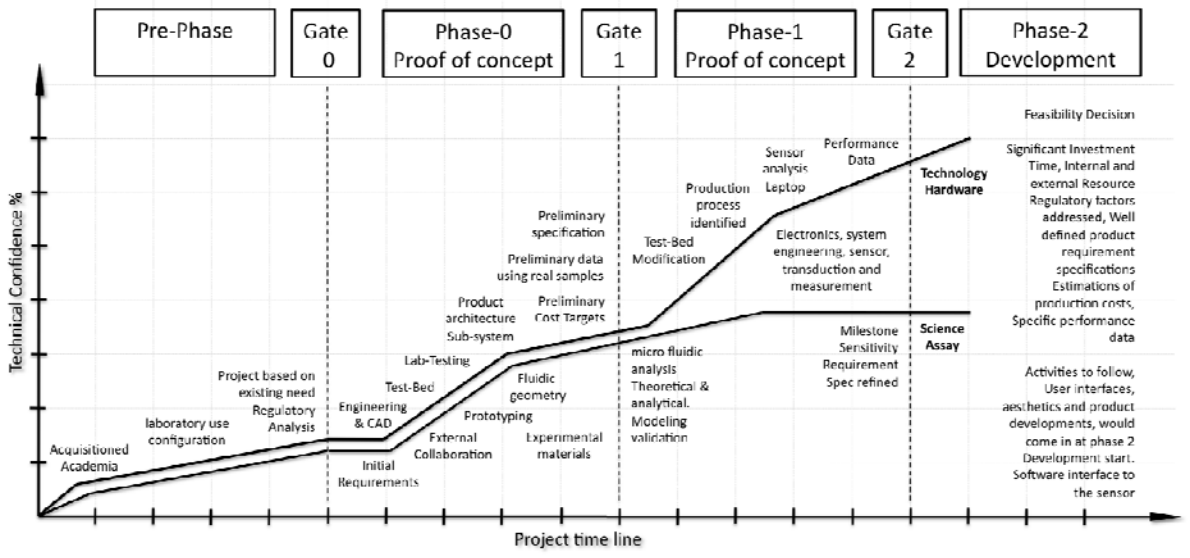

Figure 3: Exploratory case study 3

Within the development of case study 3, the design process provided decision gates at each phase interface. This involved an evaluation of technical progress and requirements for further consideration. An important observation of this project was the parallel activities of both the ‘science’ and ‘technology’. Design activities such as hardware development, electronics and software were progressed. However, the core science did not prove successful at the end of the project. It appears clear that resource was allocated to secondary activities, prior to establishing sufficient confidence within the core science. This should have been

identified as the first technical challenge, and resolved as part of proof-of-concept. Preliminary regulatory analysis was considered at the beginning of the project, however, this was based on the previous configuration. If the science and technology had been successful, lengthy regulatory assessment would have been subsequently required; this did not appear within their pre-development activities.

Exploratory research findings

This research provides evidence of how three projects within the medical sector managed their pre-development activities. It would appear from all three studies that each company has some form of design process in place, however their pre-development processes lacked technical guidance, defined outputs and do not provide specific tasks or actions. Each company process is shown at the top of the each graph. All three models have similarities, however, they all appear to only specify "phase titles" and "decision gates". The findings of this research suggest that linear models do not reflect the true nature of the work conducted within scientific feasibility. Behind these theoretical models lies a huge number of activities which are sporadic, unstructured and in some cases unknown. All three projects were technically very different, although the design process models were similar in terms of content and structure; several key technical activities were common throughout all projects. These graphical representations may suggest a logical development sequence was followed. However, Figure 4, below illustrates that various key activities were not considered during all three projects and show that front end activities continue to lack both technical confidence and technically related regulatory consideration.

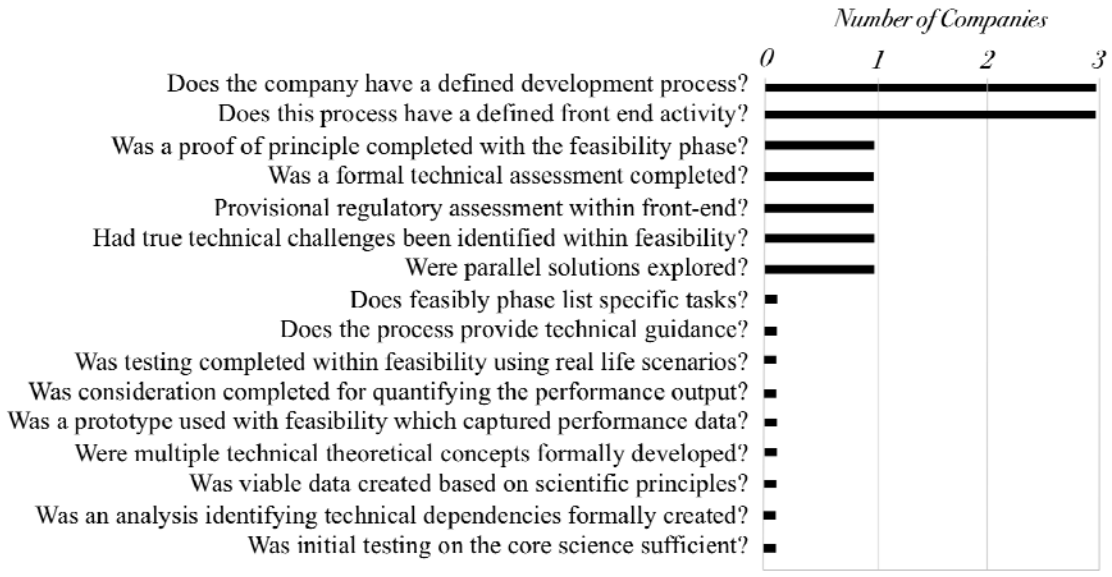

Figure 4: Activities that were not considered during all three projects

Conclusion

The medical device industry needs to reduce development time, increase predevelopment effectiveness and improve regulatory approval. This preliminary study has identified that although companies have skeletal front-end process models in place, they lack clarity and specific technical guidance detail. The findings suggest that linear models do not reflect the true nature of the work conducted within scientific feasibility. Behind these theoretical models lies a huge and diverse number of intricate activities which are sporadic, do not necessarily follow a sequential path and are typically undocumented. Two of the projects within this study did not proceed onto regulatory approval. It would appear that these projects are typical of the vast amount of research and development conducted within the medical sector, which has low success rates in new product development. The evidence suggests that these organisations are underestimating the importance of preliminary technology assessment, lacking key consideration for robust data on which decisions to invest are made. These project downfalls within the research may be attributed to the lack of appropriate technological consideration, guidance and understanding of the importance of establishing systematic confidence within feasibility. There is evidence within the literature that decisions and planning made within the front-end of development can dramatically influence the success of product development. Project success can be achieved by using appropriate tools and processes tailored to a specific industry; ensuring careful consideration of technical risks and applying a systematic approach to identifying the technical challenges. Gaining confidence early on can minimise disruption during development, where implementation procedures are time consuming and costly. Although the area of front-end development has received attention in the literature in recent years, these principles are not specifically customised for the medical sector which has numerous unique requirements. Existing process models aimed at the medical healthcare industry predominantly suit the later phases of development and lack appropriate consideration and guidance on leading the technological process within the embryonic phase. These regulatory procedures provide only a basic framework on which organisations base extensive scientific development.

Therefore, the main contribution of this work plans to develop in-depth guidance which goes beneath the regulatory linear process and provides detailed practical instruction for the front end of technological planning within the medical device industry. The research to date has shown that certain common technical activities were not considered within feasibility and thus had a detrimental effect on the outcome of the projects. If the design process encompassed sufficient technical consideration, initiated a thorough rationale in identifying technical risks, pitfalls, dependencies and listed specific activities, the majority of these obstacles may have been successfully avoided. Thus, there is a clear commercial and academic need to support further studies in this area, to improve front-end effectiveness. Such studies potentially also improve regulatory viability, resulting in fewer errors, significant cost saving and maximise benefits to the patient healthcare industry.

Current and Future work: Within the preliminary case studies, the technical confidence axis provided a visual indicator. Further development of this principle, adopts greater rigour in terms of the constructs of measure. By analysing the exploratory case studies, various levels of testing appeared critical and formed part of the technical confidence axis. This scale is an adaptation of the TRL principle, however, integrates testing and validation which are critical aspects in medical regulatory approval.

- High repetitions, quantitative test data, real life testing.
- Low repetitions, Quantify test data output, real life testing.
- Identify method to quantify performance output.
- Low volume REAL sample testing.
- Identify method of REAL testing.
- High volume, NON-real sample testing.
- Low volume, NON-real sample testing.
- Identify method of NON-real testing.
- Visual observation of function.
- Computational detail, calculations, simulations.
- Formulate.
- Conceptualise idea.
- Plausible technology identified.
- Basic need.

Ten further studies are currently being conducting using generic constructs of measure as illustrated above. The image below is an example of a historical case study being conducted within the medical device sector.

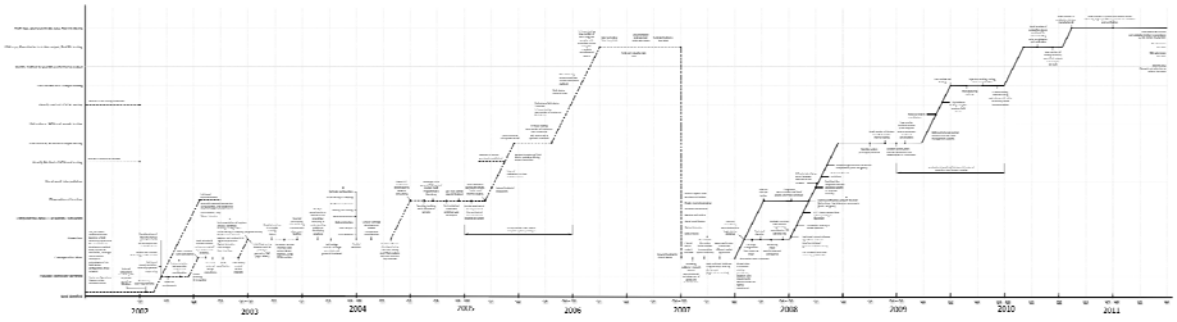

Figure 5: Existing study being conducted using the constructs of measure

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Predicting New Service Success: Comparing Evaluations of Managers, Customers And Designers

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The purpose of this research is to compare manager, customer and designer evaluations of the aesthetic design quality of new services. The findings of this research suggest that customers provide the best evaluations in terms of predicting new service success, while design experts provide the poorest evaluations. In general, multiple evaluators should be used if possible. However, if this is not feasible, we conclude that using design expert evaluations alone is not a promising strategy and if manager evaluations of quality are to be used, the same managers should not evaluate new service success. We find that evaluations of service aesthetic design quality by customers who have already bought a service provide the best predictor of new service success.

INTRODUCTION

A number of researchers have examined the relationships between design and performance by using measures of design quality as the independent variable. Broadly speaking three basic approaches have been used to assess design quality, namely evaluations by customers, evaluations by design experts and self-evaluations by managers. Each of these approaches suffers from drawbacks and because of the practical limitations that typically constrain empirical research – limitations that may make it infeasible to include more than one evaluation strategy – it is very important to compare these methods and determine which are likely to result in valid and reliable results.

This research focuses on design in the context of service innovation, which we refer to as the aesthetic design[1] of services. In view of the growing economic importance of services, research is needed on how aesthetic design can contribute to new service development (Ma et al., 2002; Candi, 2007). Services, although they are not manufactured objects, usually include something that customers perceive and to which aesthetic design can be applied. For example, a credit card is a tangible object that is a common, although not necessary, part of credit payment services. Furthermore, although customers do not necessarily take anything with them from a service, services can evoke emotions, support self-expression and create memorable experiences (Norman, 2004; Pine and Gilmore, 1998), all of which fall under the scope of aesthetic design. In their research on service innovation, Storey and Easingwood (1998) argue that services consist of a functional core and augmentation. Storey and Easingwood (1998) find that while core functionality leads to sales performance, augmentation contributes to other performance measures including profitability and what they refer to as enhanced opportunities. Likewise, Schmitt (1999) argues that firms should focus not only on functional features and transactions but on added factors that create more intangible value during decision making, purchase and use. Pine and Gilmore (1998) and Prahalad and Ramaswamy (2003) describe service augmentation in terms of using a core service as a platform on which to stage an experience or co-create experiences with customers. Norman (2004) argues that developing new offerings requires attention to behavioral (functional) design, on one hand, and visceral design to appeal to the human senses and reflective design to create emotional value and symbolic cues, on the other. In a similar vein, Schmitt (1999) argues that experiences consist of five elements: sense, feel, think, act and relate. Think and act have to do with a rational approach to product or services and are supported by functionality and technology. Sense, feel and relate are less tangible, more subjective elements. Our research will be focused on these less tangible, more subjective design elements, thus on aesthetic design to appeal to the human senses (sense), evoke emotions (feel) and provide symbolic cues (relate), which together can create a memorable experience.

This paper presents the results of a pilot study undertaken in preparation for large-scale longitudinal research on aesthetic design in service innovation. The purpose of this pilot study was to compare manager, customer and designer evaluations of the aesthetic design quality of services. Existing research tends to take a one-dimensional approach to measuring design quality, considering only self-evaluations by managers, potential customer preferences, post-purchase evaluations by customers or evaluations by design experts. In view of the limitations of each of the methods for measuring design quality, a combination of evaluations by design experts, customers and managers seems likely to provide more valid measures and increase understanding of the relationship between aesthetic design and

[1] The term industrial design is commonly used in the context of products, but being highly associated with the design of tangible objects, it does not lend itself well to the service domain. Hence, we adopt the term aesthetic design to essentially mean *industrial design of services*.

performance. Practical limitations may make a three-pronged approach infeasible. Hence, a comparison of the validity of these methods is needed.

The findings of the research suggest that customers provide the best evaluations in terms of predicting new service success, while design experts provide the poorest evaluations.

THEORETICAL FRAMEWORK

As discussed in the Introduction, three basic approaches have been used to assess design quality in existing research. Because most existing research on design has focused on products rather than services, these approaches have dealt primarily with the assessment of product design quality.

Research in which customer evaluations are used to measure product design quality can be divided into two categories. First, there are those that examine how design elements such as shape, proportion, color, and configuration influence customer preferences (e.g. Veryzer and Hutchinson, 1998; Veryzer, 1993; Creusen and Schoormans, 2005; Yamamoto and Lambert, 1994; Berkowitz, 1987; Hekkert et al., 2003; Meyers-Levy and Tybout, 1989; Bloch et al., 2003). This type of research, which generally uses an experimental research design, can help in the development of successful new products as it predicts whether customers will find products attractive or not. However, marketing studies have shown that customer preferences are not necessarily good predictors of overt customer behavior (e.g. Smith and Swinyard, 1983). Hence, research using customer preferences as a measure of design outcomes may not provide reliable findings on the contribution of design to performance.

The second type of research using customer evaluations to assess product design quality, examines actual customer purchase behavior instead of customer preference. This is generally done by means of surveys or interviews in which customers are asked to identify or rank factors influencing their purchase decisions (e.g., Bruce and Whitehead, 1988; Moody, 1980). This method suffers from the drawbacks of hindsight particularly when dealing with one-off purchases, but may be more reliable when dealing with the continual or repeated purchases of service.

An alternative approach is to ask design experts to evaluate design quality (Goodrich, 1994; Hertenstein et al., 2005; Talke et al., 2009; Walsh et al., 1988). In research adopting this approach, design quality may be measured directly, by polling design experts, or indirectly by counting design awards or other forms of certification of good design such as citations in relevant indices. To test design effectiveness, the performance of firms or products evaluated as exhibiting good design is compared with the performance of firms or products lacking these credentials (Hertenstein et al., 2005; Talke et al. 2009; Walsh et al., 1988) or, less convincingly, by analyzing the performance of good design by itself, without explicit comparisons (Goodrich, 1994). Probably the most important limitation of this approach is that design experts may not be representative of the market for a product or service.

In cultural fields such as art, film, and music, it has been shown that customer and expert evaluation criteria often differ or even conflict, so these two groups come to different conclusions about the quality of cultural product (on art, see e.g. Hekkert and van Wieringen, 1996; on film, see e.g. Hirschman and Pieros, 1985; and on music see e.g. Haan, et al., 2005). Much fewer studies examine the difference in quality evaluations by various groups in the field of product design. One of the few existing studies is one by Hekkert, et al. (2003). In this research, Hekkert, et al. (2003) found that experts and non-experts attach similar importance to the evaluation criteria for novelty and typicality when judging the aesthetic quality of cars. This is rather surprising since in the cultural realm experts tend to suppress an initial affective response for typical objects, and seem to base their aesthetic judgment more on considerations of novelty (e.g., Hekkert and van Wieringen, 1996). The failure of Hekkert et al. (2003) to find evidence for expertise effects on preference for novelty may be due to limitations in their operationalization of design expertise; they looked at expertise in the automotive product category rather than expertise in design or aesthetics. While Hekkert et al. did not find design students knowledgeable about cars to attach more importance to novelty than design students classified as not having automotive expertise, they did find that knowledgeable students were better able to differentiate between novelty and typicality. In a study by Hsu et al. (2000) similar results were found; designers were more sensitive and discriminating with regards to product form characteristics than users when evaluating telephones. However, contrary to Hekkert et al. (2003), Hsu et al. (2000) found that designers and users differed significantly in their preference distribution patterns.

To summarize, even though the existing evidence exhibits somewhat conflicting findings, we expect that customers and designers will differ in their evaluations of aesthetic design quality due to differences in knowledge and experience. Design experts are likely to have more fine grained cognitive models for design that are likely to influence their perception and evaluation of aesthetic design quality. Designers are likely to be better able to distinguish subtle design differences and tend to attach different values to different design dimensions than customers. Customers, however, have their own use experiences on which to base their evaluations. Hence, we expect aesthetic design quality assessments by experts and customers to not concur.

H1: Customers and design experts will not concur in their evaluations of the aesthetic design quality of a new service.

The third approach used to assess design quality mentioned in the Introduction is to ask managers to evaluate the design quality of their products or services (e.g., Candi, 2010). This method has the advantage of being the only one of the commonly used approaches that allows examination of design quality *during* the new product or service development process, while the others can only be applied after an offering has been developed or launched. The primary limitation of this method is the risk of non-objectivity on the part of managers evaluating their own products or services. Furthermore, like design experts, managers may have skewed views of what the market will accept. Indeed, as emphasized in research

examining the antecedents and determinants of NPD success, new product success rates are relatively low, which is in part due to a lack of understanding of customer needs and wishes (e.g., Ottum and Moore, 1997; Cooper 1993). We thus expect aesthetic design quality assessments to differ between managers and customers and we expect that customer evaluations will provide better predictors of the success of new services than managers' evaluations.

H2: Customers and managers will not concur in their evaluations of the aesthetic design quality of a new service.

H3: Customer evaluations of aesthetic design quality of a new service will be better related with new service success than managers' evaluations.

Due to the business experience and sector experience that competent managers are likely to have, they can be expected to be better able to predict the performance of a new service than design experts. Managers' perceptions of aesthetic design quality, even though they sometimes misunderstand customer needs and wishes (Ottum and Moore, 1997), are likely to be more closely related with actual service success than design experts' evaluations since managers can be expected to use their interpretation of customer needs and wishes as guiding principles, even though they may not understand them. Design experts on the other hand may have a tendency to judge according to their own tastes rather than being guided by how they think customers will ultimately judge aesthetic design quality. And these experts' tastes may not concur with those of the customers who ultimately decide to buy (or not) a service.

H4: Managers' evaluations of aesthetic design quality of a new service will be better related with new service success than design experts' evaluations.

METHOD

The unit of analysis for this research is the service innovation project and resulting new service. In 2008, CEOs of technology-based firms participating in an ongoing longitudinal survey study were asked about the role and use of aesthetic design in a specific current new service development project. Out of 140 survey participants, 109 were developing at least one new service. The average size of the firms was 17 employees and their average annual turnover in 2007 was about 1.7 million Euros. About 83% of the firms sold their services only or primarily to other firms (B2B).

A year later, in 2009, the same managers were surveyed again and asked whether their new service had been launched. A total of 12 service development projects had been abandoned, 7 had been launched but had no customers yet and 46 had been launched and had customers. The remaining projects were still under development. The managers with newly launched services for which there were already customers were asked to participate in the pilot study by answering questions about their new services and providing a list of customers that could be contacted with a short survey about the services. A total of 29 (63%) firms agreed to participate and made lists of customers available. There was some reluctance by the managers

about providing customer contact information and allowing us to send them a survey, since they thought this might harm their customer relationships or violate confidentiality.

Additionally, five university-level design students were recruited to evaluate information that was available on the Internet about the 29 new services. The result was three independent sets of evaluations of each new service. First, a single evaluation by each CEO; second, multiple evaluations by up to 15 customers that had used each service; and third, 5 independent evaluations by design students.

The surveys with managers were administered over the phone. Customers were surveyed using an Internet-based survey and adequate participation insured using follow-up phone calls. The design students conducted their evaluations independently.

Measures of aesthetic design quality

Measuring the aesthetic design quality of a service is challenging due to the largely intangible nature of most services. Referring back to the aesthetic design construct as discussed above, recall that aesthetic design quality was defined to consist of three aspects. These are design to appeal to the senses, design to evoke emotions and design to create symbolic cues (Schmitt, 1999; Norman, 2004). This terminology did not fare well in pilot tests of the manager survey. Managers found the terms vague and irrelevant. Hence, in the interest of simplification and increasing respondent engagement, two concepts were used in the surveys: visual design and experience creation. Indeed, experiences can be viewed as the outcome of successful aesthetic design of services (Schmitt, 1999; Candi, 2007). Managers were asked about the extent to which they believed their services were characterized by notable visual design and customers and designers were asked to what extent they noticed the visual design of the service. Similarly managers were asked about the extent to which they believed their firms had created a specific experience with the service and customers and designers were asked to what extent they believed the service created a specific experience.

As an alternate measure of aesthetic design quality and the experiences resulting from aesthetic design, items from Voss et al's (2003) scale of the *hedonic* and *utilitarian* dimensions of attitude to products was included in all three surveys. In our measure of hedonic value we included items for a service being fun, exciting and enjoyable.

Measures of service success

To test hypotheses 3 and 4, measures of service success were taken from the manager survey and the customer survey. Managers were asked to compare their service with those of competitors' on several dimensions including pricing and customer loyalty. Ideally, evaluations of service success by a fourth group of evaluators independent of the firms' managers should have been used. However, since the unit of analysis was individual services, it was not reasonable to obtain such information from anyone other than managers of the firms. A possible strategy would have involved collecting the information about service

success from a second respondent in each firm, but since this pilot study was inserted into an ongoing longitudinal study, asking for additional respondents in each firm was not feasible.

Customers were asked to rate their satisfaction with the each new service with respect to how well it met their needs and expectations, their rating of service quality and how likely they would be to recommend the service to someone else.

Table 1 provides a summary of the items and measures used for analysis. For multi-item measures factor analysis was used to select items. All factor analyses were conducted using the entire sets of data available, not just the data for the 29 firms to be included in the comparisons. All factor analyses were subsequently tested on the 29-firm sample to verify the existence of the same patterns as were found in the larger samples.

Table 1: Measures and items used for analysis. X=the new service under inquiry.

	Managers	**Customers**	**Design experts**
N used for factor analysis	N=46 completed service innovation projects	N=150 (2-15 per service)	N=145 (29 services, 5 designers)
Pricing	The pricing for X is higher than the pricing for comparable services offered by competitors. *Single item measure*	n/a	n/a
Customer loyalty	Customers are likely to stop buying X and buy a similar service from a competitor. *Single item measure (reverse coded)*	n/a	n/a
Customer satisfaction	n/a	X has completely met our expectations. X has completely met our needs. X is of high quality. I am likely to recommend X to someone I know. *Eigenvalue=3.3, Alpha=0.88*	n/a
Aesthetic design quality	X's aesthetic characteristics attract attention from potential customers. X's aesthetic characteristics attract attention from current customers. X creates a specific experience for customers. X's aesthetic characteristics differentiate it from competing services. *Eigenvalue=2.8, Alpha=0.89*	X's aesthetic characteristics caught my attention. X creates a specific experience. *Eigenvalue=1.4, Alpha=0.87*	X's aesthetic characteristics caught my attention. X creates a specific experience. *Eigenvalue=1.5, Alpha=0.89*
Hedonic quality	X is fun X is exciting X is enjoyable *Eigenvalue=1.3, Alpha=0.91*	X is fun X is exciting X is enjoyable *Eigenvalue=4.3, Alpha=0.95*	X is fun X is exciting X is enjoyable *Eigenvalue=1.8, Alpha=0.97*
Utilitarian quality	X is effective X is helpful X is functional X is necessary X is practical *Eigenvalue=3.6, Alpha=0.86*	X is effective X is helpful X is functional X is necessary X is practical *Eigenvalue=0.9, Alpha=0.87*	X is effective X is helpful X is functional X is necessary X is practical *Eigenvalue=4.5, Alpha=0.97*

FINDINGS

Pairwise correlations between variables were examined to test the hypotheses, see Tables 2 and 3. The relatively small number of cases (N=29) made testing using regression analysis inadvisable (Cohen, 1992).

In Table 2 we see that within each group of evaluators there are significant correlations between aesthetic design quality, hedonic value and utilitarian value. This indicates that the measures should not be included together in regression analysis due to the risk of multicollinearity. The only exception is that aesthetic design quality as evaluated by managers is not significantly correlated with managers' evaluations of utilitarian value. A positive correlation between hedonic value and utilitarian value is not necessarily to be expected since it is entirely plausible to imagine a service that has only utilitarian value and no hedonic value. The converse, namely a service with hedonic value only, may not be quite as plausible except in the specific area of entertainment services. Managers may better distinguish between these two while customers and design experts may have been more influenced by a generally positive or generally negative attitude to the service being evaluated. This may explain why evaluations of hedonic and utilitarian value are significantly correlated in the customer and design expert evaluations but not in the manager evaluations.

Managers', customers' and design experts' evaluations of aesthetic design quality are significantly correlated with each other. This suggests agreement among these three groups with regards to aesthetic design quality. The same is true for evaluations of hedonic value. Thus, hypothesis 1 about disagreement between customers and design experts is not supported, nor hypothesis 2 about disagreement between customers and managers.

There are a number of possible explanations for why we do not find differences between the evaluations of the three groups. First, hypothesis 1 about differences between customer and designer evaluations may not have been supported because the design experts who evaluated the services in the sample were design students rather than designers with extensive experience. Ours was similar to the strategy employed by Hekkert at al. (2003) and Hekkert and van Wieringen (1996), who also used evaluations by design or art students. Design students may not have developed the level of acumen about design as experienced designers, and thus their evaluations may tend to be similar to those of customers, who are also likely to lack such acumen about design. Second, the existing research on which we based our arguments for the hypotheses is all research with a product focus and it is conceivable that the patterns observed in product design evaluation do not hold in the context of services. Thirdly, existing research suggests that evaluations by both experts and non-experts are more positive when evaluating offerings that are experiential rather than functional in nature (cf. Hekkert et al, 2003) and so due to the experiential nature of services, evaluators showed greater agreement than they would have for products. In the fourth place, a possible reason why customers and managers were found to agree in their evaluations of aesthetic design quality rather than disagree, as hypothesized, is the high percentage of B2B services included in the sample. Business-to-business relationships tend to last longer than business-to-consumer relationships and it is possible that the managers sampled had deep knowledge of their customers' preferences, which may have influenced their evaluations of their services' aesthetic design quality.

Table 2: Pairwise correlations between manager, customer and design expert evaluations (AD=aesthetic design).

	Managers			Customers			Design experts	
	AD quality	Hedonic value	Utilitarian value	AD quality	Hedonic value	Utilitarian value	AD quality	Hedonic value
Managers								
Hedonic value	**0.60** ***							
Utilitarian value	0.21	**0.61** ***						
Customers								
AD quality	**0.60** ***	**0.61** ***	**0.34** **					
Hedonic value	**0.49** ***	**0.62** ***	**0.50** ***	**0.86** ***				
Utilitarian value	**0.03**	**0.48** ***	**0.51** ***	**0.44** ***	**0.56** ***			
Design experts								
AD quality	**0.49** ***	**0.34** **	-0.09	**0.43** ***	**0.40** **	0.05		
Hedonic value	**0.50** ***	**0.40** **	-0.11	**0.44** ***	**0.38** **	-0.04	**0.87** ***	
Utilitarian value	**0.19**	**0.04**	-0.02	**0.23**	**0.16**	-0.03	**0.66** ***	**0.53** ***

** p<0.1, ** p<0.05, *** p<0.01*

In testing hypotheses 3 and 4, we avoided common-method bias by examining only relationships between aesthetic design evaluations by one group and service success evaluations by another group.

In Table 3, we see that managers' evaluations of aesthetic design quality and hedonic value are significantly correlated with customers' evaluations of satisfaction. Customers' evaluations of aesthetic design quality and hedonic value are significantly correlated with managers' estimates of pricing compared with competitors but not with managers' estimates of customer loyalty. In fact, managers' evaluations of customer loyalty are not significantly correlated with customers' evaluations of satisfaction, so we must conclude that the managers included in the sample do not perform well in terms of predicting customer loyalty. Taken together, these findings provide support for hypothesis 3 about customers' evaluations being better predictors of new service success than managers' evaluations.

In Table 3 we see that design experts' evaluations of aesthetic design quality and hedonic value are correlated with neither the managers' nor the customers' evaluations of new service success. Thus, we conclude that designers' evaluations are least predictive of new service success, which provides support for hypothesis 4.

Table 3: Pairwise correlations between service performance and manager, customer and design expert evaluations.

	manager survey		customer survey
	pricing	customer loyalty	customer satisfaction
Managers			
AD quality			**0.24** *
Hedonic value			**0.60** ***
Customers			
AD quality	**0.24** *	0.21	
Hedonic value	**0.30** *	0.15	
Design experts			
AD quality	0.13	0.00	0.16
Hedonic value	0.12	-0.22	0.18

** p<0.1, ** p<0.05, *** p<0.01*

CONCLUSIONS

Valid and reliable methods are needed to measure aesthetic design quality in service innovation. Existing research tends to take a one-dimensional approach to measuring aesthetic design quality, considering only self-evaluations by managers, potential customer preferences, post-purchase evaluations by customers or evaluations by designers or peers. This paper presents the results of a pilot study, the purpose of which was to compare manager, customer and designer evaluations of the aesthetic design quality of services. Evaluations by potential customers are less likely than evaluations by actual customers to predict future purchase behavior and so were not included in the pilot study.

So, who should be asked to evaluate the aesthetic design quality of services? When the findings about relationships between evaluations of aesthetic design quality and service success outcomes are examined, it seems that customer evaluations are the most preferable and design expert evaluations the least preferable in terms of predicting service success. Manager evaluations lie between the other two, but should only be used if service success outcomes by someone other than these same managers are being used.

Evaluations by managers have the advantage of being possible during the service development process but the disadvantage of possibly lacking objectivity. As such, they might be most valuable as an element of longitudinal research in which managers evaluate aesthetic design quality, along with aesthetic design emphasis and aesthetic design capabilities, during the development and prior to the launch of new services. This can then be followed by evaluations by customers and/or design experts after launch.

Evaluations by customers have the advantage of being evaluations by the stakeholders who play what is arguably the most important role in new service success, namely buying the service. At the same time evaluations by customers might suffer from a kind of myopia and non-representativeness due to the customers' focus on their own current needs and a lack of focus on the broader issue of future needs or other customers' needs. Therefore, customer evaluations should include evaluations by a representative sample of customers and survey instruments should be designed to encourage evaluators to think not only about a narrow scope of current needs and urgent functional issues but a broader scope including future needs and non-tangible issues.

Evaluations by design experts have the advantage of likely being the most neutral or objective evaluations compared with evaluations by managers or customers. This is assuming the design experts involved in evaluation are not employees of, or consultants to, the firms in question or past or present customers. This advantage may be balanced by the disadvantage that design experts may lack grounding in market realities. Designer evaluations might be plagued by the stereotypical problem of designers concerned only with design for its own sake but without concern for practical or market implications. Evaluations by design experts may be most useful as a means to validate evaluations by managers or customers. If used in this way, design expert evaluations can be conducted by just a few design experts as long as their neutrality and objectivity is insured.

This paper has examined the issue of who should undertake the evaluation of service aesthetic design quality to insure the best possible validity and reliability. Further research involving larger samples is needed to more thoroughly compare analyses by managers, customers and design experts. The scope of comparisons could also be broadened by including different types of managers, e.g. innovation managers, project managers or marketing managers. Furthermore, analogous research using design experts with considerable experience should be conducted to examine differences compared with design students. In view of the experience element of services and the contribution of aesthetic design to experience creation, evaluations by experts in event management and theatre might also be useful.

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Designing Context-Specific Service Systems: Applying Pattern Design Principles to Service Design (Work in Progress)

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Keywords: Pattern Design, Service Design, Portrait Gallery, User Interface

This study develops and tests a new pattern language development process for the design of culturally sensitive user interfaces. Drawing on the pattern approach within the human-computer interface literature, we propose a distinctive set of procedures that aim to: (1) improve the validity of patterns; (2) improve the organisation of pattern languages; and (3) integrate stakeholder values into the interface design process. As a proof of concept, we will test our approach in the cultural services setting using data from a sample of gallery visitors.

INTRODUCTION

Many of the most complex service systems being built and imagined today combine person-to-person encounters; technology-enhanced encounters; self-service; computational services; and multichannel, multidevice, location-based and context-aware services (Glushko, 2010). This research builds on the work of Glushko to examine the application of pattern-based design principles for different service contexts to propose a unifying view that spans them, especially when the service system is information intensive. In particular, we focus on the information required to perform the service and the patterns that govern information exchange to provide more useful insights into service encounters and outcomes. This in turn will make it easier to see the systematic relationships among the contexts that can be exploited as design parameters or patterns.

A case study for the (re)design of the service delivery system of an innovative, multichannel cultural institution – the Australian National Portrait Gallery (ANPG) – will be undertaken to illustrate the use of pattern design principles in different service contexts. In particular, our

research will use patterns as the building blocks for re-engineering both the physical and virtual visitor experience. The ANPG is enthusiastic about the potential of using emergent technologies to create location-specific, education-focused service encounters. From a practical perspective, the aim of this research is to design a novel, interactive system of integrated services that enable the co-creation of value for both producer and consumer.

From a theoretical perspective, the aims of this research are the following:

1. Scrutinize the use of pattern design principles and propose (where necessary) a range of new, reusable patterns that capture the way visitors engage with different services provided by the National Portrait Gallery;
2. Pioneer a new pattern language development process that builds on the strengths of discrete choice analysis as an approach for creating and evaluating the efficacy of the pattern approach to service design.
3. Design and test a range of services in different contexts and for different visitor groups as a proof of concept for the proposed approach.

BRIEF LITERATURE REVIEW

Patterns for Service Design

Simply stated, a pattern is a proven solution to a recurring design problem. It pays special attention to the applicable context, to the competing "forces" it needs to balance and to the positive and negative consequences of its application (Borchers, 2000). It references higher-level patterns, describing the context in which it can be applied, and lower-level patterns that could be used after the current one to further refine the solution. This hierarchy structures a comprehensive collection of patterns into a *pattern language*.

The original concept of pattern languages was conceived by architect Christopher Alexander in the 1970s. Alexander (1979) explains how a hierarchical collection of architectural design patterns can be identified to make future buildings and urban environments more usable and pleasing for their inhabitants. His initial work presented 253 such patterns of user-friendly solutions to recurring problems in urban architecture. It is less known that Alexander's goal in publishing this pattern language was to allow not architects but the inhabitants themselves (that is, the *users*) to design their environments. This is strikingly similar to the ideas of user-centred and interaction (participatory) design, which aim to involve end users in all stages of the software development cycle. Pattern languages essentially aim to provide laymen with a vocabulary to express their ideas and designs and to discuss them with professionals.

The central concept presented here is that experts from a range of disciplines will work with ANPG staff and visitors to design patterns for the critical touch points in the service experience. Advanced experimental designs and mathematical modelling will be used to

identify the optimal combination of patterns for particular groups of visitors and various service-design situations. This approach will enable the cross-disciplinary team to express and codify its expertise in the form of a pattern language, creating a vocabulary to improve communication within the team. The approach also has the advantage of acting as a tool for capturing corporate memory and tacit knowledge.

Although patterns have become a popular tool for researchers in a range of disciplines over the past decade or so, the pattern approach has not yet been applied to the design of complex service systems. A key feature of patterns that makes them particularly useful for service design is that they can include prescriptions for both design and activity. In this regard, patterns are interspersed with the values of all stakeholders involved in the design process. Fincher and Utting (2002) insist that patterns and pattern languages must embody values, because they advocate particular design ideas to be emulated and because all patterns challenge users, management (ANPG in this case) and service designers to examine the values that influence their decisions. In a critical review of the pattern approach in the field of information technology, Dearden and Finlay (2006) assert that the research on patterns has been dominated by form and examples, with limited examination of the value of pattern-based design. They subsequently assert that future research on patterns should prioritise the following issues:

1. Evaluating the validity and practical value of existing patterns, and documenting the processes by which new reusable patterns are developed;
2. Improving the processes by which patterns are identified, recorded and reviewed, with particular attention to the organisation of pattern languages so that patterns at different levels (e.g., broader social context, personal user preferences, detail of context, etc.) can be incorporated into designs;
3. Examining the manner and extent to which values influence patterns and pattern language development.

This research will seek to address all of these issues. The next section will elaborate on the approach that will be used in support of these research aims.

APPROACH

This research draws on a rich, cross-disciplinary knowledge base. The work is to be undertaken by a team of nationally and internationally renowned experts in their respective fields and will be overseen by Service Design Lab. Modelled on the successful “Living Lab” research group at MIT, the Service Design Lab brings together experts from complementary fields to examine service-system problems using a unique service-design methodology. This approach utilises systems engineering tools to capture and model service delivery processes before drawing on pattern-based design principles to identify, unpack and redesign the

critical customer touch points. The process engages both experts and affected stakeholders in the service-design process, and it captures the explicit and implicit knowledge that is needed to develop complex, context-specific service systems.

This process will be conducted during July and August 2011 and included five distinct stages as follows: (1) ethnographic study; (2) development of patterns; (3) creation of pattern language; (4) prototype design; and (5) usability testing. Each of these stages will now be examined in more detail.

Stage 1: Ethnographic Study

The qualitative fieldwork in this project was conducted according to a critical ethnographic tradition. Critical ethnography adopts an analytical perspective of ethnography by focusing on the implicit values expressed within ethnographic studies and on the unacknowledged biases that may result from such implicit values (Thomas, 2003).

Traditional ethnography tends to emphasize the researchers' role in controlling interactions in the field and in reporting their findings in a disengaged way. Critical ethnography, on the other hand, examines the assumptions behind actions and postulates that a researcher can ask questions. It attempts to free researchers from ideologies that detract from informed reportage.

The purpose of the ethnographic fieldwork was to observe and uncover implicit cultural rules that influence how visitors to the ANPG interact with technology. The fieldwork was guided by Berry's (1997) eco-cultural framework, and it made use of firsthand observation and semi-structured interviews. While these are among the more common methods for collecting data in an ethnographic study, the eco-cultural framework ensured that we uncovered latent cultural and ecological issues as they influenced behaviour in a given society or polity (Lonner and Adamopoulos, 1997).

Visitors were observed in two contexts: (i) the normal gallery environment, where they were given access to an iPod with static content related to the exhibitions; and (ii) a simulated environment, where they interacted with two different Web-based interfaces designed to support location-based learning. These activities were punctuated by semi-structured interviews conducted according to the laddering technique (Reynolds and Gutman, 1988). This particular interviewing technique draws on means-end theory to identify and rank issues in terms of importance.

The transcribed observation and interview data was then analysed to identify important themes using the well-established genealogical method (Rivers, 1900). This method is employed to discover and record connections, relationships and values, which are represented using diagrams and symbols. The goal of this analysis was to identify and understand the relationship between important issues. This work was the basis for the identification of problem statements and the development of patterns.

Stage 2: Development of Patterns

Using the pattern template developed by Alexander (1979) and the common-ground patterns for HCI interface design proposed by Tidwell (1998) as a starting point, this task focused on translating the problem statements identified in the previous stage into a pattern collection. Each pattern included a short, descriptive title followed by examples of the application of the pattern, a description of the context in which the pattern would be applied, an overview of the various forces impacting the pattern use, and the proposed solution. In line with the work of Tidwell (1998), our patterns also included a free text field in which random comments regarding the pattern and its application were recorded.

As an extension to the original pattern template, and based on the recommendations of Dearden and Finlay (2006), our patterns also included specific information regarding cultural values. This information was codified according to Trompenaar et al.'s (1998) seven cultural dimensions, which have been found particularly effective in uncovering cross-cultural subtleties. The first five of these relate to the ways human beings deal with each other: (i) universalism vs. particularism (i.e., what is more important, rules or relationships?); (ii) individualism vs. collectivism (i.e., do we function in a group or as individuals?); (iii) neutral vs. emotional (i.e., do we display our emotions?); (iv) specific vs. diffuse (i.e., is responsibility specifically assigned or diffusely accepted?); (v) achievement vs. ascription (i.e., do we have to prove ourselves to receive status, or is it given to us?). In addition, there are various perspectives of time and of attitude towards the environment: (vi) sequential vs. synchronic (i.e., do we do things one at a time or several at once?); (vii) internal vs. external control (i.e., do we control our environment, or are we controlled by it?).

The resulting pattern collection was presented at a workshop coordinated by the Service Design Lab at the University of Canberra in late July. The purpose of this workshop was to evaluate the patterns and make suggestions for refinement.

Stage 3: Creation of Pattern Language

Arguably, the most critical aspect of the pattern approach is the creation of pattern languages. The DCA methods serve as a significant and novel contribution in the present study to inform the creation of pattern languages.

The creation of the pattern language was done in four distinct steps. The first step was to translate the patterns into design elements that can be incorporated into a mock interface. For example, where the problem of poor literacy may result in a pattern solution to use audio instructions, the decision still needs to be made regarding the nature of the audio instructions (e.g., whether to use a male or female voice, a mature or youthful voice). Every pattern solution had options that need to be translated into design elements. The presence or absence of a particular design element in a mock interface was controlled via an underlying

experimental design derived from first principles using the optimal design theory (Street and Burgess, 2007). The educational design team at the University of Canberra provided support for the development of the design elements and the mock interfaces. This team has in-house graphic design and Web programming capabilities as well as access to cutting-edge audio-visual production equipment.

The second step was to identify an efficient experimental design (i.e., a design for main effects and all two-way interactions) such that each respondent is presented with a manageable number of choice tasks. Each task required that respondents select the mock interface they like most and least from a set of three mock designs. The resulting number of choice tasks was determined by combinatorial design theory and takes into consideration the number of patterns (design elements), the number of options for each pattern solution, and the number of respondents available to complete the task.

The third step was to analyse the resulting data using a conditional logit model (McFadden, 1973). The conditional logit model is a regression-type model that was developed as part of McFadden's Nobel Prize winning research. It extends the multinomial logit model to estimate parameters based upon an underlying experimental design. As we are using an exploded ranked order model, we also needed to weight each choice according to the Luce and Suppes (1965) weighting theorem. The resulting analysis provided a sound basis for a pattern language, in which the importance of each pattern is established along with the strength of the relationships between patterns. In this research, we also seek to pioneer a nomenclature for presenting pattern languages based on a combination of concept mapping and density mapping. The resulting map represents patterns as circles, in which the size of the circles reflects the importance of the pattern, and the proximity of one circle to another reflects the strength of the inter-pattern relationships.

The final step was to examine how factors such as cultural values influence the preference for and relationship between patterns. To do this, we introduced additional information and estimated a latent class (finite mixture) model over the original conditional logit model. In doing so, we captured some of the unexplained variance in the pattern preferences at the aggregate level by segmenting the respondents into groups. The result of this analysis was the identification of different pattern languages for subgroups of users with different cultural values. Ultimately, this provides the basis for designing a range of interfaces that cater to the preferences and needs of different user segments within the gallery visitor population.

The resulting pattern languages were presented to a second workshop of the Service Design Lab in late August 2011. The workshops were intended to provide valuable feedback on the face validity of the pattern languages.

Stage 4: Prototype Design

The translation of the pattern languages into working prototypes was a relatively straightforward process. The DCA analysis conducted in the previous task (and the resulting pattern language) provided information on user preferences for different design elements as

well as an optimal combination of these elements. This optimal combination represents a recipe for the prototype design, in which the ingredients for this recipe are the relevant design elements created in step 1 of stage 3. Two different prototypes were designed. The first was a Web-based interface for use with a laptop, and the second was a more compact version for use with a handheld PDA device. The working prototypes will be available for viewing at the conference.

Stage 5: Usability Testing

The study will involve both field and laboratory testing of the interfaces. The aim of the usability testing is to observe people using the prototype interface(s) and to discover errors and areas for improvement. The testing will involve three waves of measurement and will be conducted at the Service Design Lab over a two-week period in late 2011. Each wave will examine how well the interface responds in the areas of performance, accuracy, recall and emotional response. The results of the first wave will be treated as a baseline/control measurement, with all subsequent waves compared to the baseline to indicate improvement. Specific issues to be examined during the testing phase include the following:

- *Performance:* How much time and how many steps are required for people to complete the task?
- *Accuracy:* How many mistakes did people make, and were the mistakes fatal or recoverable with the right information?
- *Recall:* How much does the person remember after the testing, or after periods of non-use?
- *Emotional response:* How does the person feel about the tasks completed? Is he or she confident? Would the user be willing to participate in future testing?

Based on the recommendations of Virzi (1992), each test will involve 10 users (i.e., 60 persons in total). This recommendation is based on the observation that the probability of identifying an actual problem increases with the number of participating users up to about 10 persons, with the benefit of additional participants deemed marginal beyond this number. The results of the usability testing, and the final design solution(s), will be presented at our final workshop of the Service Design Lab in November 2011. The results of this stage will be made available to conference participants after the conference.

KEY FINDINGS

Results from the case study will be available for presentation at the conference.

IMPLICATIONS FOR THEORY AND PRACTICE

Improving the Validity of Patterns

One of the weaknesses of prior research on patterns is the lack of substantive evidence for the actual benefits of the approach. Attention to date has focused on generating patterns rather than on showing how patterns can contribute to effective design solutions at a practical level. Furthermore, little attention has been afforded to evaluating the quality of the available patterns and languages. According to Dearden and Finlay (2006), only three notable studies have demonstrated possible approaches to evaluating patterns in use. Borchers (2002) evaluates the value of patterns to student learning in undergraduate education. Dearden et al. (2002) and Finlay et al. (2002) describe a qualitative study of the role of patterns in simulated participatory design activities. Chung et al. (2004) report on a structured empirical study using a pattern language in a simulated design activity that includes a group of experienced designers. Although these studies provide insight into ways that pattern evaluations could be conducted, none is conclusive, suggesting a need for further research exploring the efficacy and use of patterns.

More fundamentally, there is a need for research that identifies patterns that are generic and applicable to a range of [service] design situations, rather than for additional research that is specific to a particular context or situation. To create patterns and pattern languages that are generic across platforms, styles and domains as well as timeless and reusable requires a better understanding of how the pattern approach can contribute to successful design in complex service settings. Frameworks for analysing pattern-based design quality are needed. Work in other fields on understanding the nature of the user experience (e.g., Wright and McCarthy, 2004) in observations from other disciplines (e.g., Dorst, 2003) may be useful in this regard.

This study will respond to these needs in three important ways. First, we will add to the sparse literature on patterns in use. We will do so by examining the transferability of existing patterns to the service design setting and by developing new patterns that can be reused to assist designers developing future service systems. Importantly, our research moves beyond simulation to focus on the real-world benefits of the pattern approach to interaction design. Second, our work will take a critical approach to pattern development. We will focus on evaluating the efficacy of existing patterns and on adapting, where possible, rather than recreating. Finally, our research will document the steps taken in the pattern development and design process. By documenting the rationale for design decisions, it is expected that our research will inform future service design work and, possibly, alternative ways in which pattern languages can be constructed and used to develop effective design solutions. It is also noteworthy that our work will form part of a real-world solution. As such, we will have the unique opportunity to collect data and monitor the long-term benefits of the pattern approach to design, the results of which will be measured using the evaluation framework created during a pilot project conducted for the ANPG.

Improving the Organisation of Pattern Languages

Fincher and Windsor (2000) have raised concerns about how pattern languages are organised. This issue has significant implications for the way pattern languages can be applied as practical resources in design. The organisation of pattern languages in services could be particularly problematic because of the wide range of different service delivery modes and contexts that need to be addressed by pattern languages, from the broader social context in which a service is consumed to the details of service systems and user interaction. Unlike other disciplinary approaches to patterns, in which scale provides a useful organising principle, in service settings, the problem is multidimensional. Scale is important, but designers also need to address issues of technology, task, information and time. Providing pattern languages that reflect these different needs is a challenge that would benefit from further research. To this end, Fincher (2002) argues that it is appropriate that pattern language development become more cross-disciplinary, drawing on design theory and the experience of other disciplines.

This research makes a valuable contribution to the challenge of organising pattern languages by pioneering the use of an advanced combinatorial methodology – discrete choice analysis (DCA) (McFadden, 1973). DCA is an approach that allows users to conceptualise individual choices as a process of decision states. The method requires that respondents compare alternative choice options and make a decision that involves trade-offs between the components of these options. The result of this process is a choice outcome that can be deconstructed based on the marginal utility of each of the options available within the choice task conditional upon the underlying experimental design. Recent advances in experimental design theory and DCA modelling (Street and Burgess, 2007) have resulted in extremely efficient models that minimise the cognitive demands on respondents while obtaining robust estimates of preference that are extremely accurate at predicting future behaviour. Stated simply, the use of DCA will enable us to better understand the relative importance of a particular pattern as well as the inter-relationships between patterns.

In this research, we will employ a novel combination of DCA-related methods. Rather than rely on the traditional first-choice–only DCA methods to investigate preferences, we will use an exploded ranked order model that treats each subsequent choice in a particular choice task as though it were the first choice out of a set of alternatives from which the options already selected have been eliminated. This extension will enable us to capture more information on pattern preferences, which in turn will allow us to make more accurate prescriptions for the organisation of pattern languages. Further, the utilization of latent class modelling will enable us to examine the extent to which group-level differences account for preference variation. That is, we will be able to further decompose the aggregate-level findings (from the DCA) to identify a range of different pattern languages that reflect the preferences of difference subgroups within the user population. This innovative combination of advanced combinatorial methods will add substantial rigour to the process of pattern language

development and could potentially revolutionise the way in which design process decisions are made.

Integrating Values into the Pattern Approach

Dearden and Finlay (2006) assert that values need to be given more attention in design and that the wider social and cultural contexts of users need to be better recognised through the design process. This is particularly relevant to the present study, in which the resulting patterns and pattern language need to reflect the cultural and personal values of visitors. This will require that we understand and codify the values embodied in the pattern development and design processes.

A valuable advantage of the discrete choice approach described above is that, once codified, values can be introduced as additional explanatory variables in the DCA and latent class models to help us understand how values influence pattern preferences and the development and organisation of pattern languages. It is also noteworthy that the cross-disciplinary nature of the "Service Design Lab" is well suited to this task.

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Creating Value for Multiple Stakeholders with Intelligent (Lighting) Solutions

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Keywords: value proposition, probe and learn process, design

This study is concerned with the way designer's build-up and maintain shared values and uncover the unmet needs in a network of partners in the context of service innovation. It draws attention to the activities related to the probe and learning process of creating value propositions that are not dichotomous, but reciprocal. We study the case of the improvement of the quality of life of dementia patients and their caregivers. In this research we apply the method to create so-called 'experience flowcharts' for onset dementia patients and related stakeholders, such as caregivers, relatives etc, to uncover unmet needs and opportunities for innovative solutions with lighting. The contribution of this paper lies in the application of design driven tools to create value for multiple stakeholders.

DESIGNING VALUE FOR MULTIPLE STAKEHOLDERS

There is a growing amount of literature that indicates the potential of designerly approaches to realize societal benefits by designing breakthrough products and services that create new meanings (Verganti, 2008, Brown, 2009). For such innovations the knowledge, experience and insights from multiple parties is needed to create a holistic view on the unmet needs and emerging opportunities (Trimingham, 2008). At the same time, solutions for a higher-level opportunity, such as the improvement of quality of life of dementia patients and their caregivers, need to be supported by multiple stakeholders to realize the intended benefit (Pol & Ville, 2009). Designers typically have a strong background in understanding users through empathy, and are used to work with seemingly opposing requirements (Martin, 2009). This paper argues that these designer skills can be extended to uncover unmet needs of other stakeholders as well, and to create a solution that addresses shared value for these stakeholders. In this study we refer to a value proposition as the common shared product values and the related system functionality that contribute to all stakeholder values.

Customers perceive value by trying out new products and services, in search of new performances (Carpenter and Nakamoto, 1990, Rindova and Petkova, 2007) and experiences (Pine & Gilmore, 1999). Producers engage value by creating products that deliver more returns on their investments (Moran and Ghoshal, 1999, in Rindova and Petkova, 2007). In traditional perspectives on value creation the process is perceived as single directional (Ballantyne et al., 2010). As such, a value proposition is a deliverable offered to customers and/or users. Yet, the different stakeholders have various perceptions on values (Rindova and Petkova, 2007), often compete with each other for different market segments (Christensen and Rosenboom, 1995), often have different incentives (Casadesus-Masanell and Yoffie, 2007), and often have various challenges for success (Adner and Kapoor, 2010). There is an enormous potential to create shared value in addressing societal needs with a business approach, but the conventional business processes are inadequate (Porter and Kramer, 2011). Thus, to create sustainable value propositions and the related successful designs the value creation process has to be reconsidered.

The value proposition is created in a process of interaction among various stakeholders. At the same time an emergent value network is formed by negotiation of interests and positions in a dynamic process (Ihlstrom Eriksson et al., 2009). The value proposition becomes based on reciprocal values (Ballantyne et al., 2010). In this context a designer needs to facilitate this process by exemplifying and synchronizing all reciprocal needs in a network of stakeholders in order to create reciprocal value propositions. This value might evolve during the design of new products, but also changes after market release due to new emerging market patterns. The questions addressed in this research project are:

A. How can designers efficiently make sustainable value propositions and prototypes that address the reciprocal needs of multiple stakeholders?
B. How can we effectively learn from the emerging patterns in order to uncover new opportunities and unmet needs?

In this paper we use the case of improvement of the quality of life of dementia patients and their caregivers. The opportunities for designers' to create value with intelligent lighting solutions have increased tremendously in the past decades. Various studies have postulated that light can have a good influence on the sleep-wake cycle, which is one of the common symptoms that lead to institutionalization of dementia patients, as caregivers can no longer cope with patients with distorted sleep-wake rhythms.

CONCEPTUAL FRAMEWORK AND METHOD

Current environmental circumstances require designers to interact with stakeholders in order to come up with feasible value propositions. It is also noticeable that this interaction requires a proper process of value propositioning to prevent loss of momentum through all kinds of barriers and complexities. This process is multifaceted, iterative, and requires abilities to communicate early probes, concepts, but also prototypes and final versions. In this study we

focus in particular on the interaction, and the role of design in optimizing this activity. The study presented in this paper is part of a larger research project. The overall goal of the project is creating a platform for future design and research projects, a platform through which others can explore the process and get insight through the collected information. Analogous to this reasoning this study adopts the probe and learning process proposed by various authors (e.g. Lynn et al., 1996). In addition, we are particularly interested in methods to create reciprocal value propositions.

The design project we describe is characterized by implementing a first-of-a-kind lighting solution that aspires to improve quality of life of dementia patients and their care givers. Because of this the project is inherently faced with many stakeholders, and needs to ensure they create value at multiple levels:

- **Users**: patients, their family members and home care givers;
- **Organizations (profit and non-profit):** those organizations involved in the design and realization of the lighting solution, and its maintenance;
- **Ecosystem:** those individuals and stakeholders that have an interest in the innovation, such as the health insurance companies, patient associations, municipality, etc.;
- **Society:** the people and the planet, that are affected by the innovation directly or indirectly through the changes in the social environment and physical environment, e.g. overall social wellbeing and pollution levels.

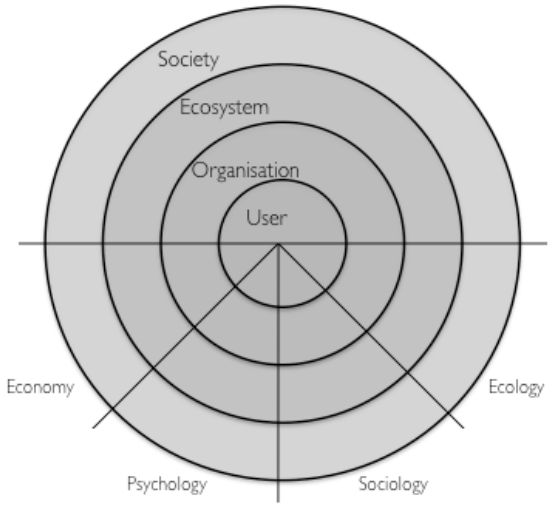

Figure 1 - Levels of analysis

This project aims to find methods and tools to support the process of creating and balancing value for sustainable innovations that have multiple stakeholders. The project uses the four levels of analysis as shown in Figure 1: users, organizations, ecosystem and society (Den Ouden, 2011). The stakeholders present at these four levels are of a different nature: individuals, profit and non-profit organizations, public and private organizations, industrial and regulatory organizations, as well as society at large. It is clear that they have different drivers and aspire different values. In this project the relevant stakeholder needs from economical, psychological, sociological and ecological perspectives will be analysed (as shown Figure 1).

Procedure

Based on the literature and practical experience from industrial cases, several methods were identified that offer partial solutions. These were combined into a 'probe and learning approach' that consists of three important elements:

1. *Extracting values and opportunities through experience flowcharts* – Personas of the target group whose needs and values are representative of a typical patient and their care givers, that help to understand the motivation for sustained use of the new solution, and provide insight in the changing needs and values of time as a patient's condition develops;
2. *Creating stakeholder insights through workshops* – gathering of multiple stakeholder insights in fast iterative loops through interviews and observations, to facilitate the development of value propositions and concepts that are consistent with primary insights from key stakeholders from different organizations;
3. *Multidisciplinary prototyping* – learning by doing, creating a holistic experience of use across all aspects of product, service and communication by quickly building and testing probes and prototypes.

In order to get real insight in how this process and its segments we approach the problem through engaged research (Van de Ven, 2007). The methods were implemented in an action research project in an empirical setting. Innovations in healthcare are often initiated in complex network of several parties with each their individual values. The program line 'Sound Lighting' of the Intelligent Lighting Institute aims to develop lighting solutions that will optimally benefit the physical and mental well-being of people and human behaviour in general, with minimal environmental impact. Part of the research is done in close collaboration with a psychiatric hospital. A promising area for the use of lighting was defined in the field of dementia, and this was selected as the setting for this research project. The specific challenge is to analyze and understand the various values of stakeholders in the dementia process, and then secondly make it understandable for others to be able to create a proposition that creates value for these multiple stakeholders.

Data collection

Since the process of creating reciprocal value propositions is an iterative process the data collection during this process covers four stages. *First*, a process overview was created based upon "cold"-research. Information from the first iteration is based on internet research and public brochures. Quickly information can be gained about what dementia is and what it means for patients. Hard to find are the relationship of parties, how an dementia patient and his/her relatives experience this process, or what the differences are between dementia's patients.

Secondly, observations to get insight in patients, clinics and other professional environments were held. Observations gave in dept insights in the possible scenarios and the value network. A group of dementia patients and relatives were visited in mental health care institutions and at gatherings organized by patient associations.

The *third* iteration of the experience flowchart extraction process was based on interviews with professionals from the field, each working with dementia patients. Expert interviews gave insight in the detailed steps patients go through and how different scenarios can turn out. During these interviews also personal problems (thus opportunities for design) arise in the operating of the total care system. An important insight from the expert interviews and observations was that various experts might hinder new interventions because of their hesitance to adopt new ideas and approaches. Interesting might be to investigate the reason why this is and what solutions require to be convincing in meeting their needs.

The *forth* step was the creation of a value network. This value network was created iteratively during a workshop with several stakeholders in the dementia process. During the workshop we motivated the stakeholders to actively and mutually create a value network. To guide the stakeholders, and still keep a central focus on the needs of patients and their family, we started the process by discussing the values of the patient and the family that were collected in the experience flowchart. Then we gradually extended the network overview, and eventually added the stakeholders themselves to the network.

CASE STUDY RESULTS

The societal problem

Due to an increase of elderly people as a percentage of the population in the coming decades, our society is confronted with more and more people suffering from various forms of dementia, including Alzheimer's disease. This leads to an enormous pressure on patients, but also on caregivers. Especially the informal caregivers in the social support system that are directly connected to the dementia patient are seriously burdened by their beloved ones. 98% of the informal caregivers have problems with care process leading to physical and emotional problems such as overtiredness, insomnia, and depressions (Brabants Actieprogramma Dementie, 2011). The research project that is subject of this case study aims to develop solutions to improve the quality of life of dementia patients and their care givers. Among the most important other stakeholders of the dementia case are also various governmental organizations, health insurance companies and industrial companies that could benefit from the improvement of the situation of the dementia patient and their caregivers. The case study aims to investigate the process of creating reciprocal value propositions in a stakeholder network of both governmental funded organizations and private owned firms.

Dementia & Light case

Elderly patients with dementia are next to cognitive decline confronted with disturbances of mood, behavior, and activities of daily living (Lee, et al., 2003; Purandare et al., 2001; González-Salvador et al., 2000). Circadian rhythm disturbances have been associated with these symptoms (Riemersma-van de Lek et al., 2008). Indeed, light has a modest benefit in

improving some cognitive and non cognitive symptoms of dementia (Riemersma-van de Lek et al., 2008). Previous studies with light therapy with institutionalized patients with dementia have shown that the effects of light therapy are slowly increasing; nevertheless they have significant effect on the mood of the patients, and their sleep/wake cycle (Riemersma-van de Lek et al., 2008). This delivers opportunities for the improvement of the quality of life of onset dementia patients and their caregivers. Due to lack of treatment possibilities for dementia, various approaches could be developed for the symptom management to reduce the need of institutionalization. Especially the effects of lighting therapy on the sleep-wake cycle, offer opportunities, as this is one of the common symptoms that lead to institutionalization of dementia patients.

Various studies on the effects of light therapy on the on dementia are available (e.g Van Someren et al. 1999; Weldemichael & Grossberg, 2010; Riemersma-van de Lek et al., 2008). These studies focus on light therapy for institutionalized patients. In this research project the aim is to develop lighting solutions for the home environment of onset dementia patients. In the home setting patients are living either completely independent, or in small scale elderly homes without specific health care. In order to have a societal impact it is intended to develop solutions that reduce the overall workload of the dementia disease. To develop successful interventions the values of various stakeholders need to be addressed, such as therapists, nurses, but also partners and family.

Experience flow

Through our hands-on approach we ended up with an interactive experience flowchart, a platform that integrates user perspective, expert point of view and process logic. Figure 2 illustrates the experience flowchart of the dementia process. The possible routes people go through when diagnosed dementia's disease are diverse. The coloured lines give examples of three possible persona's that are connected to the dementia case. These personas are integrated into the experience flowchart to support the understanding of the overall process for the stakeholders that often only have a view on a particular section in which they are

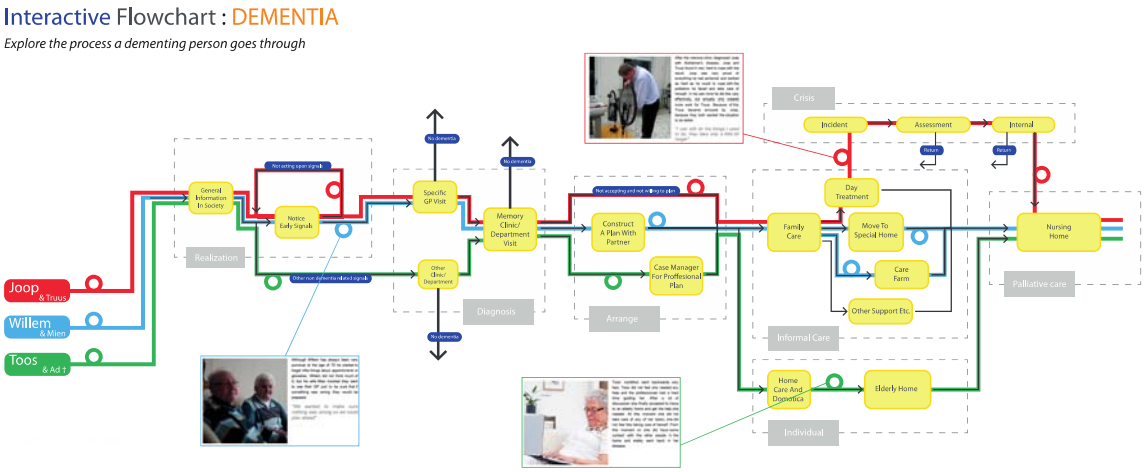

Figure 2 - Experience flowchart

involved directly. These personas represent three possible and general scenarios through the dementia process. In the interactive flowchart short stories and short video clips of interviews are included and can be revealed by clicking on the flowchart at each stage in the dementia process. In figure 2 three of such short stories are shown. By going through the interactive flowchart the viewer is able to compare his view with the experience patients go through.

To make the diversity in patient experiences more understandable we used different personifications of possible dementia's patients to this interactive experience flowchart to get different user perspectives in the overview.

- Persona 1: perfect scenario. An ideal patient flowing through the process as the stakeholders and professional care givers would prefer it. This person typically goes to the doctor to discuss symptoms early, accepts the diagnosis and follows all the advice he gets. His caregivers are trying to understand the situation, and provide the best support they can give.
- Persona 2: doom scenario. A story of a person who seems to be rebellious in the system and is a worst case scenario for the process and its stakeholders. This person typically ignores symptoms, does not accept the diagnosis and discards advice. His caregivers are not able to influence the person either.
- Persona 3: a single person, living on his own, going through the dementia process on his/her own and all the service/trouble this adds, such as not being aware of symptoms and having difficulty to cope with the effects of the disease.

These personas are not the only personifications possible in the scenario, as mentioned before every patient flows through the process in a different way. But they provide a perspective to look at the experience of patients and support discussion and debate.

In the next step an analysis was made of which other stakeholders were important. An overview was made of the financial flows related to the care of dementia patients. The result of this analysis is shown in Figure 3. Based on the financial flow several stakeholders could

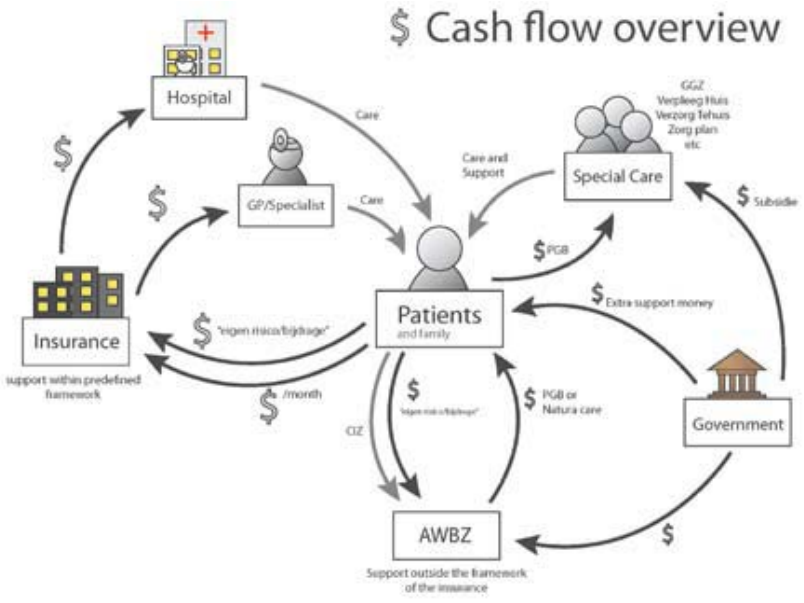

Figure 3 – Financial flow overview

be invited in a workshop. Next to the financially involved stakeholders, also other organizations were invited to the workshop, such as the patient association and industrial companies that aim to provide solutions for dementia patients. In the workshop the most important values were iteratively extracted and analyzed. Figure 4 gives an overview of the value network and main value flows that resulted from the workshop. The needs and analysis showed that next to the economical aspects there was a strong attention to other values such as quality of life for patients, as well as their social support system.

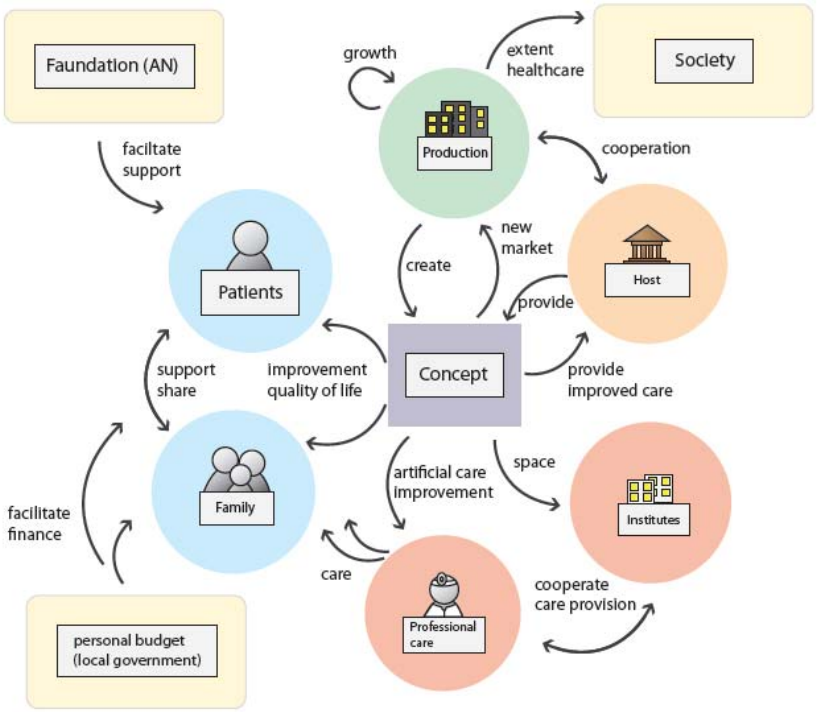

Figure 4 – Value network & value flows

Problems and design opportunities

Anchored on the findings of the iterative study several problems and design challenges are extracted. Table 1 shows some examples of critical incidents during the dementia process. Various incidents were extracted based on the experience flow, while others are based on the discussions during the workshop. During the workshop we build with the participants iteratively a value network. An interesting finding was that the participants were able to make their findings explicit by creating a value model. Furthermore people were able to communicate and discuss their perceptions. In the evaluation of this part of the workshop the participants expressed that they learned a lot from the different viewpoints of other stakeholders. As such this part of the workshop was found to contribute to the creation of a shared understanding of what specific issues are encountered in the total process of a patient with dementia. Also interactions were highlighted, such as the discussion of delaying the institutionalization of a patient. On the one hand this seems favourable, as patients feel more

at ease at home. On the other hand, when they need to move to an institute later, when the disease is progressed, they will have more difficulty to adapt the new situation.

Table 1.Some examples of critical incidents during the dementia process

Phase	Example of critical incident
Realization In this phase individuals become aware of what dementia means and how to recognize signs and symptoms that could be related to dementia.	When the disease begins to develop certain symptoms of the disease will occur. With every patient the symptoms can be different. Sometime the symptoms are clear and can be easily identified and sometimes the symptoms are much more subtle. Besides this the reaction of the patient and close relatives can also differ a lot from patient to patient. The reaction people have depends heavily on what knowledge they already have about the disease and what their attitude towards the disease is.
Diagnosis The second phase in the process is called "Diagnosis." In this phase an individual will come in touch with professionals, either their GP or other specialized people.	In this phase the patient knows something is wrong and acts upon the signals and symptoms to discover what is going on. In this phase it will become clear if the patient is really suffering from dementia. Mostly people will go to their GP for the initial symptoms or problems and explain what is wrong. When the GP suspects it could be dementia he/she will send the patient to a specialized clinic.
	Occasionally people have other signals, which could be caused by dementia. In this case they first go to other clinics or departments before going to the specialized memory clinic. From this stage some arrows are leaving the flowchart. These represent the people that actually have something different than dementia that are causing the problems. These will have to go to other clinic specialized for that specific case.
Arrange An individual enters this phase called "arrange" when officially diagnosed with a form of dementia. A patient together with either family and/or professionals, will make a plan for how to move on from this point.	A patient can be in very different states of dementia influencing the specific plan they will make for the future. Sometimes a patient is still able to live at home for a couple of years, and sometimes the dementia has already developed to such a point that they will have to be taken into a nursing home almost immediately.
	For the patient this phase is the hardest psychologically as the acceptance of a diagnosis is a very difficult process and the realization that a person is going to be dementing further in the next months to years is very hard to deal with. For a partner/family this phase is also hard but all they can do at this point is to make sure there is a plan and provide support where needed.
Informal care The situation described in the "informal care" phase only applies when the patient has a family or has friends to take over the care.	Informal care is the phase where the patient is beginning to rely more and more on relatives and/or close friends to take care of them. This can range from minor to major dependence. Often the caring family or friends choose how much they can or want to handle.
	This stage is psychologically most heavy for the family and/or friends as the patient is dementing and the personality of the patient changes. Often this starts with losing the short-term memory and develops to a point of not remembering long-term memory. At some point the patient will need to go to an institute.
Crisis The "crisis" phase is an occasional phase that handles crisis situations that can occur when behavioral problems of the demented patient get out of hand.	When an incident happens specialized institutions can be contacted by the professionals, the partner or the family and will act upon the incident. Often when an incident happens at home a patient will have to stay at an institute for about 8 weeks or so until his situation is balanced again. Often an incident is an indication the patient is in a far step of dementia and from such crisis care they will often go to the nursing home.
Palliative phase The "palliative" phase represents the final step in the dementia process. 50% of the patients time can be spend in this phase and sometimes even more.	A specialized institute were patients are treated with complex psychiatric issues, with more care required. In such an institute three parties define the care plan, these are the responsible doctor (GP, psychiatrist or other) the nurses and the activity managers. They try to offer a balanced plan specific for every individual to maintain quality of life.

In the second part of the workshop intervention opportunities were identified by looking at the (dis-) balances in the value model. Table 2 gives some examples of opportunities that were identified. Each of these design opportunities could be used to create reciprocal value propositions that do not only bring value to the main stakeholder, but to other stakeholders as well.

Table 2. Some examples of design opportunities

Opportunity	Description	Source	Main stakeholder
Dementia in society	There is an opportunity in how much common knowledge there is in society about dementia. Mostly it is seen as a memory problem, that's it. It seems that dementia still is a certain taboo. This could be caused by the personality changes that occur in dementia or because there is no cure for it.	Patient meetings	Patient association: non-profit organization to support dementia patients and create awareness about the disease.
Patient and family relation	Dementing people change over the course of the disease both in behavior and character. A person with dementia changes in role from somebody of the same level to share and discuss things with, to a person who you have to care for. What you give is no longer what you gain, this is a very heavy mental and psychological load. Also how long can a partner keep a dementing person at home, and how long is it good for him or her?	Expert view on patient family relations. Impression at the dementia-cafe.	Family: support in accepting the disease and understanding what is best for self and siblings.
Adoption to care	People usually don't adapt easily to care. In early stages of the disease this is no major problem, but when they have to go to a nursing home or other institute permanently they tend to be harder to handle and cause problems.	Crisis caretaker expert view. General elderly psychologist and manager.	Patient: the one going through the process and causing trouble. Institute: be involved with patient at an earlier stage.
Keep People at home	One of the more obvious opportunities, but not less important is the possibility to keep people longer at home. As patient care is less costly for society when they stay at home compared to staying in an institute. Domotica is a direction which could enable this.	Nursing home visit.	Patient: being able to manage living on its own better to reduce family
Return of value	When patients are institutionalized they feel they only cost money without being able to returning anything anymore to society. They have a need to feel useful	Patient meetings	Patient: in an institute. institute, return value to society through being useful.
Nursing efficiency	Nurses often spend a lot of time on basic care of people like cleaning and washing etc. As they are closest to the patient they would like to spend more time in contact with the patient, who needs this contact. When the other processes become more efficient, there could be more time for contact and the quality of living can rise.	Nursing in an institute.	Patient: receive better care and more quality in life. Nurses: work more efficient and have more time with patient himself

The evaluation of the second part of the workshop in which design opportunities for reciprocal value propositions were discussed in a process with several stakeholders, revealed that the designerly approach to start with the end-user in mind is also feasible with multiple stakeholders. By starting with the patient experience flowchart, a common platform for discussion is provided, that allows for sharing of issues, thoughts and ideas. Based on this study, several recommendations can be made for advancing the process of interaction with stakeholders to come up with feasible value propositions. This study can be seen as a first attempt. As part of the larger project we will try to investigate these mechanisms in future

studies. Furthermore, we will search more in-depth for methods to support shared value creation. Unfortunately the results of the further development of a reciprocal value proposition for an intelligent lighting solution for use at home by onset dementia patients and their caregivers was not available at the time of writing of this paper. Further research will specifically address how early probes and prototypes of the solution can be used to further explore the needs of multiple stakeholders during the design process.

CONCLUSIONS

In this research we analyze the dynamics of value creation in a design process from a multiple stakeholder perspective. We propose the experience flowchart to extract the most important insights and design opportunities. In order to design intelligent lighting systems that create value for all the stakeholders, a value proposition needs to be defined that creates shared value. The experience flowchart proved to be a valuable tool to have a common ground for discussion with different stakeholders. The flowchart also helps to create insights in the unmet needs of the various stakeholders and supports the process of understanding the shared values. A value network and value flows proved to be helpful in discussing opportunities that address (dis-) balances in the total care process and related value flows. As such, the value proposition comprises the shared values among the stakeholders (e.g., increase health for patients, lower costs for insurance companies, higher profits producers) and the related intelligent lighting functionality (effect on the circadian rhythm, persuasive technology) required for the development of an intelligent lighting solution. The case study also gave practical insights in how the individual and shared values can be visually represented, and how this can be used in the creation of value propositions for intelligent solutions that require the support of multiple stakeholders.

As this is a first attempt to use design tools in the process of creating value for multiple stakeholders, more empirical research is needed to further develop methodologies to support such processes.

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Platform Design: How the Increasing Importance of Platforms Impacts Design Management

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Keywords: Design Management, Design, Platforms, Platform Design

This paper draws together research in multiple disciplines to examine changing demands on the role of design management within platform-based companies. Through a review of literature and interviews with practitioners in a range of industries, we examine how platforms are perceived, how design management is involved in the design of various kinds of platforms, and evaluate the maturity of 'platform design' thinking in these industries. We propose a conceptual framework to describe this phenomenon and evaluate it through case studies.

INTRODUCTION

There is a long history of confrontations and expansions in design. In the last hundred years, the discipline has adapted considerably, making way for a number of sub-disciplines such as graphic design, engineering design, information design, interaction design, or service design to emerge. In this, design has tried to adapt to social, technological, and economic forces. Design management has followed by developing adjusted practices, processes, and strategies so as to more effectively design products, services, messages, and experiences (Jensen 1993; Cohen 2004; Jones and Samalionis 2008).

Nowadays, platforms are an emerging force in many industries. Although hard to define, they are easy to recognize. Examples include product platforms, such as shared chassis and engines in the automotive industry or shared hardware components in the consumer electronics industry; industry platforms, such as Spotify or Netflix for digital distribution of albums and films; as well as multi-sided platforms such as Apple's iTunes, which bring various industries together in a single distribution space. These various definitions of

platform share a common thread, that they are increasingly important in corporate strategies. Anecdotal evidence indicates that the rise of platforms is affecting the role of design management. Talking about the battle between gaming platforms, Hayes (2005) mentioned that there "needed to be quantum leaps in both design and marketing, not just incremental improvement". Designers have to accommodate constraints and standards set by industry leaders and anticipate future trends more keenly. Tighter supply chains and strategic sourcing arrangements demand increased collaboration and risk sharing for new and growing industry players: this has profound implications for how design is managed, and how platforms factor in this interconnected world. However, research into the impact of platforms on design management has been limited. In studying this area, we seek to establish whether 'platform design' is a suitable phenomenon for further study.

LITERATURE REVIEW

Design has been represented as a flexible activity that strongly escapes simplification and reduction. Academic literature contains contrasting and sometimes contradictory accounts of design. While most definitions share a number of attributes, the lack of a single and encompassing definition has been deemed one of the main strengths of design (Buchanan 1992; Heskett 2001; Friedman 2003). According to Buchanan (Buchanan 2001) the disciplines with settled definitions have languished and become rather sterile. Design however, with its rather acrimonious community of researchers and practitioners, has been able to maintain high levels of critical inquiry and debate (Cross 1999; Buchanan 2001; Forlizzi, Stolterman et al. 2009).

Discussions have not only taken place among designers and design researchers, but also within a wider community of professionals and scholars. Being an integrative discipline, design is placed at the intersection of several large domains (Friedman 2003). In effect, by being relevant to potentially any domain of human experience, design has become almost universal in interest and scope (Buchanan 1992). Common to all participants is an implication in and concern for the creation of the artificial as well as the social, cultural, and business contexts in which design is received and used (Simon 1968; Rittel 1987; Buchanan 1992; Meurer 1999; Negrotti 2001). But in the midst of all possible subjects and objects, design has been somewhat penalised for failing to develop shared strategic-inquiry objectives (Buchanan 2001). However, and in spite of this potentially excessive self-expressiveness, others have argued that intuition, guesswork, and holistic thinking have been some of the reasons why design has been so successful in addressing contemporary issues and challenges (Swann 2002).

There is a long history of confrontations and expansions in design. In the last hundred years, design developed from reconciling mass-production technologies for mass-consumption markets, to spreading globally as a formal practice while becoming an integral capacity operating across a wide range of business needs and arenas (Heskett 2001). But whilst

designers may have been somewhat perplexed with what confronted them, new domains within design have emerged. New sub-disciplines and professional sub-categories such as architecture design, furniture design, interior design, graphic design, engineering design, information design, interaction design, or service design, have been gradually and individually established (Meurer 1999; Heskett 2001; Swann 2002). Service design is an exemplary case of how design research has struggled to evolve yet emerged as a research domain in its own right.

With continuous social and technological changes, it may be a natural outcome that design has progressively shifted from artefacts to activities (Pine and Gilmore 1998; Shedroff 2001), but designers have not always been well aware of these transformations. In the early 1990s, a group of thinkers and academics (Hollins and Hollins 1991; Manzini 1993) started discussing the growing contrast between the stronghold of industrial or product design and the increasing economic and social importance of service activities, particularly within developed economies. Over the last two decades, countless discussions have taken place, many against service design becoming a formalised domain (Kimbell 2009). Still, service design has emerged as a discipline in its own right, with identified practitioners, methodologies, concepts, and publications (Saco and Goncalves 2008; Junginger and Sangiorgi 2009).

As with the discussion of the early 1990s around services and service design, a number of researchers have also been progressively signalling the divergence between an overwhelming focus on products or services and the growing importance of platforms (Woudhuysen 1996; Hayes 2005; McCullagh 2006; Cusumano 2010). The first references to platforms took place in the context of new product development, defining product platforms as a range of products that share common components and manufacturing processes and for which a number of standardised add-ons can be offered (Wheelwright and Clark 1992). In this, product platforms address customer demands for modularity and easy modification, such as the addition, substitution, or removal of features. In some ways, product platforms are a set of components and interfaces that form a common structure from which derivative products can be efficiently developed and produced (Meyer and Lehnerd 1997), with implications for design management activities. They may also be seen as a collection of assets (i.e., components, processes, knowledge, people and relationships) that are shared across a family of products (Robertson and Ulrich 1998).

Other authors have moved away from narrow definitions and introduced the notion of industry platforms (Gawer and Henderson 2007). In this, a product and/or a service is a platform when it simultaneously is (1) a component of an evolving system, (2) functionally independent of the other components of the system, and (3) when user demand is for the overall system (not for single components). As such, platforms started being understood not only as product or service platforms, but also as ecosystems in which several organisations have their technologies, products and/or services integrated into single offerings. There is also the notion of multi-sidedness (Evans 2003). For Evans, multi-sided platforms (MSP) emerge out of the need to coordinate the demand of various customer groups who in some

way need each other. In an MSP, three conditions are apparent: (1) there are distinct customer groups; (2) a group member benefits from having his demand placed with that of other members; and (3) an intermediary can facilitate that demand placement more efficiently than a bi-lateral relationship. As such, MSP-dominated businesses often try to involve multiple market sides and devise strategies that internalise externalities across group members.

From the various studies and definitions, three rather marked platform notions emerge: product platforms, industry platforms, and multi-sided platforms. Whereas product platforms take place within a single organisation, industry and multi-sided platforms are open to other organisations. In this, the difference between industry and multi-sided platforms is that the latter can involve organisations from various industries, whereas the prior is dominated by a single industry, namely computing, telecommunications, and other ICT (information and communication technology) intensive industries (Cusumano 2010).

In spite of very fluid meanings and definitions, most studies agree on the potential benefits from product and/or service platforms. Improving flexibility in design and development processes; reducing complexity and development times; improving economies of scale and scope; being able to produce a large number of derivative products, as well as encouraging firms to invest more time and effort in design and development activities (Meyer and Lehnerd 1997; Robertson and Ulrich 1998; Muffatto 1999; Krishnan and Gupta 2001; Simpson 2004; Cusumano 2010). To achieve such benefits, platforms need to be effectively designed and developed, and design management plays a critical role in this. However, design research has focused mostly on product platforms, ignoring industry and multi-sided platforms (Dahmus, Gonzalez-Zugasti et al. 2001; Sanchez 2002; Sanchez 2004).

This literature review suggests that design and design management have been through continuous change and expansion, and this has systematically escaped simplification and reduction. In this, a somewhat recurrent opposition and deferment between changes in design and the underlying social and technological transformations was uncovered. Concepts of product, industry and multi-sided platforms are addressed widely in the literature but remain largely unnoticed in design and design management research. The expected benefits from adopting platform strategies include greater flexibility in design and development processes, shorter development times, and better economies of scale and scope. There are profound implications of these benefits for design management in theory and practice. In summary, one can assert that increasingly, design management has to engage with platform design and development.

RESEARCH DESIGN AND METHODOLOGY

A qualitative approach has been taken to examine interactions between the rise of platforms and the role of design management. An initial literature review and informal conversations with designers was used to identify the research question: How does the increasing importance of platforms impact design management?

Given the newness of 'platform design' as an area for study, an exploratory approach was taken to gain direct input from design managers on whether (and how) the rise of platforms has effected design management, practice and organization. As an exploratory study, a limited number of industries were examined: the sample of five design managers originated from personal connections of the researchers. This *purposeful* approach was determined based on the exploratory, information-rich nature of the interviews (Patton 1990).

Semi-structured interviews with designers were conducted in five industries. Criterion for selection included experience in design management in the industry being examined. A table of interviews is provided below.

Alias	Industry	Profile
Bill	Social Gaming	Bill has a design engineering background and is now VP of Business Development at a San Francisco-based social gaming platform start-up.
Don	Enterprise Software	Don has 20+ years experience of design, architecture and development of large-scale enterprise software applications, including financial trading, e-commerce and service oriented platforms. He is currently based in Santa Cruz, California
John	Design Consulting	John is the Chief Marketing Officer (CMO) at a leading global design-consulting firm.
Pete	Manufacturing	Pete is a senior internal design manager with NPD background in an industrial global manufacturing company
Tom	Medical Devices	Tom has 10+ years experience in the medical products industry in design, development and deployment of new products.

Table 1. Interviewee Profiles

Interviews were conducted in person or using Skype, and audio recordings of these meetings were transcribed. The analysis of these transcriptions, using textual analysis and manual coding to identify emergent themes, has been folded into the literature review to develop a conceptual framework for interactions between platforms and design management.

RESULTS

Having transcribed and analyzed the interviews, a number of emergent themes can be identified: platform definition; the multiple meanings of platform regarding design management; the currently low but growing connection between platforms and design; emerging trends, and changes to organizational and industrial contexts. A further observation from the interview data is the effect of industry context on how platforms affect design management: for example in social gaming, platforms are critical and contemporary whereas in medical devices, platforms are just emerging.

Definition. The Chief Marketing Officer at a leading design-consulting firm (John) provided a clear definition of 'platforms': a platform is "a system upon which you build additional services … an ecosystem of services, of applications that provide value." (John). As a client-

facing manager, his primary concern is what large Fortune 500 brands (clients) want. By comparison, Pete (manufacturing) saw platforms as taking a long time to develop: the word 'ecosystem' was rarely used in his product-focused, conservative industry. In enterprise software, definitions are affected by the role of open source software (OSS), with a bifurcation between OSS platforms and commercial industry platforms (such as iTunes and various consumer-oriented application stores). Furthermore, enterprise software platforms are defined in terms of their impact on design and development as much as on the consumer: "A good platform enables certain classes of problems to be implemented much quicker and faster than they could before." (Don). In medical devices, Tom seemed to change his definition of platforms during the interview, as if the ramifications of 'platform thinking' were being revealed for the first time. Tom first defined 'platform' as a component-based concept, which reduced time to market through sharing of common components (without external collaboration). Later, this view was amended when discussing industry level platforms: in medical devices, the scrutiny related to Intellectual Property (IP) protection means that creating platforms at industry level is difficult. In the manufacturing sector, Pete was clear: platform thinking in a sub-sector such as valves is "not about lowering development time, although that is a side benefit. It's more about managing complexity in our factories"

Meaning. There are multiple meanings of 'platforms' arising from analysis of the interviews, including definitions, which changed during the interview (Tom). This could indicate a lack of understanding of platform design concepts. Firstly, if the definition of platform is unclear, this may vary between individuals, organizations and even industries. Secondly, the relative position of an individual or organization in relation to the platform 'leader' is important. This can be objective (e.g. Bill's need to co-exist with Facebook and Android platforms) or normative (e.g. Don and Bill referring to the revenue sharing agreements with Facebook and others as 'levies' or taxes, in the sense of 'unearned revenue'). How a person or firm sees a platform is affected inevitably by their relationship with that platform. Thirdly, terminology such as 'product platform,' 'industry platform,' and 'multi-sided platform' assume a common nomenclature is in place, yet the interviews reveal that no such common understanding exists and that any commonality might not apply outside of a particular industry.

Connections. Does the rise of platforms affect design management? It depends. Having worked at Apple, Don indicated that "engineers do their own design" – with clarity over standards for industrial design and user experience (the Apple platform), design management becomes an embedded, implied activity rather than a separate "platform design" concept. The implications of this for design management are significant, perhaps leading to horizontal peer-based organizations rather than hierarchical structures. In social gaming, the speed with which partnerships and product direction changes means that design and design management is an embedded activity – for Bill, "Quarterly updates and design changes would be too slow – It's a daily update thing." Indeed the concept of design goes beyond product, user experience and applications, to a point where the business model may be adjusted on a daily basis.

For his clients, John sees a shift in recent years, partly due to the rise of consumer platforms that are not yet resolved into a stable market landscape. This shift leads brand executives to desire (for example) an “iTunes for healthcare” in the healthcare space, revealing the desire to unify a fast-changing array of technology platforms for an optimal business outcome. In this way, conservative consumer product firms hope to tie together various channels and media to provide a consistent but attractive message. In a sense, the brands are co-opting the concept of platform for their marketing needs. What John delivers as a design consultant is a brand platform to cross products and sectors and offers a unified, efficient way to reach consumers. Perhaps this is typical: the concept of platform is so broad, and implies a degree of domination over other non-platform players in a market, that ‘platform’ may become synonymous with ‘desirable business position’.

In more conservative industries, design management may be less affected by platform emergence. Tom, as a designer, states: “I don't see there is a huge difference between developing products and platforms for products. That's just my personal experience.” Tom also suggested that complexity of products holds back the emergence of platforms “My experience of doing generic components was they tend to be more complex” and thus the design of re-usable and recyclable components in a platform may diminish any momentum towards platform development.

In manufacturing design, Pete indicated that the degree of platform orientation varied between product groups. In some, such as frequency converters, “we have been doing platform design there for maybe 15 to 20 years. It started out almost as a platform design”. However in other areas, with high-price and high-quality products, platform design was less prevalent, along with the degree of collaboration and sharing of IP.

Trends. The connection between platform emergence and design management was not always clear from the interviews, but with Don and Bill, there was an implied connection. For Don, it was obvious that designers now had to take account of platforms, whether they were traditional (e.g. Microsoft’s dominance of the PC platform), OSS-based or newer, emerging platforms (Apple App Store, Facebook, Zynga games). This may not mean any change in organizations or explicit design management practice: rather it was the responsibility of all enterprise software designers to be aware of and accommodate platform design in their everyday work. For Bill, this went further, with design being an integrated activity involving all staff in their small start-up company: platform design was a pervasive aspect of a designer’s role. John saw the importance of designing for and within platforms as a key requirement to meet client expectations, but no organizational or external-facing change was required to reflect this. Perhaps the emerging importance of platforms is an explicit trend, but the impact on design management, though strong, is subtle: it is as if platform design is woven into the fabric of design management in these information-intensive industries but there is no need to announce or label this to the world at large.

Organizational Context. This research aimed to see if ‘platform design’ as a concept was manifest in the way design management sets roles, hierarchies, job descriptions and other

organizational activities. From the interviews, it is clear that this is not currently the case. Interviewees were either unclear of the need for a 'platform designer' role per se (Tom), or uncertain whether the existence of platforms justified a new discipline and role definition in their organizations. For Bill, John and Don, platforms were a vital part of their industrial landscape but formed part of everyone's requirements rather than needing to be formalized into a particular function or role. Pete (manufacturing) described a structure in which design management was delegated to business units, with some strategic company-wide advisors to assist on best practices. At the present time, he indicated that platform design was something left to the preferences of the business units, and there was little evidence of 'industry platform' thinking at present.

Industry Context. Interviewees were design managers within their industries, and each industry provided strong context for how design and platforms are perceived. From our limited sample, the degree of collaboration in an industry as well as its information-richness provided an indication of how design was viewed. In highly collaborative (inter-dependent) businesses such as social media and enterprise software, in which fast-paced partnerships are commonplace, the impact on design management was high (c.f. Facebook and Zynga, Open Source Software licensing, etc). The implication for design management can be seen as elevating the strategic importance of design, with increased communication and collaboration between senior management and designers.

In more conservative, regulated, product-centric industries such as medical products, platforms were regarded as an incremental opportunity for efficiency and coordination in design. In regulated industries such as medical devices, Tom indicates that regulation may have an impact on the evolution of product platforms: due to the scrutiny brought by standards such as ISO 13485 during development, managers require dedicated and non-collaborative design to maximize the purity of IP. His industry rewards the creation of long-term 'cash cows' based on proprietary IP, and therefore discourages too much collaboration or the development of industry-wide platforms.

Similar issues arose in manufacturing, stimulated by wide variations in business units and product divisions. Some product groups have complex design requirements, and collaboration with outsiders (especially competitors) is hard to imagine (Pete). He continues: "in developing compressors, scroll sets for compressors is a black art that takes a long time to learn." Furthermore, Pete points out two issues regarding platform strategy. Firstly, "decisions about platforms are senior decisions", indicating that investment in platforms is a strategic decision-point within his industry, and secondly, that the platform lifecycle is long – more like a decade than a couple of years.

Summary. We spoke with a limited number of design managers in a limited number of organizations and industries. However, it was clear that industry context might play a strong role in how design management can be impacted by platforms. Both Tom's discussion of medical device design and Pete's analysis of designing industrial parts identified the limited preparedness of their organizations to develop industry or multi-sided platforms and to some

extent embrace more consistent management practices for designing platforms (see Figure 1, bottom left). On the other hand, Bill in social gaming described his industry as rife with platforms, with design often not being swift enough to respond to market dynamics (Figure 1, top right corner). Inbetween, we found enterprise software development and design consulting. The enterprise software case revealed a competitive playing field between multiple internal and external product platforms and upcoming innovations in cloud computing, demonstrating the rise of internal service platforms (Figure 1, centre). But with enterprise software, it might take a while for business models to change and for firms to become more adept at building and managing multi-sided platforms already prevalent within the consumer software sector. Finally, design consulting (John) reflects a need to remain flexible to respond to the changing requirements of clients (Figure 1, centre). In all companies and sectors we suggest that the various degrees of impact of platforms on design management are implied rather than explicit. Even in platform-rich industries, managing the design of platforms or conducting some sort of 'platform design' was important but remained an implied phenomenon, with little impetus to change organizations or practice as a result.

However, even in more conservative product-faced industries such as manufacturing and medical devices, there was a split in attitudes: while stating that platform evolution in their industries was relatively slow and strategic, Tom and Pete both recognized the immediate relevance of platforms and design management. Pete put it strongly. When asked where platforms and design management made sense, he responded: "it's probably easier to go the other way and say, "Well, where don't platforms and design management make sense?"

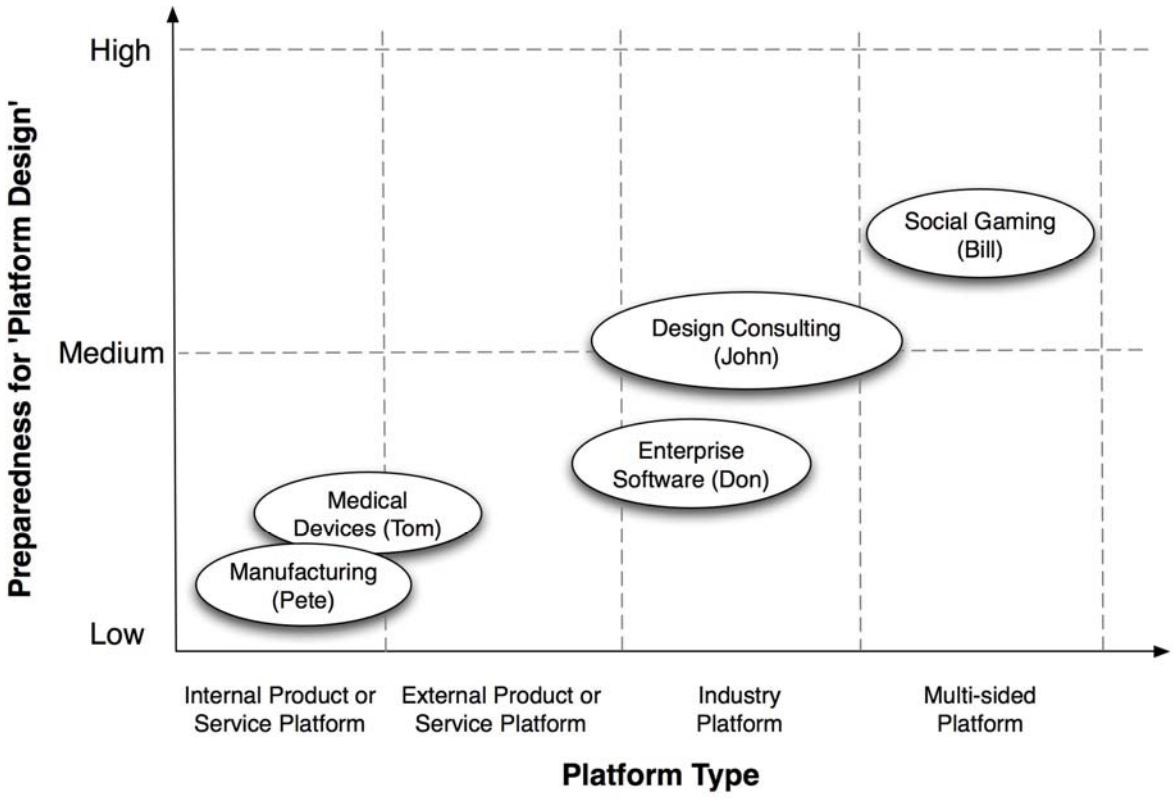

Figure 1. Mapping of Interviews to Preparedness for 'Platform Design'

DISCUSSION

Interviews conducted with industry practitioners revealed a range of expectations and practices related to design management in platform-based companies. In some, such as social gaming, platforms are ubiquitous (Microsoft, Facebook, Google) and 'platform design' is a consideration for designers. How designers deal with external platform leaders, or handle partners on their own platform, is an everyday issue. This is implied at present, rather than an explicit trend: platform design appears to be such an embedded factor in product/service (and business model) design that it is not viewed as a separate discipline for operational design or organization. However, the complex interactions between firms and platform providers, suggests that a next step in maturity – the 'multi-sided platform' concept – exists in fast-paced information-rich industries such as these. In other industries, such as manufacturing and medical products examined here, managing 'platform design' as a legitimate force in design management seems a long way off. Although practitioners indicate that platforms make sense to rationalize complex product ranges, thereby reducing cost and time to market, designing 'products and platforms for products' does not seem fundamentally different. Furthermore, forces such as conservatism, the need to protect IP for the long-term, and the slower pace of product development, may militate against the emergence of 'platform design' and the need to manage it as a major feature in design management. In such industries, neither design management nor organizational practices, as examined in this paper, appear to be changing to reflect the rising importance of platforms.

CONCLUSION

Trends in design have taken 5-10 years to evolve from general interest to formalized areas of scholarly pursuit. For example, service design took years to formalize (Kimbell 2009). Therefore it seems appropriate to examine emerging forces such as platforms and establish a reference point now that might be re-assessed at a future date. The wider context of changing business environments suggests that platforms are becoming more prevalent and increasingly dominate activities for new and existing firms within particular industries. Perhaps there is a corollary here to the monopolistic trends of the nineteenth century, in which large monopolies (Standard Oil, JP Morgan's banking companies) emerged as de facto platforms. There was little an industrial player could do without thinking of, partnering with, or competing with such monopolies. At the time of writing, a number of industry platforms have emerged which are starting to dominate the landscape of various industries: Apple's iTunes; eBay's PayPal; Google's AdWords; or Facebook's Open Graph. In parallel with other trends such as globalization and virtualization leading to increased collaboration in a number of industries such as automotive and aviation, perhaps design management will need to increasingly understand how platforms impact the world, leading to a new domain of managing 'platform design'.

This research aims to provide insight into how design management is affected by the rise of platforms, a major development in industry business models. It is hoped this will reveal

relationships between various stakeholders, and refine the proposed conceptual framework, which may become increasingly important for corporate strategy and management. Further development of this framework may support practitioners as well as researchers, offering a tool for design management within businesses.

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Scenarios for Coupling Design Thinking with Systematic Engineering Design in NPD

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Keywords: design thinking, consultant-client relationship, design collaboration

This study addresses the external consultant-client interface and suggests different scenarios for coupling the design activities of both parties. More specifically, it investigates scenarios for coupling the user-centred perspective of design thinking with systematic engineering design processes via the consultant-client relationship. Having interviewed eight innovation consultants and lecturers working with design thinking, a scheme for differentiation of coupling-scenarios is proposed. The scheme considers different *types of process-couplings* (partial and complete substitution of the client's design activities) and *modes of interaction* (the client's active or passive involvement in solution generation). Implications for design practice are discussed. Our findings furthermore suggest four dominant issues that affect successful (external) consultant-client relationships: both parties are aware of design process models used when preparing and implementing design projects, negotiate the solution space when writing the design brief, manage expectations especially with respect to envisaged outcomes, and allow for unplanned and potentially unknown solutions.

INTRODUCTION

Innovation is necessary to stay competitive and grow in today's global product development environment [e.g. Moultrie, 2007; Blessing, Yates 1999; Cooper, Kleinschmidt 1986]. It is an environment characterised by a web of dynamic political, economic, social and technical challenges, and ever-changing consumer aspirations and user needs. These challenges show no sign of slowing down. They affect design processes in all types of design and industry sectors, irrespective of whether the product or system designed is a machine, a consumer good, software, a building, electronics, or service. Given these challenges, companies which

do not yet possess capabilities in product innovation have to develop resources in-house or find other ways to compensate for the lack. If in-house development is not an option, an alternative for enhancing capabilities in innovation is through collaboration with design and innovation consultancies. It offers the chance to innovate whilst remaining focused on core competencies [e.g. Utterback, Vedin, 2006]. Buying in required design capabilities to enhance innovation can range from, for example, market research and product planning (with exploration of (lead) user needs, analysis of market segments, and ideation of possible products) to concept development.

Literature

A growing body of literature on involving external actors in the innovation process and researching the external actor-client relationship has developed around the concept of open innovation [Chesbrough 2003] and the use of external sources of knowledge [see e.g. Laursen, Salter 2006]. For a review of academic studies see Lichtenthaler [2011] and for case studies on implementation of open innovation in industry, see Mortara, Napp [2010]. Studies highlight the potential for product innovation and overall competitive advantage through inclusion of the user perspective. Studies in management have also addressed the consultant-client relationship to explore the interaction between the innovation consultant and client [for an overview see O'Mahoney, 2010]. In design management and focusing on the client-perspective, Behrends, Reymen et al. [2011], for example, report that the intensity of the involvement of external designers in a client's design process has an effect on the occurrence of iterations in the process. Greater intensity leads to a greater occurrence of convergent design phases [Behrends, Reymen et al. 2011]. What these studies have in common, regardless of whether they focus on user involvement (open innovation) or on the involvement of design consultants, is the emphasis on the 'external' actor as an integral part of finding solutions and not as solely a source for requirement definition [e.g. Reichwald, Piller 2006]. Whilst the value that consultants can add to a business has long attracted management attention [e.g. Argyris, 1970; Schein, 1988], interest in the actual consultancy process in general is relatively new [Fincham, 1999]. In the design management literature, the nature of consultant-client relationship in general with emphasis on the perspective of the innovation consultant in particular seems to be underexplored.

Research focus

This paper takes first steps towards addressing the above-mentioned gap, describes scenarios and researches implications for coupling design thinking with systematic engineering design processes in New Product Development (NPD). More specifically, it investigates what is current practice at the interface between design consultancies, working with an IDEO-inspired design thinking approach [Brown, Katz 2009; Plattner et al. 2009], and their clients, who are mainly NPD-companies used to following systematic engineering design processes. Incorporating design thinking through external actors into the NPD-process of a client-company enables user-centred innovation also for clients who have no capabilities in doing

so alone. This paper takes a design process perspective when describing multiple scenarios of how design consultancies and clients might be coupled. We use the term coupling in this paper in its broadest sense as linking two 'parts', e.g. through communication but do not distinguish directly between tight and loose couplings [e.g. Weick, 1976]. The paper is guided by the following research questions:

- *Which scenarios for coupling design thinking with 'conventional' systematic engineering design processes are observed in industry practice?*
- *What are implications of the observed scenarios for the consultancy and the client?*
- *What issues affect the consultant-client relationship?*

The remainder is structured as follows. The next section introduces our interviewees and gives a snapshot of reported projects. This is followed by a discussion of findings for each research question. A summary and ideas for future work conclude the paper.

INTERVIEWING INDUSTRIAL DESIGNERS AND LECTURERS

Collaborating with a design consultancy affects the design process of any company. There are similarities to open innovation where a NPD-company also works with external stakeholders and 'opens up' its most important value creation processes – the design process.

Study design

We conducted eight interviews (see *Table 1*) to identify typical scenarios of such collaborations, implications for the participating parties, and key issues affecting successful partnerships.

Table 1: *Overview of interviewees from design practice and academia*

	Affiliation	Educational background	Practice	Country
Consultants	Ingomar&Ingomar – consulting	Mechanical engineering; Industrial design; Design research	> 15	US
	VIA Design	Industrial design; d.school Potsdam alumni	> 20	DK
	Tiefenschärfe	Economics; Political Science; d.school Potsdam alumni	> 5	DE
	Dark Horse Innovation	Mechanical engineering	> 5	DE
Lecturers	d.school Potsdam	Fine Arts	>20	DE
	d.school Potsdam	Computer Science	>10	DE
	Copenhagen Business School	Graphic design; Industrial design	> 20	DK
	Copenhagen Business School	Industrial design	> 5	DK

Interviews focus on the consultant-side of the consultant-client relationship. In addition to design consultants, university lecturers offering courses in design thinking were interviewed.

The university lecturers were chosen as they supervise student projects. These projects tackle real-life design problems and are executed with industry partners. University lecturers have a potentially great influence on the future design practice of their students and might therefore be considered in a position similar to representatives of a design consultancy. Our interviews cover four different design consultancies and two universities located in three different countries. The interviewees' expertise ranged from young entrepreneurs to very experienced design consultants. All interviews were semi-structured to allow for comparability between the two interviewers, were conducted face-to-face or over the telephone and lasted between 60 and 90 minutes.

Design projects

We asked our interviewees to refer their answers whenever possible to the same reference project. This posed challenges, especially for the university lecturers as they mostly act as supervisors rather than actively involved designers. Reported projects included a number of design disciplines and refer to large as well as small and medium-sized clients. Some cases were executed during previous engagements in other consultancies. Due to confidentiality reasons, clients in the projects described will not be named. Out of the many examples given during interview, four projects consultants mainly referred to will be described in brief (an overview is given in *Table 2*).

Table 2: *Overview of selected design projects*

	Industrial	**Service design**	**Interaction**	**Event design**
Content	new models for consumer good	alternative service concept	interacting in a prison	stand at fair use renewable
Goal	improve functionality	to support product planning	increase positive experiences	to interest youth
Size of client	large	large	large	medium
Type of client	private	private	public	public
Role of contact person	R&D	Marketing	Board and all stakeholders	Director of public relations
Duration	6 months	3 months	1.5 years	3 months
Main result	design prototype	product idea user information	activities newsletters	experiments with materials
Success	profitable design awards	follow-up project roll-out service	reduced crime roll-out	strong use and interest

Selected projects range from industrial design, to service design, to interaction design, and event design and cover clients from industry as well as governmental institutions. The industrial design project was motivated by the launch of a new product through a competitor. Our consultancy interviewed was hired to propose a modern design for a vacuum cleaner that attracts customers as well as improves the functionality of the product. The service design project was initiated in order to propose an alternative service concept for a logistics company. A main aspect of this project was the analysis of consumer behaviour in densely populated areas. The interaction design project was driven by the need to improve interaction

between guards and inmates of a prison in order to support the rehabilitation of the inmates and to improve the sometimes threatening atmosphere. The event design project was initiated by a public special interest group in order to design a stand at a fair that allows the younger audience to experience different ways of using renewable primary products.

What unites the four projects selected is the fact that all projects were initiated by the client and judged as successful – last but not least as the consultant-client relationship turned into a long-term one. A further commonality of these examples is that the results of the projects were strongly affected by the type and mode of coupling between the consultants and the clients, even though coupling scenarios differed.

FINDINGS: COUPLING PROCESSES AND ACTORS

Our findings encompass configuration options for coupling design processes and modes of interaction between the consultant and the client.

Types of process-coupling

This paper describes opportunities for coupling a design thinking (DT) approach [Plattner et al. 2009] with the design methodology proposed by Pahl and Beitz [2007]. Both approaches start with an initial problem statement or with the identification of a need. Pahl and Beitz' methodology for systematic engineering design covers the whole design process from product planning and task clarification, to conceptual design, and detail design as a full description of the product, including parts lists, detailed drawings for manufacture and the like. The design thinking approach ends with the development of a prototype (see *Figure 1*).

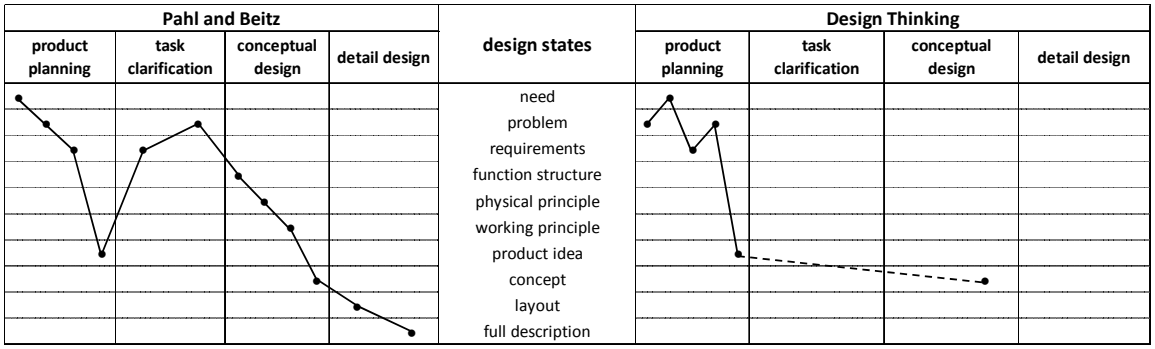

Figure 1: *Sequence of realised design states [Gericke et al. 2010]*

The graphs shown in *Figure 1* indicate the sequence of realised design states (from left to right; iterations are not represented) as described in literature (for Pahl and Beitz) and observed during a case-study of design thinking projects at the d.school Potsdam, preceding the interview study reported in this paper. Depending on the problem addressed, the final deliverables of the student projects were categorised as a product idea or concept (indicated by the dotted line in Figure 1) [see also Gericke et al. 2010].

This led to the idea that coupling both approaches might be beneficial for product development projects which are characterised by complex problems, in which users are

involved and innovative solutions need to be developed. Combining both approaches offers the chance to combine the user-centred perspective of the design thinking approach in the beginning of the project (more design-oriented phases) with the methods proposed for systematic variation, selection and optimisation during later phases of the project (more engineering-oriented) [Gericke et al. 2010]. We might conclude from this study that in design practice, different types of coupling the design thinking approach with a company's design process are constrained by the required maturity of the delivered solution and design thinking might not take us to a detailed design. In order to find out whether these statements derived from student projects are supported by findings from design practice, our interview study set out to analyse examples of successful consultant-client relationships.

Perhaps as expected, interview results point to two types of how design processes can be coupled: One, what we call partial substitution, in which parts or some phases of the client's design process are completed by the consultant and another one, what we call complete substitution, in which the client's design activities are fully undertaken by the consultant.

Partial substitution of the client's design process

In the reported cases, the design consultancies were mostly involved right from the start or sometimes even before a specific project was launched. Most often, consultants were tasked with the goal to propose ideas for new products and services. This type of coupling can be described as a partial substitution of the client's design process by the design thinking process. In the cases reported, the deliverable from the design thinking project was often a product idea, a solution concept or a first layout of the final solution. This would depend on the type of product. Most of the reported projects resulted in the proposal of a product idea and in case of less complex design problems, a concept (see *Figure 2*; partial substitution – a). One project resulted in the development of a layout of the final solution (see *Figure 2*; partial substitution – b). Distinguishing between design states implies an increase in knowledge about the solution. The distinction between product idea and concept was difficult in some cases as the degree of complexity of some solutions was rather low.

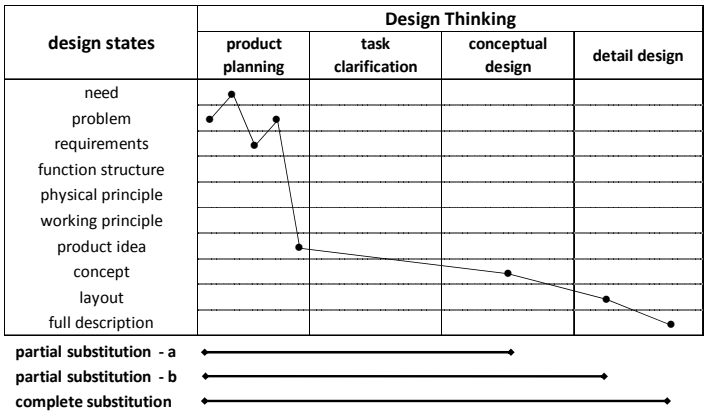

Figure 2: Types of process coupling

Complete substitution of the client's design process

Another type of coupling between design consultancies and clients can be described as complete substitution, where product development was wholly performed by the consultancy. This type of coupling was reported for consultant-client partnerships where the client did not possess own design capabilities. Projects characterised as such resulted in a deliverable that was ready for implementation (see

Figure 2). Detailing of the product idea that resulted in a full description of the deliverable was done by iterating the later stages of the design thinking process, which was, as and when needed, supported by additional and sometimes additional external experts. *Table 3* summarises findings from types of design process-couplings seen.

Table 3: *Description of observed types of design process-coupling*

	Partial substitution	**Complete substitution**
Size of client	• rather large companies	• rather small and medium sized companies
Design capabilities client	• company is capable	• design/innovation resources or capabilities are limited
Intent of collaboration	• to get new ideas • to get new impulses for own work • to have a competitive advantage • to learn about users • to maintain image as innovative company • to try a new approach • to get insights into the DT approach	• to get new ideas • to have a competitive advantage • to compensate lacking design resources/capabilities of the client
Scope of the design challenge	• open solution space	• related to client's own portfolio
Deliverable	• new ideas are paramount	• implemented solution

Modes of coupling: The consultant-client interaction

A further factor that influences collaboration between a design consultancy and a client is the mode of coupling, i.e. the mode of interaction between both partners. Interview results point to two configurations: a somewhat passive coupling and a more active coupling between a consultancy's design thinking team and their clients.

In consultant-client partnerships categorised as passive coupling, the consultancies' design thinking teams developed the solution on their own and contacted their clients only in order to get further information or for reviewing results. In active couplings, the consultancies' teams were supplemented with designers from the client. Intensity of the collaboration varied during the project. Designers from the client-side collaborated closely, e.g. through regular workshops and contributed to the final solution.

There is no one best way. Strengths and weaknesses of each mode depend on the context of the particular design project. A main issue that influenced the decision on which mode to

choose is related to the open-mindedness of the client to ideas that were not invented by their own designers. This might be more or less relevant, depending on the goal of the collaboration. Collaborations in which co-creation of the solution during an on-going project is the goal, active coupling might be beneficial as the proposed solutions enjoy higher mutual acceptance. Collaborations aiming to provide new ideas and insights into consumer needs might benefit from passive coupling, as the design thinking (DT) team might be less affected by restrictions and fixations imposed by the client's designers. An overview of additional benefits and challenges of the different modes of couplings are given in *Table 4*.

Table 4: *Comparison of coupling modes*

	Passive coupling	**Active coupling**
Description	• Consultancy's DT-team develops the solutions on its own • Designers from the client-side are not involved in design activities	• Co-creation of solution • DT-team is composed of designers from both the client and the consultancy. (Alternatively, designers from the client-side are only involved during workshops)
Benefits	• DT-team will not be affected by restrictions and fixations within the client-company • DT-team is familiar with the approach	• Easier acceptance and uptake of the proposed solution • Face-to-face communication might save time and makes iterations faster
Challenges	• Deliverable might suffer acceptance problems by on client-side ("not invented here"- syndrome)	• Client might focus on own contribution relative to contribution from consultant • Might narrow the solution space because of client's design fixation

Scenarios for coupling

Considering both types of process-coupling and the coupling modes allows for a description of scenarios for connecting design activities of both consultants and clients. Cases reported by the interviewees did not cover all possible combinations of the identified types and modes (see *Figure 3*). All configuration options appear feasible but in design practice, demarcation lines between the different scenarios characterised by coupling-types and -modes are blurred.

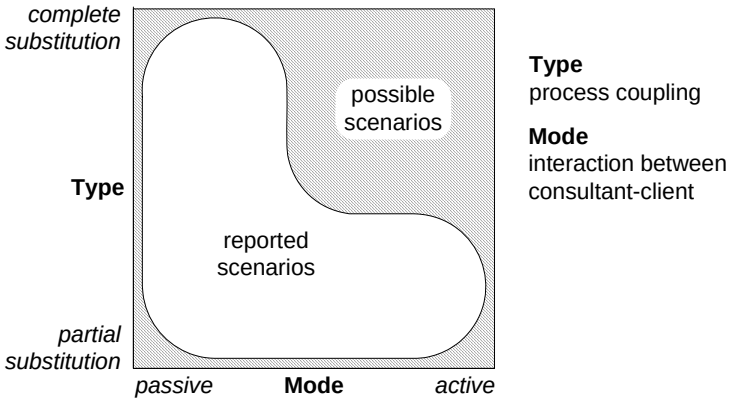

Figure 3: *Scenarios for coupling*

DISCUSSING IMPLICATIONS OF COUPLING-SCENARIOS

A good fit between the design process of a design consultancy and the design process of a client will improve the outcome of the collaboration and will avoid wasting resources [Browning 2003]. The choice of a suitable coupling-scenario can compensate for the absence of design capabilities, required expert knowledge and skills in the client-company and can determine efficiency of such a collaboration.

Interpreting our findings within the context of the projects, we suggest that there are major influences on the course and the outcome of the consultant-client relationship. These influences or determinants concern the client and the consultant (design capability, size, and goals) and the product (complexity, type of product/branch).

> One determinant for the decision to which extent design activities are substituted by a design consultancy is the design capability of the client. It is obvious that if a client-company has no own design capabilities, it cannot contribute to the design process, thus the design consultancy has to substitute that completely. But even if the client possesses good design capabilities a comprehensive substitution (compare scenario 'partial substitution – b' in

Figure 2) might be sensible, if the client wants to engage in a market sector where they have currently no expertise or if the product development process is driven by different expert knowledge or skills (for example industrial design skills).

Influence of the design capability on the choice of a suitable scenario seems to explain the observed tendency that a complete substitution was only reported for collaborations with small companies. Collaborations with large companies were usually characterised by partial substitution aiming to support the early phases of the product development process, namely the need finding and product planning/conceptualisation phases.

Another determinant for the extent to which a design consultancy can substitute design activities is the existence of the required expert knowledge and skills on the consultancy side. As reported by some interviewees, the consultancies hired external experts in order to complement the design thinking team if required. The flexible organisational structures of the rather small design consultancies allowed integration of external experts even in the later iterations when the basic idea was already developed and the design activities focussed on a further refinement of that idea.

Yet another determinant for the suitability of the portrayed scenarios seems to be the product respectively the nature of the design task. A complete substitution of the design process, what differs from observations in a previous case study [Gericke et al. 2010], was only reported for service design or products with a rather low complexity. This suggests that design thinking can be used in order to develop solutions beyond the product idea or concept level (see

Figure 2). However, it also suggests that a complete substitution is not possible in all cases. An explanation might be that more complex products seem to usually require more diverse

expert knowledge and more manpower. Even if the design consultancy might be able to build a team with the required expertise it seems questionable whether the iterative design thinking approach is the most appropriate in that case. The reported design thinking projects involved a rather small number of designers which allowed intensive face-to-face communication. The question remains whether this is can be uphold when the team grows in size. In such cases, consultancies working with design thinking might contribute best during the early phases of product development, with concept refinement and detail design being perhaps out of scope.

ISSUES THAT AFFECT THE CONSULTANT-CLIENT RELATIONSHIP

Four for us unexpected issues were emphasised in interview. Related and in no particular order, consultants found themselves what one might call 'being guided by process models', 'negotiating the solution space', 'managing expectations', and 'daring the unknown'.

Being guided by design process models: design thinking useful myth

We were surprised by the fact that both design consultants and university lecturers had a process model in mind which they followed when executing their design projects. Interestingly, it seemed that most of the design consultants focused on the process models or a slight modification of the ones they were taught.

The four interviewees from the d.school Potsdam and d.school alumni followed the design process model as proposed by Plattner et al. [2009]. The two interviewees from the Copenhagen Business School referred to using the UK Design Council's Double Diamond [Design Council 2007] in their teaching and consulting, one interviewee referred to Andreasen and Hein's Integrated Product Design process model [Andreasen, Hein 1987], and one hand-sketched a design thinking process model he was using. All interviewees were familiar with the IDEO-inspired design thinking approach.

Confirming Norman's 'design thinking: useful myth' [Norman, 2010], most interviewees mentioned that they had been using design thinking characteristics throughout their industrial design practice, even if they did not call it design thinking when they started. Some speculated that giving it a label probably accelerated the trend to focus on the user – the trend of co-creation and treating the client as an actively involved partner in the project.

Negotiating the solution space: Stage-gate vs flexible process

Design thinking emphasises the need for and benefit from design iterations and differs from how most companies are used to manage their own design processes, which is often inspired by a stage-gate approach with defined stages and deliverables [e.g. Cooper 1990]. A lot of times, clients had problems accepting the iterative nature of the design thinking approach and ambiguity resulting from the open solution space. Especially large companies asked for concrete and tangible solutions early on. Accommodating and using this tension, industrial designers found themselves continuously communicating, negotiating, creating and re-defining the solution space.

Managing expectations: The design brief

Managing the client's expectations with respect to the solution is one of the most crucial aspects for a successful consultant-client relationship. It contributes towards client satisfaction and re-assurance that the right problem had been invested in.

Consultancies interviewed were confronted with two different situations, which, when confused, lead to difficulties in executing the design project. In the first situation, the client had clear ideas for expected deliverables. The initial focus in the design brief would often forestall possible solutions and perhaps neglect central user-needs. It would often perhaps solve the problem right but not the right problem. Intensive negotiation of the initial design brief was therefore required in order to widen the solution space, e.g. by re-defining the system boundary and loosening requirements and restrictions imposed by the client. Contrary to the first, in the second situation, the client had only vague ideas or rudimentary understanding of the problem but the feeling that there might be potential for a good product or service. This situation required careful preparation of the design brief to develop shared understanding of the problem and user-needs to be addressed and satisfied. In both situations, giving priority to managing expectations and capturing them in the design brief was highly recommended (see also [Petersen, Phillips 2011]. Industrial designers interviewed also highlighted that managing expectations and formulating the initial design brief were easier and less time consuming during follow-up projects as clients were then already familiar with the design thinking approach.

Daring the unknown: Is a bird in the hand worth two in the bush?

Irrespective of the coupling types and coupling modes chosen, interviewees pointed to the importance of the client's mindset with respect to the design thinking approach. According to the design and innovation consultants interviewed, design thinking is highly iterative and requires the willingness to try something new. Something, the client might not be able to predict or control but something that might offer the potential to exceed expectations. In this context, one of the designers pinpointed the situation by using the English proverb 'a bird in the hand is worth two in the bush'. Often, one of the participating parties tends towards thinking that it is better to accept or be content with what one has than trying to get more and thus risk losing everything. If this is the case and the innovation envelope is trying to be pushed, it is therefore of paramount importance to agree on a journey of experimentation; as in these cases, only the future will prove whether the chosen approach is right but without embarking on the journey, the unknown yet rewarding destination could never be reached.

SUMMARY AND FUTURE WORK

Summary

A company might be fixed on existing solutions, locked-in a certain way of perceiving and interpreting user needs, or might lack capabilities in designing. Working with a design

consultancy might offer possibilities for developing products which were not thought of before. Working with a design consultancy might also offer possibilities to adapt a company´s own design process, for example, by learning from observation and analysis of the design consultancy's practices and/or by getting insights and inspirations from an external pair of eyes.

However, such collaborations are also sensitive, as they require valuable resources and success is not guaranteed. In order to support preparation of a client-consultant partnership, this paper investigated different aspects of such collaborations by interviewing eight industrial designers and lecturers in design thinking. The paper focused on three questions.

Which scenarios for coupling design thinking with 'conventional' systematic engineering design processes are observed in industry practice?

Different scenarios for coupling have been reported by the interviewed design consultants and lecturers. The scenarios can be distinguished by two main aspects: the *type* and the *mode* of coupling. The coupling *type* describes what part of the design process is executed by the design consultancy, i.e. whether the consultancy or the client has the process ownership. For all reported projects the consultants had the ownership at least for the initial part of the design process (*partial substitution*) and for few examples the consultancy had the ownership of the whole process (*complete substitution*). The coupling *mode* describes the way the client is integrated into the consultancy's design activities. Two different modes can be distinguished: *active* and *passive*. An *active* integration means that designers from the client-side are integrated into the team of the design consultancy, i.e. it is both expected and desired that they contribute with own ideas to the final solution. In a *passive* coupling mode, the client is not integrated into the consultancy's team.

What are implications of the observed scenarios for the consultancy and the client?

There is no one best scenario. Suitability depends on the context, in particular on the design capabilities of the consultants and the clients, the goal of the collaboration, and the addressed design task. Each scenario has different strengths and weaknesses which should be considered when preparing such collaborative design projects. Findings in this paper resulted from interviews with design experts who embraced design thinking. We believe that findings also relate to other consultant-client partnerships.

What issues affect the consultant-client relationship?

In addition to the different options for coupling (see e.g. *Figure 3*), this paper highlights four dominant issues that affect both sides of the (external) consultant-client relationship and the outcome thereof: Being aware of explicit or implicit design process models used when preparing and implementing design projects, negotiating the solution space and putting emphasis on writing the design brief, managing expectations especially with respect to envisaged outcomes, and allowing for unknown and possibly even more rewarding solutions.

Future work

This discussion contributed to coupling of design thinking with systematic engineering design processes via the consultant-client relationship. Empirical data was gathered through the eyes of the consultant and with help from academic examples. Future studies will explore the client-side. Further work will extend scenarios, e.g. by exploring situations in which the consultant-side itself is composed of a number of partnerships.

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We thank the interviewees for their time, willingness, and openness in sharing their experiences. It allowed us to describe characteristics and challenges of the consultant-client relationship during design practice.

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Designing a Product Service System: Does Congruity Add Value?

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Keywords: Product-Service System, Congruity, Value.

Product Service Systems (PSSs) are combinations of products and services that are brought together to the market to fulfil consumers' needs (Goedkoop et al., 1999). When using PSSs, consumers experience product and service elements as one. Consequently, consumers' evaluations of the total offering are based on the integration of the product and service elements that encompass it. However, the intrinsic differences between products and services may complicate the successful integration of these elements and create incongruities. This research studies the influence of (in)congruities in the evoked symbolic meaning on consumers' evaluations of a PSS. Results of this study suggest that congruent offerings can create assurance with consumers (i.e., reduce the perceived risk), resulting in a more positive evaluation of the complete offering.

INTRODUCTION

Product Service Systems (PSSs) are combinations of products and services that are brought together to the market to fulfil consumers' needs (Goedkoop et al., 1999). The design of this type of offering is an area of increasing attention for academics and practitioners. During the last decade, academics have studied the benefits for companies relying on this type of offering (e.g., Morelli, 2003; Tukker and Tischner, 2006; Williams, 2007; Tukker, 2004; Baines et al., 2007; Mont, 2002). Similarly, reports from practice suggest an increased interest from organizations, which following the success of market pioneers, have acknowledged the potential impact PSSs can have on customer retention and satisfaction. An example of a company that has successfully introduced a PSS is Apple. Apple sells the iPod to consumers (i.e., the product) and presents them with the option of buying music and applications online (i.e., the service).

What differentiates PSSs from conventional choices is the significance that both the product and service elements of such offerings have to the consumer. While traditional products often comprise service elements and vice-versa (Shostack, 1977), it is the product (or the service) around which strategies are created. For example, when buying a new television, a consumer may have access to a service warranty. However, this warranty does not considerably influence the interaction between the consumer and the television, or his/her experiences with it. Similarly, a visit to the hairdresser has a high content of service interaction with the employee, where the haircut and service become central to the experience, and where not necessarily a tangible product is purchased. In contrast, when using PSSs product and service elements are both important and jointly influence consumers' experiences with the offering.

The combination of both product and service elements makes the development and commercialization of PSSs an aspect of critical consideration. Products and services clearly have different characteristics (Zeithaml and Bitner, 2000, p. 11). Products are tangible and manufactured. The quality of products is relatively constant and easy to control because products are designed following specifications enabling uniformity among series of the same product. When consumers buy a product its ownership is transferred to them. Consequently, products are available to those who purchase them at all times, and for as long as the product lifecycle permits it. Services, on the contrary, are intangible and cannot be manufactured. A service is an activity with economic value that takes form the moment it is accessed. The interaction between consumer and service provider is recurrent and particularly important for a positive impression formation. The quality of a service can be variable and difficult to control (Zeithaml, 1981) as it highly depends on, among others, employees' behaviour and environment (Parasuraman et al., 1985; Bitner, 1992). Hence, employees are often part of the service organization and are trained to reflect corporate values towards clients.

Despite their intrinsic differences, PSSs bundle products and services into one complete offering. The integration of product and service elements takes place through the system. In the example of the Apple iPod, the system is represented by iTunes. Through this platform, consumers can access the service that Apple provides (i.e., purchase of music and applications), while the product facilitates the interaction between consumers and service provider.

The integration of product and service elements, with different characteristics, may influence the way consumers evaluate PSSs. Consumers make use of different cues to draw inferences about quality. Among others, products' tangibility allows consumers to use materials, shapes, colours or sounds, to assess the value and quality of a product (Schifferstein and Desmet, 2008). For services, consumers may turn to the surroundings to find cues about the service's quality, when the service experience is difficult to assess (due to the service's intangibility heterogeneity and inseparability; Parasuraman, Zeithaml, Berry, 1985). Booms and Bitner (1981) named those ensembles of cues servicescapes: "the environment in which the service is assembled and in which the seller and customer interact, combined with tangible commodities that facilitate performance or communication of the service" (p. 36). For

example, consumers may use the colour and style of the uniform of flight attendants as a quality cue for an airline. Also, chairs' comfort, food, space, or displayed information may influence the service experience and perceptions towards the airline. Consequently, consumers evaluate products and services in an integrative manner by combining the different cues available in their evaluation (Van Rompay et al., 2009; Van Rompay et al., 2010; Mattila and Wirtz, 2001; Bitner, 1992). For PSSs, both product and service elements may become particularly important for consumers' evaluations of the offering. Hence, consumers may not only look at the tangible elements of the product but also turn to elements of servicescapes to draw conclusions about the PSS.

The intrinsic differences between products and services represent a challenge for the successful integration of these elements from a consumer's perspective. The symbolic benefits that consumers experience in the various elements of a PSS may differ or even conflict. For example, a fully customized service element may provide the important symbolic benefit of self-expression because it conveys a person's uniqueness, whereas a standardized product element may fail to do so (Mugge, Schoormans, and Schifferstein, 2009). Failure to provide a congruent experience can be expected to confuse the consumer, and ultimately, damage the user experience.

Despite the relevance of developing congruent PSSs that are perceived as one total offering, research on how consumers experience PSSs is limited. This research contributes to the literature by investigating how consumers experience and evaluate these particular offerings. Specifically, we explore the influence of congruity with respect to the conveyed symbolic meaning (i.e., by both the service and product elements) on consumers' evaluations of the PSS.

Congruity in PSSs

The term congruity refers to the extent to which two or more objects (e.g., products, brands, people, images, companies, text, groups), correspond to each other. The correspondence can take different forms: meaning, functionality, usability or shape can all influence congruity. Past research has studied the effect of congruity on consumers' perceptions and evaluations of products or services (e.g., Bitner, 1992; Mattila and Wirtz, 2001; Patrick and Hagtvedt, 2011; Bosmans, 2006; Van Rompay, 2010). Van Rompay et al. (2010), for instance, studied congruity effects for services purchased through a website. In their research, congruity was defined by the resemblance in (symbolic) meaning, elicited by the different elements depicted in the website (i.e., text and product image). Thus, a picture advertising a hotel that is cosy should be accompanied by describing text reflecting the same attributes. Conversely, a picture-text combination that does not share the same attributes can create negative effects on the shopping experience. Other studies have found similar findings for different scenarios (Bitner, 1992; Bosmans, 2006; Mattila and Wirtz, 2001; Patrick and Hagtvedt, 2011), and confirmed the importance of congruity when designing consumers' experiences towards products and services.

In summary, past research has investigated the effect of congruity for services or products separately. We contribute to the literature by exploring the effect of congruity when both product and service elements are combined into one complete offering (i.e., PSS). The intrinsic differences between products and services may complicate the evaluation of PSSs. Accordingly, a potential discrepancy between product and service elements may look unreliable in the eyes of consumers and negatively affect their evaluations. In contrast, a high level of congruity between the product and service elements may reduce the associated risk of the PSS and thus facilitate consumers' purchase decisions (Van Rompay, 2010; Campbell and Goodstein, 2001). In other words, when congruity is present, consumers feel confident and safe about the offering and dissociate perceptions of risk from it. Congruity thus provides assurance to consumers, which will positively affect their attitudes towards the PSS. Our research assumptions are summarized in Figure 1.

Figure 1. Conceptual Model

METHOD

In this research, we focus on achieving congruity through the symbolic meaning that is evoked by both the product and service elements of a PSS. Particularly, we focus on the 'professionalism' represented by both elements. This symbolic meaning is often included in products and services, and is shown to positively affect the quality perception of the offering (Mugge, 2011, *in press*). Moreover, we use a web-based 'system' to manipulate the product and service elements because PSSs often make of use of online environments to promote and get in touch with consumers.

Design and participants

One hundred and twenty-nine participants took part in this study. Participants were Dutch citizens in the age range of 19 to 73 (50% male, mean age = 32.91, *SD* = 9.08). We created a website for a fictional rental car company, Renta Flex, as stimulus material. Rental car service companies are often mentioned as an example of PSSs in the literature (e.g., Baines et al., 2007; Williams, 2007), and therefore, appropriate for this research. Moreover, for rental car services product and service elements are both considerably important in the evaluations of consumers.

The product element was represented by a picture of a car with a company logo on it, while the service element was represented by a service description accompanied by an employee

photo. Four versions of the website were created, which varied in the level of congruity (i.e., professional product and professional service, professional product and non-professional service, non-professional product and professional service, non-professional product and non-professional service). Two pre-tests were conducted to confirm the appropriateness of our manipulations and selection of stimuli. Pre-test 1 focused on the selection of pictorial representations of product and service elements, while Pre-test 2 focused on the written description of the service.

Pre-test 1: Car, logo and employee image

Car, logo and employee image were pretested using separate questionnaires for the same participants (N=50, 44% male, mean age = 24, SD = 2.40). To create a more and less professional version of a car, both the colour of the car and the size of the company logo were manipulated. Volkswagen Golf was chosen as the stimulus product as it is a type of car that is often used by rental car companies around Europe. The Volkswagen Golf was presented in six different colours (i.e., black, yellow, dark blue, red, grey, and light blue), which were obtained from the official Volkswagen website to guarantee realism. All pictures made use of the same product view and image quality to guarantee consistency. Participants were asked to rate all six cars on their professionalism on a three-item, seven-point semantic differential scale (i.e., (not) professional, (not) business-like, (not) serious). Moreover, the attractiveness of the car was checked for confounding effects on a one-item, seven-point scale, anchored by unattractive and attractive. The cars in the colours grey (M = 5.47, SD = 1.02; α= 0.87) and light blue were selected (M = 3.25, SD = 1.02; α= 0.77), as the professional and non-professional car, respectively. These cars differed significantly on the perceived professionalism ($p < 0.001$), while no difference for the perceived attractiveness of the cars was found ($p > 0.05$). Both analyses were conducted using Bonferroni as post hoc test.

A trained designer created a fictional logo for the rental car service company. Professionalism of the company logo was manipulated by changing the size and position of the logo on the car, and pre-tested using the same professionalism scale as previously reported. Five logo variations were presented to the participants. We selected the logos with the highest and lowest scores on the professionalism scale as stimulus material (M = 5.41, SD = 0.91; α = 0.79 versus M = 3.15, SD = 1.1; α = 0.75; $F(4, 180) = 54.92$, $p < 0.001$). The selected cars and logos were combined (i.e., professional car and professional logo vs. non-professional car and non-professional logo), making use of photo-editing software to create the two product variations (See Appendix A and B).

Finally, to select employee pictures with either a more or less professional image, twelve pictures of a person varying in pose (e.g., thumbs up, crossed arms, extended hand) and formality of clothes (e.g., suit and tie, only tie, no tie or jacket), were created and pretested. Participants were asked to rate all employee pictures on the three-item professionalism scale. The employee pictures with the highest and lowest scores on professionalism as stimuli (M = 5.53, SD = 0.80; α = 0.77 versus M = 3.80, SD = 1.10; α = 0.88, $F(11, 517) = 38.96$, $p < 0.001$) were selected.

Pre-test 2: Service description

Two service descriptions were created, where tone and wording were changed in either a more or less professional text. The structure and meaning of the text were kept consistent across conditions. Forty participants (75% male, mean age = 22, *SD* = 2.39) were asked to rate one of the two service descriptions (i.e. twenty each condition) on the three-item professionalism scale (α = 0.83). An independent samples t-test revealed significant differences in the perceived professionalism between both descriptions (M = 5.47, SD = 0.68; vs. M = 3.77, SD = 1.17, $t(38)$= -5.62, $p < 0.05$), confirming the success of this manipulation. These service descriptions were combined with the selected employee images (i.e., professional service description and professional employee vs. non-professional service description and non-professional employee), to create two service variations (See Appendix A and B).

Final Stimuli: Picture of a Website

The selected stimuli, product and service elements, were brought together in a picture of website. The website promoted the Renta Flex company and enabled consumers to identify the location of a car and book the offering. This resulted in four different pictures: two conditions in which the product and service elements were congruent and two conditions in which the product and service elements were incongruent. The pictures were created making use of professional photo editing software and were standardized in terms of size and quality (See Appendix A and B).

Procedure and Measures

Four online questionnaires were created, one for each of the conditions. Participants were contacted via email and assigned randomly to one of four conditions. To encourage participation, a small monetary incentive was offered to every third respondent. Participants were first asked to imagine themselves as potential Renta Flex customers. In this scenario, participants were asked to imagine themselves as owners of a small business, who do not possess a car themselves, and who contact Renta Flex expecting them to be a good representation of their own businesses. As such, participants would have a scenario in mind were social approval was needed (i.e., risk). Subsequently, they were shown the picture of the website and were instructed to observe and read the content carefully. The image of the website was made available to participants throughout the questionnaire.

We measured attitude towards the PSS by means of a three-item, seven-point differential scale (i.e., bad/good, unfavourable/favourable, negative/positive), inspired by the work of Campbell and Goodstein (2001). We measured assurance with three seven-point Likert scales: “I consider Renta Flex’s offering to be a safe business decision”, “I would feel confident if my clients saw me using the Renta Flex offering” and “I would feel assured about Renta Flex’s support when needed”. The scales were anchored from 1 (strongly agree) to 7 (strongly disagree) and inspired by the same work (Campbell and Goodstein, 2001).

Finally, we assessed the perceived congruity of the offering with two seven-point Likert scales: “Renta Flex presents a coherent offering to its clients” and “The offered car matches with the service that Renta Flex provides”.

RESULTS

Reliability and Validity of the Measures

The internal consistency and convergent validity of the scales to measure attitude, assurance, and congruity was investigated by performing a confirmatory factor analysis (CFA) on all items of the latent variables using ML-estimation in LISREL 8.72 (Jöreskog and Sörbom, 1993). The results indicated a good fit to the data ($\chi^2 = 26.50$, $df = 17$, $\chi^2/df = 1.56$, $p = 0.07$; GFI = 0.95, CFI = 0.99, RMSEA = 0.066). Convergent validity was indicated by the fact that the items loaded significantly on their corresponding latent construct (all t’s > 2.0) (Bagozzi et al., 1991). Discriminant validity among the scales was assessed as follows. First, a baseline model (in which the correlations between pairs of constructs were freely estimated) was estimated for each possible pair of scales. Next, we compared this baseline model to a series of alternative models, in which the correlations between pairs of constructs were constrained to unity (Anderson and Gerbing, 1988). In each case, the constrained model exhibited a statistically increase in chi-square ($\Delta\chi^2$ (1) > 3.84), providing evidence of discriminant validity (Bagozzi and Phillips, 1982). Furthermore, the reliability of each scale was explored by computing the reliability coefficient or Pearson’s correlation ($\alpha_{attitude} = 0.88$; $\alpha_{assurance} = 0.83$; $r_{congruity} = 0.45$). Together, these results indicated a sufficient degree of reliability and validity of the scales.

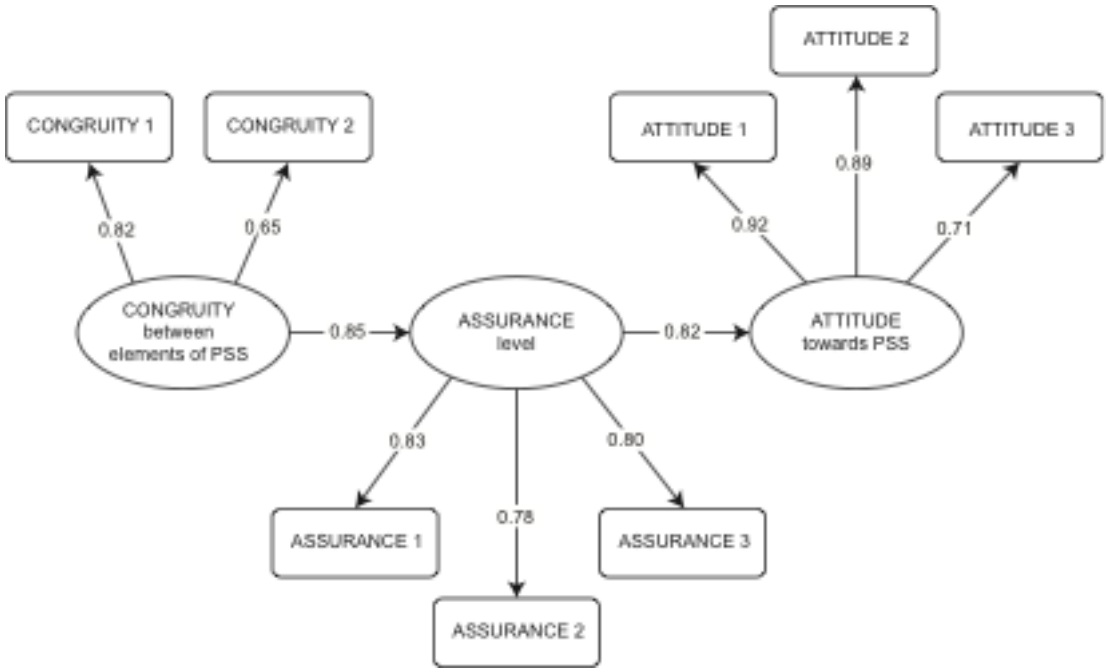
Manipulation and Confounding Checks

Based on an exploration of the boxplots for the variable congruity, three outliers were removed from the dataset. Next, an analysis of variance showed that the manipulation of congruity between the product and service elements of the PSS was successful and resulted in variations in congruity. As intended, a significant interaction effect between product and service was found on congruity ($F(1, 111) = 7.51$, $p < 0.01$). Specifically, participants who were presented with the professional product, perceived the PSS to be more congruent when the service had a professional image than when it had a non-professional image ($M_{prof} = 4.30$, SD = 1.25 vs. $M_{non\text{-}prof} = 3.78$, $SD = 1.08$, $t(67) = 1.80$, p = .08). In contrast, participants who were presented with the non-professional product, perceived the PSS to be more congruent when the service had a non-professional image than when it had a professional image ($M_{prof} = 3.98$, $SD = 1.04$ vs. $M_{non\text{-}prof} = 4.58$, $SD = 0.76$, $t(44) = -2.27$, $p < .05$). No other effects were found.

Test of the Model

In order to test our conceptual model (see Figure 1), we estimated the structural equation model with latent variables in LISREL 8.72. The fit statistics for this model indicated a good fit (χ^2 = 26.58, df = 18, p = 0.06, χ^2/df = 1.48, GFI = 0.95, CFI = 0.99, RMSEA = 0.061). This model explains 67% of the variance in consumers' attitude towards the PSS. The results provided support for our conceptual model. Specifically, the degree of congruity between the product and service elements of a PSS had a positive effect on the perceived assurance of the offering (b = 0.85, p < 0.05). Furthermore, the perceived assurance positively affected consumers' attitude towards the PSS (b = 0.82, p < 0.05). The estimated model is presented in Figure 2.

Figure 2. Results of the Structural Equation Model



DISCUSSION

In this study, we have explored the role that congruity in the elements of a PSS plays on consumers' evaluations of the PSS. Our results suggest that consumers who evaluate a PSS value the congruity of meaning between product and service elements. Furthermore, following the work of Campbell and Goodstein (2001), we have found evidence suggesting that congruity can reduce the perceived risk associated to online transactions and unknown offerings. When confronted with new PSSs, congruent offerings can evoke assurance with consumers, resulting in a more positive evaluation of the complete offering. Previous research has studied the effects of congruity for products or services separately (e.g., Bitner, 1992; Mattila and Wirtz, 2001; Patrick and Hagtvedt, 2011; Bosmans, 2006; Van Rompay,

2010). Our findings add to these theories by exploring these effects for offerings where both products and services are important to consumers. Moreover, literature on how to design PSSs is scarce (for an exception see Morelli, 2006). As such, we give a first step in understanding how consumers evaluate PSSs, in order to create new guidelines for practitioners on how to successfully design and market these new offerings.

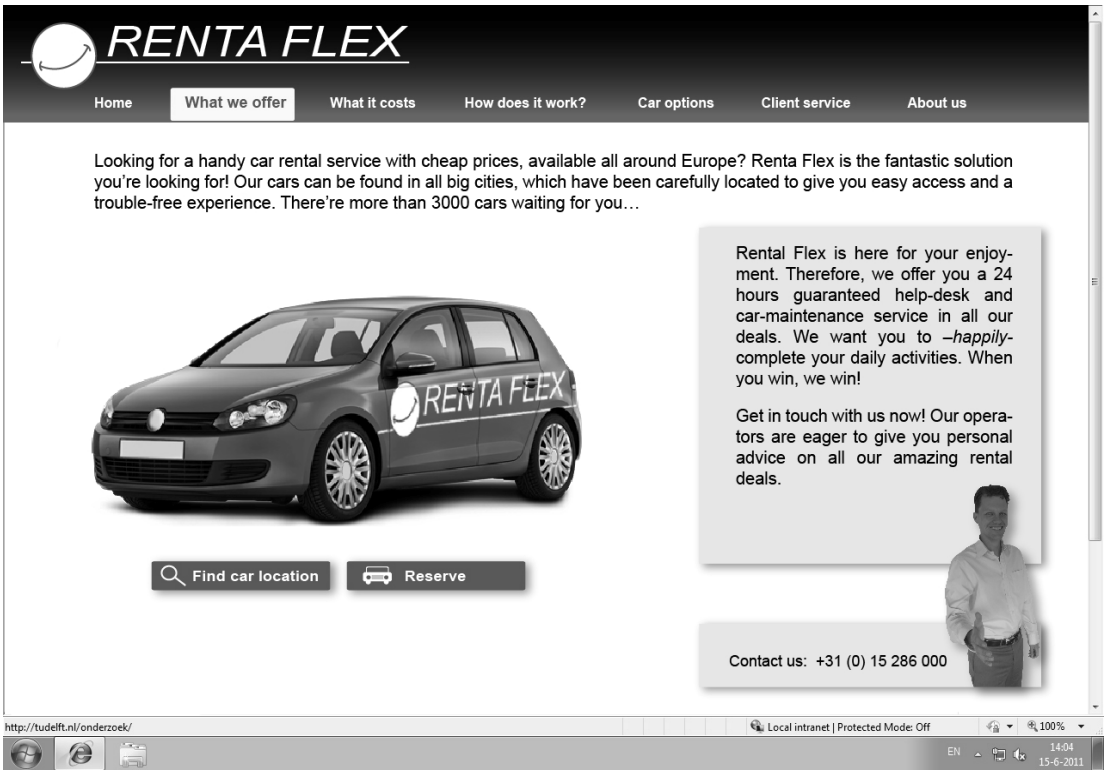
Our findings have several implications for practitioners. First, differences between the service description and attributes of the product have not passed unnoticed by participants. Designers and marketers need to pay close attention in defining the message the PSS should convey, and match such impressions with those of the product and service elements that define it. Thus, product and service elements should not be developed separately. An overall view of the total offering should to be created, where consumers' experience with the PSS is clearly defined. Second, practitioners should clearly establish the perceived risk associated to their offerings. In new PSSs where perceived risk is often high, congruity between product and service elements could reduce that perceived risk, and positively influence consumers' evaluations towards the total offering.

Our research leaves some open questions for further research. First, our study has primarily focused on the congruity based on a single element: the symbolic meaning of professionalism. Other aspects, such as functionality, usability or shape can have congruity effects on the evaluation of PSSs as well. Further research is therefore needed to better understand these phenomena and the relative importance of these factors. Second, we have opted for an often-mentioned PSS in the literature (i.e., rental car service company) with a relatively high social risk and a low grade of ownership. The nature of the interaction between consumer and service provider, and the perceived risk associated with the purchase, can differ considerably between PSSs. For example, NikePlus, a PSS that encompasses a product to track running distances, provides a web-based system where consumers can store their data, look at development graphs, and get in touch with other NikePlus' users. In this case, consumers are actively involved with the service and have continuous contact with other users. Consequently, the community becomes a much more important aspect of this particular PSS than for a rental car service company. Moreover, the perceived risk associated with the purchase could lie in other aspects, such as functionality or performance, and could thus have different effects on consumers' evaluations of the PSS. Further research should set out to explore the role of ownership, interaction (e.g., community dynamics), and perceived risk of (diverse) PSSs, in order to fully understand the effect of congruity on consumers' evaluations of PSSs. Finally, our research used a picture of a website to characterize PSS. Future research should make use of more realistic settings where consumers can experience the service elements first hand, thereby enhancing the external validity of their evaluations.

APPENDIX

A. Stimulus material: Professional product and professional service

B. Stimulus material: Non-professional product and non-professional service



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The Evolution of the Design Management Field: A Journal Perspective

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Keywords: Design management, conceptual survey, literature survey, evolutionary theory, semantic mapping.

Based on a literature survey of the development of concepts supplemented by a selective literature review for the years 2000 to 2010, this article aims to trace the dynamic development of the field of design management – a cross-disciplinary research field seeking to establish itself in its own right. The framework of this research is evolutionary theory (Campbell, 1969; Aldrich and Ruef, 2006), and our analysis is based on two primary design management journals. After establishing a concept model, we identify four changes in the development of design management leading to the main conclusion of the research, namely that the field of design management is evolving into a phase where selection processes prevail over variation. Research tends to be driven by emerging agendas in the domain of design research as well as by major agendas in society as a whole. A more in-depth knowledge sharing with the field of management research may enhance the dynamics of design management. The challenge is to avoid being overwhelmed by the established paradigms and logics dominating the field of management research. Should that fail design management might be unable to establish itself as a separate discipline within the realm of management.

INTRODUCTION

The term “Design Management” was introduced by The Royal Society of Arts in 1965 (Best, 2006), and the following year the first book on design management was published by Michael Farr (Farr, 1966). Although the term has been around for 46 years and design management *as a field of research* has grown stronger (McBride, 2007), it is still in a state of emergence (Vazquez & Bruce, 2002). The first *academic* Cambridge Design Management

conference in 2011 is an example of the expanding academic attention the field is receiving in these years, bearing in mind that previous conferences were primarily for practitioners.

A first step in strengthening a research field is to look back on the literature of the field. Our contribution consists of an analysis of the development of design management over an 11-year period as presented by articles in the primary journals of the discipline. In this contribution we use the lens of evolutionary theory (Aldrich & Ruef, 2006) and combine this perspective with semantic mapping (Smith & Humphreys, 2006) in order to explore the evolving state of design management as a field of research in the decade after the turn of the 21st century.

The evolutionary theory

Evolutionary processes in society as well as in research may be seen as the result of four generic processes labelled variation, selection, retention and diffusion (Campbell, 1969). In addition the evolutionary process is fuelled by struggles over scarce resources and reputation. As Aldrich (2006, p. 21) notes:

"Evolutionary theory is not a set of deductively linked law-like statements".

It may rather be seen as a system of heuristic propositions explaining the dynamics guiding the evolutionary forces of the system. In the following, we briefly describe the four generic processes of evolutionary theory and why it is an applicable lens for analysing the development of the design management research field.

From the perspective of evolutionary theory, variation may take the shape of intended variation when actors intentionally try to generate alternative solutions to problems or questions at hand. Variation is characterized as blind if it is not a response to contextual pressures or selection mechanisms, but rather occurs as a result of mistakes, serendipity or curiosity.

Selection processes characterise the elimination of elements of variation. It may be caused by external factors such as new sources of knowledge, or institutional change in for example norms, rules and competitive pressure. It may also be caused by internal factors such as strategic changes in research agendas, managerial pressure to engage in specific types of research, internal competition, and out-dated selection criteria.

Retention occurs when selected variations are supported, preserved and institutionalized and reproduced. Inside specific organisations or domains retention may be fuelled by path dependency, specialization, role standardization, behavioural imitation etc. Retention between organisations and domains may for example be driven by shared assumptions and paradigms (Campbell, 1969).

Diffusion within an organization or a domain is the result of knowledge sharing, imitation and collaboration. Externally dissemination is facilitated by publications, conferences, and collaboration and in general governed by the gravitation of attractiveness, i.e. the ability of some specific research institutions to attract citations, events and research publicity.

The evolutionary theory and design management research

In this paper we propose that nascent fields of research, such as design management, often show a high degree of *variation* in their thematic contributions. Variation can be intended as it emerges for example through dedicated research programmes or through mutual learning circles between practice and open exchange amongst researchers from related fields of research. Variation is probably caused by several factors, among which two are worth mentioning. One is the search for common ground, another is the conceptual blending process based on those fields of research contributing to the emerging field – in this case the blending of concepts, terms and theoretical constructs advanced in management, design, marketing, strategy and organisational theory. Following simple evolutionary logic this leads in turn to *selection* processes in which some contributions and concepts along the way stand out (Aldrich & Ruef, 2006). These contributions, often cited, tend to generate a number of subsequent research questions and incorporate a variety of research themes. Thus it is possible to configure the research field, and eventually the way is paved for a stable core of research themes and concepts in the *retention* phase.

This contribution poses the simple question: *To what extend has the field of design management research been dominated by variation, selection and retention processes? Has it reached a stage of selection or retention? And, if so, what are the core concepts of design management?*

The survey methods we use put limitations on our study, so we do not expect to be able to give a straightforward answer to this question on the basis of the explorative means available and the space left here, which does not allow for an in-depth analysis. But we do expect to provide some basic indications of what stage and in what direction the roughly outlined evolutionary process is headed. In the following, we illustrate which part of design management research we are focusing on in this review in order to answer the questions above.

The aim of this contribution

One of the factors driving the evolutionary process of design management research comes from the dialectics of theoretical and practical knowledge generation. Recently design management researchers have found a similar interplay between design education and design practice. See for example the *DMI Education Conference* in Paris in 2008 (Cooper, Junginger & Lockwood, 2009; Lockwood, 2010).

Figure 1. Key Cross Fertilization in Design Management Research

Two streams of knowledge building (academic and professional practical knowledge) should be highlighted as indicated in figure 1 above. We propose that in the evolution of a cross disciplinary field of research like design management the sources of mutual inspiration marked in the red circle are of special importance. On one hand concepts and theories from the field of management may guide practical knowledge development in the field of design. On the other hand practice-based insights and conceptual knowledge from design may inspire theoretical as well as practical approaches renewing the perspective in the field of management. Although the trajectory of management research is longer than that of design, the two fields are supposedly aligned in the sense that they share the phenomenon of inspiration exchange between practical, often consultancy based, knowledge and research. Although this paper departs from the academic knowledge of design and management by focusing on the academic design management perspective, we do acknowledge the interactive sources of inspiration and new knowledge, as indicated in the figure above. That said, we also recognize a basic difference. Knowledge generation in the field of design is much more embedded in practice-based conceptual knowledge (Hatchuel & Weil, 1999) than traditions within the field of management.

During this exploration we will keep in mind that the field of design management originates from two separate fields of research – design and management – each with its own logic,

perspective and agenda (Jerrard & Hands, 2008). Design management theory has to overcome the challenge that designers and managers approach the subject from two very diverse ontological viewpoints. Design researchers tend to work within the radical humanist paradigm, whereas management researchers more often work within a functionalist paradigm (Håkansson, Ford, Gadde, Snehota, & Waluszewski, 2009). From a *managerial perspective* the question would be: "What do we have to manage?" This is reflected in an early definition of design management (Farr, 1965):

"Design management is the function of defining a design problem, finding the most suitable designer, and making it possible for him to solve it on time and within a budget. This is a consciously managed exercise which can apply to all the areas where designers work." (Farr, 1965, p. 38).

From the perspective of the *design research community*, the question could be: "What do specific design solutions demand from management in terms of strategic attention, managerial priority, organisational change, investment or relationship management?"

Design management may, therefore, be seen as the convergence of management-based and design-based knowledge and practises in ways that challenge traditional strategic perspectives and deep-rooted paradigms in both fields.

Thus the aim is to provide a provisional model of theory building based on a review which synthesises these two fields in order to uncover potential synergies and create new research opportunities.

Hence the specific key question to be addressed in this paper is:

Which concepts have evolved in the primary journals on design management in the period after the turn of the 21st century? And how do they inform the evolutionary dynamics in the field of design management?

In order to answer the question above, we first describe the research method of the review including a short introduction to our chosen use of the semantic software tool Leximancer. Secondly, the interpretations of our review are presented and discussed, finally resulting in a discussion of future themes within the design management research field.

RESEARCH METHOD

Since this literature survey focuses on the primary journals of design management the *first* step in the process to select the papers relevant to this analysis is to identify these primary journals. Retrieving journals by a simple journal publication search in the bibliographic databases Ingentaconnect, Wiley and EBSCO, using the search words "Design Management" resulted in three publications: "Design Management Journal" and "Design Management Review". An additional search on "design management" and "journal" resulted in another journal "Architectural Engineering and Design Management Journal". Although contributions from this journal may add value to the overall review of conceptual

developments in the field of design management, we felt it was generally beyond the scope of this paper; hence this journal was omitted in the review.

The remaining two journals "Design Management Journal" and "Design Management Review" registered 41 and 461 papers respectively, within the period 2000-2010. Hence our study will review 502 papers. "The Design Management Journal" is the more academic of the two journals, but the publication has been irregular leaving out the years 2001, 2003, 2004, 2005 and 2006; nonetheless we still consider that journal as well as "Design Management Review" to be the premier journals in the field of design management[1].

These limitations in the selected journals also pose limits to the conclusions we can draw. However, with due respect to those limitations, we also expect that events, terms, concepts and theoretical perspectives developed in contributions outside these journals, will be mirrored in the journals selected for our survey.

In the review of the 502 journal papers we specifically aim to answer a few key questions such as:

- Can we trace changes in the conceptual focus over the years?
- What stages of the evolutionary process are dominating in the period?
- What are the major issues at stake, and have they changed over the years?
- How has the research agenda moved over the years of investigation?
- Can changes be observed in the research themes generated?

Based on the survey of the 502 papers some of the key concepts presented in the design management literature over the years will be specified. In order to find opportunities for future research we point out what concepts are missing in our review and compare it with the next step in the evolutionary process.

The Application of Leximancer

It is a complex task to attain a comprehensive overview of 502 papers, keeping track of emergent concepts, arguments, themes and relationships between the concepts unfolding in the period. Parallel to our review of the papers we did a semantic analysis of the papers by mapping the development in the themes and concepts used in the papers of the two journals within the period, using the software program Leximancer. This programme not only

[1] In order to validate that we had identified the premier journals, we performed another search using the proximity indicator WITH meaning "Design WITH Management" in the bibliographic databases Ingentaconnect, Wiley and EBSCO in order to locate other relevant papers supplementing the review. Because the term "Design Management" is too non-specific our search became far too broad, resulting in an overwhelming number of publications (over 10,000 papers). We then searched for the most prominent journals having the intersection between design and management in mind. The journals identified were; "The Design Journal", "Design Issues", "Design Studies", "Journal of Marketing Management", "Journal of Product Innovation Management" and "Creativity and Innovation Management". These journals are not dedicated to the field of design management, but special issues focusing on design management make them relevant as an additional resource; they will, however, not be the primary sources for the review.

searches for frequencies of themes and concepts in the text, but can also be used to analyse the co-occurrence of themes and concepts (Smith & Humphreys, 2006). A *concept* is a collection of words (called terms) that occur together throughout a text. Thus, terms are evaluated by analysing how frequently they appear compared to other sentences. A concept is created if the necessary accumulated evidence is found using empirically validated mathematical algorithms (Leximaner, 2010), but they are also used to find clusters of concepts called *themes.* The end-result of an analysis in Leximancer is a concept map. Further descriptions of how to interpret these maps will be presented when needed in the article.

WHY ANOTHER DESIGN MANAGEMENT REVIEW?

Our literature review of the field of design management is not the first one. In 2007 Kim and Chung published a comprehensive literature review of 765 papers which had all been published in "Design Management Journal" and "Design Management Review" for the period 1989 through 2006. The aim of their study was to describe the priorities of the papers, to identify authorship patterns and to suggest future opportunities for study. In doing so, they subdivided the time frame into two periods (1989-1997 and 1998-2006) and primarily made an overall evaluation of the article topics within the period mentioned. The study identified a major change in research themes, i.e. a change from applying design as an "add on" to products to a strategic perspective on design (Kim & Chung, 2007).

Despite these significant findings concerning the overall main themes in the period from 1989 to 2006, we have found no reviews of the design management literature based on a detailed mapping of the changes, if any, in the concepts for each year. However, Borja De Mozota & Kim in 2009 propose transitions in the research field by illustrating the history of design management and its transformation from being a part of the project management agenda in the 1960s to being included in the creative organization in today's businesses (Borja De Mozota & Kim, 2009).

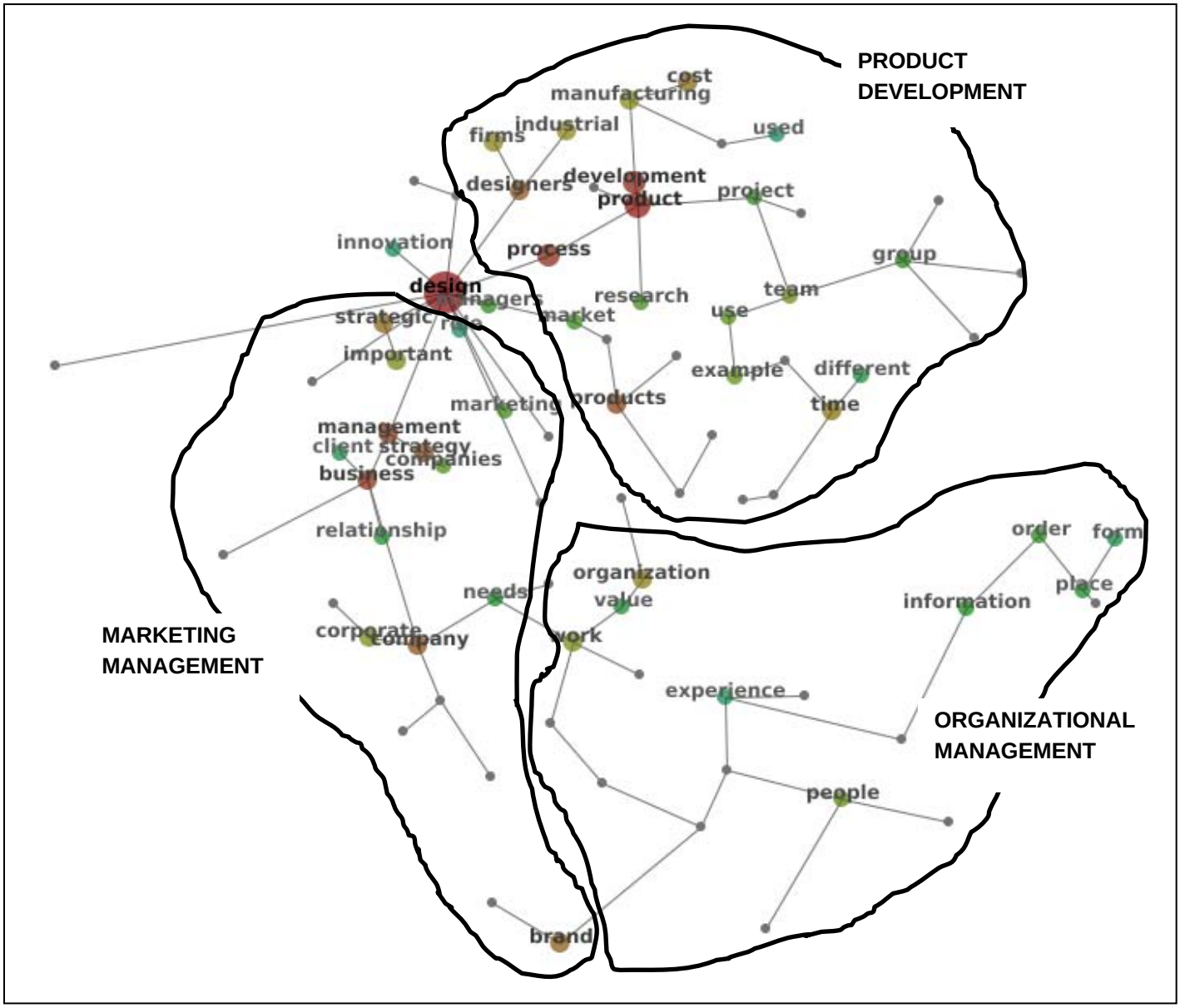
Behind this overall transformation there are a number of questions which may help identify the forces which have contributed to the development of the research agenda.

One fundamental question is whether a transition, i.e. a gradual evolutionary development, has indeed taken place, or whether it is more of a leap, a major shift – from one generation to the next. Thus, our focus is not only to describe the main concepts used each year in the study period as a whole, but to describe the relationships between these concepts and how they generate themes focusing on development over the period using the evolutionary and the semantic analytical perspectives.

THE EVOLUTION OF DESIGN MANAGEMENT USING SEMANTIC ANALYSIS

We begin our review by presenting a concept map from Leximancer showing the dominating concepts in the articles from "Design Management Review" (DMR) and the Design Management Journals (DMJ) in the year 2000, illustrated in figure 2.

Figure 2 Leximancer concept map for DMR and DMJ, 2000



In 2000 the main focus of design management literature is on the design *process*s and in particular on the *product* which is closely related to *development*, as shown in figure 2 by the size and the colour of the dots (red and orange dots represent the most relevant concepts, whereas blue and green represent the least relevant concepts). *Process*, *product* and *development* are the three most frequent concepts after *design* visualised by the size of the

dots on the map. The importance attached to administrative management (operational efficiency) is underscored by the significance of *manufacturing costs* and the ability to align design with dominating management concepts at that time. For example design management can contribute information regarding product costs related to new product development (Hertenstein & Platt, 2000) or development of new products based on the lean perspective (Bohemia, 2000), which was a buzz word in relation to product development at the time. *Industrial design* is also closely interrelated to *product development* (Bohemia, 2000; Veryzer, 2000) and indicates the strong focus on industrial design. Irrespective of the emphasis on the upcoming service society in management research (Edvardsson, Gustafsson, & Roos, 2005) the figure above shows which aspects of design management, as defined at the time, prevailed in the year 2000.

The map also reveals that *strategy, companies* and *business* are often used as synonymous terms for management, an indication that the terminologies within the design management field are not yet clearly defined, reflecting the rich terminology used in the domain of management research at that time. This points to a major dilemma within the emerging research field, namely whether to adapt to concepts embedded in established fields, or develop concepts that are unique for the design management field. As an example of the latter, the concept *strategic design* is evolving as a term specific to the domain of design management, indicating the importance of design in long-range strategy and planning (Joziasse, 2000). The concept *branding* is the fifth most frequent concept highlighting product design and brand identity (Veryzer, 2000).

As figure 2 illustrates, a large number of concepts – such as *product development, lean manufacturing, branding, strategic design, communication* – are in frequent use in 2000. The concepts close to the concepts *product* and *development* can be grouped in a cluster of concepts, called a theme. We call the theme *product development,* because the concepts within the theme are related to the concepts *product* or *development*. Thus, we classified *product development* as a theme in the year 2000, but we also identified two other themes *marketing management* and *organisational management*.

Our literature review in 2000 is thus, according to Aldrich (2006), dominated by a strong variation process, since many different concepts claim to contribute to changing and expanding the mutual understanding of the field of design management.

Based on the overview from the year 2000, our task is now to view which concepts are selected and expanded upon and which are eliminated in the evolutionary selection process over the years of the study period.

The selection process in the design management field

We begin our analysis of *the entire period* by making a literature survey of the "Design Management Journal", identifying the three most frequent concepts in relation to management and design in the six issues published from 2000-2010 (note the irregular publication). We want to gain a rough idea of the selection processes taking place within the

journal, which supposedly reflects selection processes in the extended design management research community[2].

Table 1 Frequencies of the concepts in the Design Management Journal, in published issues in 2000-2010.

Concepts/Year	2000		2002		2007		2008		2009		2010	
Design	100%		100%		100%		100%		100%		100%	
The three most dominant concepts after design	Product Development Cost	57% 49% 28%	Product Development Processes	74% 40% 50%	Management Development Branding	37% 17% 16%	Products Team Companies	63% 28% 24%	Knowledge Work Companies	24% 16% 16%	Product Research Innovation	17% 12% 12%
Management	13%		34%		37%		19%		16%		12%	

It is hardly a surprise that the concept *design* is present in all papers. It is more surprising that the concept *management* is so relatively weakly represented over the years. It might lead one to believe that the design and management fields were moving away from each other in the years from 2008 to 2010. However, it must be stressed that design and management are actually being used more as one term ("design management"). In addition *management* is also being substituted by other business terminologies such as *branding, marketing, business* and *production.*

However, overall there seems to be no doubt that the figures can be explained by the fact that the research agenda of design management in the whole period has its stronghold in the design research community rather than in the management research community.

In 2002 the term *product* is still the most frequently used. However in 2007, *product* is no longer the most frequent word after *design*. Instead *design* and *management* are frequently written in conjunction in the papers, indicating that design management is not just seen as a merger of design and management but as a field of its own. It also indicates that the focus in the organisations has changed. For example, we now find papers about the relationship between design strategy and design management (June, 2007).

One pattern is puzzling, though. While the 'other dominating words' tend to have two or three terms with a high frequency score in the period 2000-2002, the level drops remarkably in the following years. Although several interpretations are possible, we suggest the pattern may be explained by a major shift in the analytical level embedded in the research themes, away from operational themes to emerging conceptual and strategic management themes.

In order to provide some insights into the changes causing this puzzling pattern and in order to gain a more detailed picture of changes in conceptual discussions and agendas, we looked more closely at the development of concepts in our analysis over the decade for both of the

[2] The years 2001 and 2003-2006 are excluded in the table because Design Management Journal was not published in those years.

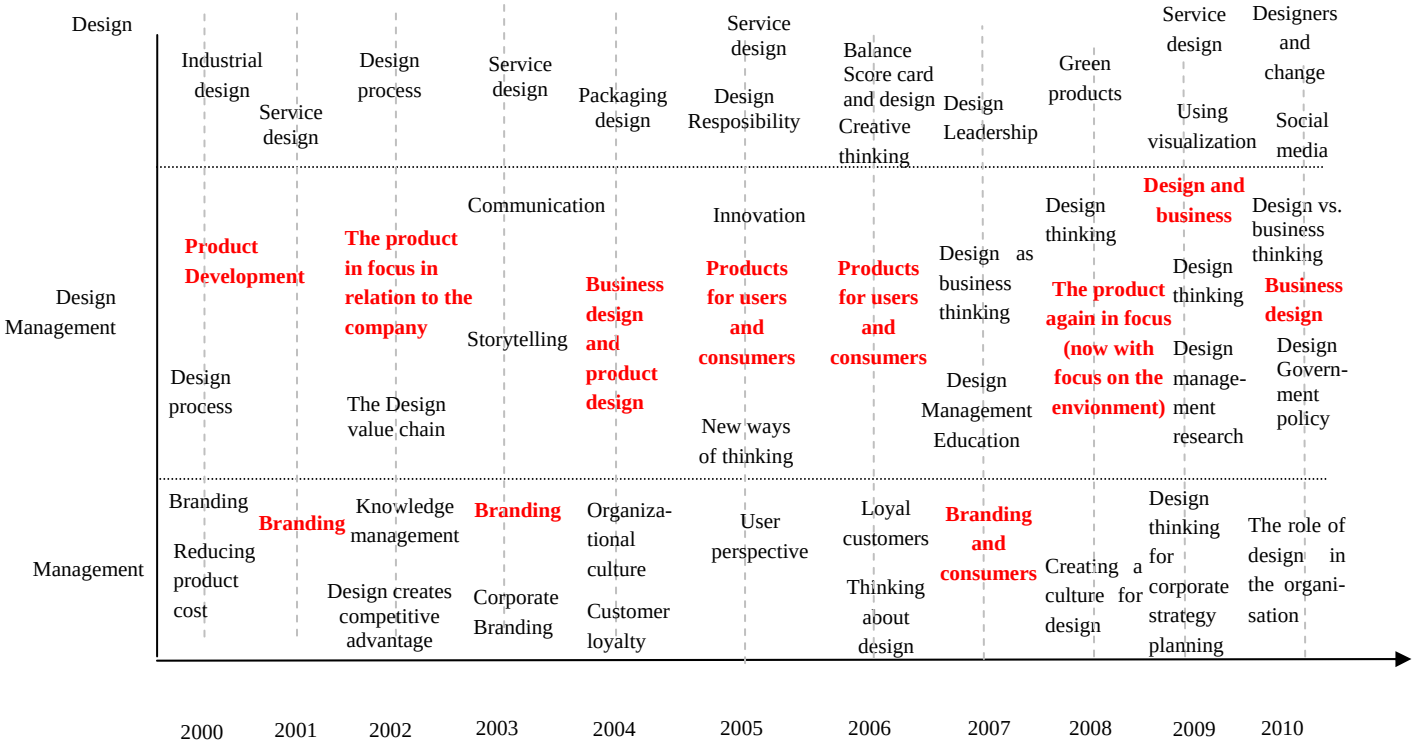
journals. Thus, we will be able to give indications of the stage of evolutionary process dominating the design management research field.

Discussion: Based on a detailed concept model

Based on a time line 2000-2011, the evolving concepts emerging from the literature review are outlined in figure 3 below. After reviewing and validating the concepts for each of the years in the period it is possible to sum up the findings in one model showing the development over the decade.

In order to provide a simplified overview, the model consists of the three overarching themes – design, design management and management. Concepts found in the literature survey and review are allocated to each of these main themes. The most frequent concepts emerging each year are highlighted in red and supplemented with other frequent, emerging concepts. The concepts in black are selected not only by the frequency with which they appear in the concept map, but also by our evaluation of the concepts that contribute to answering the key questions (as mentioned in the 'research method' paragraph): "Which concepts have evolved in the primary journals on design management in the period after the turn of the 21st century? And how do they inform the evolutionary dynamics in the field of design management?" In the following this analysis is divided into two sections; first, a general overall analysis of the period describing the development and challenges in the period, and second, the evolutionary stage of the design management field. We need to stress that only the main results of the review are presented, although a more detailed reading of figure 3 is possible, which would, however, be too wide-ranging for this conference paper.

Figure 3 Map of the literature review of design management, 2000-2011.



Source: Authors

Note: The concepts in red are the most frequent in the literature survey in year in question.

Conceptual development and the evolution of design management research

Based on the conceptual mapping above, we identify a major change in the papers concerning **design management research and the focus on value creation** within the period, and the question arises: How does design management research generate value for its stakeholders, and how does it legitimise the existence of the research field? In the following we present four changes in the conceptual development for the period related to value creation.

Value creation changes from specific design disciplines to a generic focus on design: While specific design domains, especially industrial design, were in focus in the first part of the period, the agenda – and the concepts underlying it – has moved on to a more generic and strategic perspective on design management. But product design is still seen as a dominant gateway to design management in 2010.

Value creation moves from being a borrowed theory to being an independent, generating theory: In 2002 the value chain concept is used in relation to design management in order to clarify the competitive advantages of design (Borja De Mozota, 2002). In 2006 Borja De Mozota published the four powers of design with focus on the balance scorecard model (Borja De Mozota, 2006), and most recently "Porters Five Forces" theory is applied to develop a design management model (Sun, Williams, & Evans, 2011). These are examples of how the design management research field has been trying to generate value for its stakeholders by applying design to existing and established theory. However, in 2008 the

term *design thinking* (Clark & Smith, 2008) becomes a central concept within design management research illustrating that the design management research tries to establish some generic roots of its own.

Value creation for business: A major shift can be noticed from 2007 onwards, since the concept *business* related to *design* appears more frequently and authors have started to write about *business design* (Moore, 2004) focusing on design as a business resource (Walton, 2004), i.e. for example for organisational change. The *business* concept develops to be the most dominant concept (after *design)* in 2010, illustrating that design is seen to create value for the business model as a whole and not only for part of the business.

However, coming from the field of management, we cannot help noting that the research contribution to the nexus of design and strategy tends to refer to a few, often well-known contributors in the field of – in this case strategic management research – while the in-depth research on different strategic schools of thought are seldom reflected on or included. It illustrates that the management research as presented in the selected journals tends to only scratch the surface of the research themes in management, such as organisational change, strategy, marketing and HRM. We have also noted that key themes in current research on management, such as Open Innovation; Innovation Management; Entrepreneurship; Market Creation theory and organisational inertia, are seldom mentioned and do not stand out as themes influencing the agenda of design management.

Normally scholars from outside management and management research tend to ascertain a basic logic on competition embedded within the field. These perspectives on business and management are what Håkansson et al. (2009) would call the "jungle metaphor" emphasising the strong competition between the companies (individuals) living in the habitat. This perspective is, however, only one point of view. Håkansson et al. (2009) propose another metaphor; "the rainforest metaphor" where the *relationships*, exchange and mutual adaptation processes among the companies populating the habitat (the market) is at the core (Håkansson et al., 2009). However, from the literature survey and review it seems that the majority of design management researchers are still leaning towards the "jungle metaphor" dominated by articles on concepts such as branding (Seifer, 2007) and transformational marketing and only a few articles focus on the "rain forest metaphor".

Value creation inside vs. outside the organisational borders: Although we see the issues of business design and generic design gaining importance, we also identify a shift in the perspective in articles concerning application of different economic levels in society. At the end of the period environmental issues and national design policy (macro level) considerations are included, as well as issues concerning the inclusion of 'users' in contrast to 'cost' focus which was dominant at the beginning of the period (micro level). This reflects an important change in the overall agenda – away from a pure cost-based competition perspective towards a strong focus on innovation-based competition. In this respect selection processes have been actively forming the research agenda. Despite the significant and growing importance placed on user studies and the inclusion of users, we find that a major

opportunity has opened up for research themes exploring questions at the intersection of design management research and consumer culture theory.

In our perspective, the three changes in the conceptual development concerning value creation of the design management research field are caused by a strong selection process, which tends to alter the fundamental agenda and perspective dominating design management research. It is a leap from the 1st generation of design management research in which the paradigm embedded in management research was seen as a major contributor to enriching the design research, to a 2nd generation in which paradigmatic perspectives born in design research are seen to inspire and develop the arena of management practice and research. Thus, the design management research field is still in the selection phase of the evolutionary process.

CONCLUSION AND PERSPECTIVES

For the period 2000-2010 we created a model illustrating the development in concepts in the primary journals for the design management research field. We identified four changes in the development of the design management research field: 1. Value creation changes from specific design disciplines to a generic focus on design, 2. Value creation moves from being a borrowed theory to being an independent, generating theory, 3. Value creation for business, 4. Value creation inside vs. outside the organisational borders. Thus, we find indications that the design management research field has come to a stage dominated by selection processes, but it is also showing the first signs of retention. However, design management is still an emerging field of research, characterised by fluid concepts, a search for coherence and dominated by perspectives taken from the world of design research. In-depth knowledge exchange with established management fora is still at a nascent stage, but progress is visible, as exemplified by the emerging activities in the Academy of Management.

In perspective, the future evolutionary dynamics of design management research depend on basically two fundamental issues, namely the relevance of practice-driven knowledge generation and the capacity of the research community to generate research questions which challenge and stimulate research-driven knowledge generation in conjunction with research communities, including design and management research.

Our review suggests several (retentioned) paths to take and some to be created. Let us conclude this paper by a couple of, hopefully, enticing suggestions. We find that future research might benefit from a stronger focus and new views of the concepts of business and user. Furthermore, we find that research may be leveraged by a stronger inter-organisational perspective on design management processes, combined with questions related to inter-organisational management perspectives and processes of co-creation.

Finally, the review in this paper leaves out one important dimension: the practical results of design management. The core of the design management field will no doubt benefit from

intensified analyses of companies and organisations that have implemented design in order to understand how they bridge the diverse logics of design and management.

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The Strategic Role of Empathic Design Methods in Developing New Tools for Design-Driven Innovation on Chinese Product Design

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Keywords: Empathic Design, Chinese Product Design, Education

Abstract

China has a booming economy but an inadequate design infrastructure to serve it, especially in product design education. Previous practices and theory in Chinese product design are no longer adequate to serve the new circumstances of international economic development. Western design experience and Empathic Design Methodology may help China anticipate the new issues of new product development. The aim of the paper is to discuss the importance of Empathic Design in developing effective methodology for Chinese product design based on the pilot study that explores the growth of Chinese product design and the need of Empathic Design from both industry and education.

Introduction

China is a huge manufactory, most of products in the world are “Made in China” which can be considered the logo of Factory of the World. “Made in China” just indicates Chinese advanced manufacturing, but could not conceal the lack of original design ability. How to develop the Product Design based on Chinese his own culture and characteristics? In Chinese competitive environment, companies in both the manufacturing and service sectors need to constantly develop new products. However, many new product fail because they neither

excite customers nor adequately address their needs. Traditional product design education is ineffective at identifying radical customer requirements. Western experience and Methodology may help China anticipate the problems of the product design education. However, what are its own solutions?

The research concentrates on the impact of Empathic Design Methodology for innovation on Chinese Product Design Education. It is focusing on emotional consumer research as a strategic tool to enhance the Chinese Product Design Methodologies. The research will demonstrate how Empathic Design as a user-centred design approach impacts on Chinese Product Design Education and fits into Chinese Product Design context. It will make an original contribution to Chinese Product Design Industry and Education rather than an imitation of the West.

The findings of the study led to the development of a series of new tools and methods, which target the capture and decoding of Chinese consumer aspirations within the context of their lifestyle issues. They concentrate on (a) identifying and understanding user attitudes, behaviours and aspirations, and (b) decoding what characteristics are most significant to their actual or desired lifestyle. The benefits of these new methods are that they enable design graduates and organisations to understand the consumer's motivations as opposed to purely their functional needs.

Research Background

Industrial Design was introduced by the Industrial Revolution in the 18th century. If we consider the establishment of "Bauhaus" design school in Germany 1919 as the sign of the beginning of modern design education, then we can say that design education developed approximately 100 years age in Europe. The fact is the education developed from impulse of industry, and also the industrial design education linked with industry closely in a certain extent. The modern product design education began after 1980s in China. Professor Liu Guanzhong was the initiator of industrial design. From 1981 to 1984, he as a visiting scholars Studied in Germany Career Design Institute of the Art. Then he returned back to China to establish the first subject of Industrial Design in the Central Academy of Art and Crafts in 1985. In the mean time, some other industrial design pioneers and educators went to Germany, Japan to study advanced product design thinking and theory, in order to contribute and develop Chinese product design in different regions in China.

In China, product design education originated and developed from art crafts colleges. Product design education actually meant the education of industrial arts (the manual and technical skills), which had greater difference with the modern design education that we talk about nowadays. Chinese product design education that was introduced from foreign design education certainly cannot catch up with the development of today Chinese industry. There is a gap between education and industry. Moreover, as fast changing environment, technology, industrial and commercial structure and strategy, Chinese consumers desire more from products, not only better function but also emotional connections. However inadequate design infrastructures to serve it, Consumers are thus unable to make informed decisions about their patterns of consumption. From a Chinese product design educator' perspective, a number of questions are emerging: what are the strength and weakness of Chinese product design education with more students leaving to study abroad? How to innovate and improve the Chinese product design, in education? What is the challenge along with more new thinking that come from abroad?

Research Objectives

By reflection on the research question: What are the factors impacting on the adoption and use of Empathic Design methods in Chinese product design education? The research objectives were then identified and prioritised as follow:

1. Review the theory and practice of User-centred design and Empathic design.
2. Review and model the development of Chinese industry, the development of Chinese product design industry, and the development of Chinese product design education.
3. Develop research plan and methodology.
4. Develop questionnaire and undertake full survey to identify the NEEDS (understanding & use) of Empathic Design from Chinese product design industry and Chinese product design students.
5. Coding and clustering the needs to identify the level, priority and uncertainty of needs for adopting Empathic design in Chinese product design education.
6. Undertake 3-5 case studies to learn both UK students and Chinese industrial design students through given design practices, to seek the opportunities and direction to improve customer-understanding tools.
7. Undertake interviews (students, academics and designers,) to understand the impact by using Empathic design practices.
8. Identify new approach to fulfilling identified gaps to current practices.

Research Methodology

The comprehensive literature provides an overview of significant and relevant design literature. The review includes three categories: current Chinese product design industry and education, western critical on Chinese product design, and current Empathic Design theory and practices.

With joining the Multi-disciplinary Design Network fact-finding mission that was conducted by UK Design Council to China in April 2010, the fact-finding visited universities, leading industrial companies and design studios in China (Beijing).

Case studies lend themselves to both generating and testing hypotheses (Flyvbjerg, 2006). By using the 'learning by teaching' method, a case study in BA Product Design (Level 3) at Zhengzhou University of Light industry, and a one-day design workshop at Beijing Beihang University China. It also includes interviews, observations, questionnaires, survey and documentary analysis for data collection. The purpose of the case studies is to characterise the impact of the adoption of the Empathic Design tools and methods on Chinese product design education.

Data analysis can be divided into two phases: preliminary data analysis and hypothesis testing. In order to acquire knowledge of the characteristics and properties of the collected data, some preliminary analyses are contributed usually before performing measurement quality assessment or tests of hypotheses (Karlsson, 2008). Main multivariate analysis methods were used during this stage of research: factor analysis and cluster analysis.

The Importance of Empathic Design

Empathic Design emerged as a set of techniques in 1997 (Leonard & Rayport). It is about observation, Empathic design as a set of design tools is able to identify customers tacit needs that customers don't even know they desire, or they have difficulty to articulate due to the lack of exposure to new technologies or being locked in the mindset of working with existing products and services, in order to help company to "Listen to the voice of the consumer", and also can develop ways to meets those consumers' needs (Burns etc. 1999). Empathic Design maintains that products are not merely tools but 'living objects' that people can relate to, products that bring not only functional benefits but also emotional ones (Jordan, 1999). Norman (2004) represents the concept of Emotional Design, which is not only put the physical aspects of human in centre of design, but also considers the mental demand of people as the most significant core of design.

Leonard & Rayport (1997) pointed out that Empathic Design relies on observation of consumers as opposed to traditional market research that relies more on what consumer 'say' about a product. By avoiding user-created inquiry mechanisms, Empathic Design avoids possible biases in surveys and questionnaires, and minimizes the chance that consumers will provide false information. In the empathic design process, researchers observe users in their normal home or work environment in order to see how they use and interact with the products under study. Burns ect, (1999) developed the empathic design methodologies along with the proposed empathic design process, and in their research, the use of Empathic Design techniques in the development of cars has proved an effective means of indentifying both unarticulated customer needs and solutions that have the possibility of delighting customer. Barrett (2002) in his book "Empathic Design Tutor" gave us the design and use of Empathic design tools in the development programme of some real cases. Empathic Design tools include that questionnaires, fun camera, scenario of use, storyboard, scenario mapping that address three key areas: data collection, data mapping and data analysis.

Direct contact with customers and end users has been identified as one of the best sources of information about new product ideas and that experiencing the use environment of a particular product, function or task is a prerequisite for generating high quality information (Yeaple 1992, Herstatt & Von Hippell 1992, Ulrich and Eppinger 1995, Von Hippell 2005). A significant number of studies have identified that a lack of thoroughness in identifying real needs are key factors associated with product failure (Cooper & Kleinschmidt 1987, Craig & Hart 1992).

Cooper and Kleinschmidt (1994) argue that building in the voice of the customer is one of the crucial factors in achieving new product development success. Kelly (2001) of IDEO design group builds upon this by advocating that watching real people is a key factor in their success with clients (Procter & Gamble, Pepsi-Cola, 3M, and Hewlett Packard), where small observations often lead to big insights (Kelly 2006) – hidden innovation opportunities. However many companies often undertake little market research in the early stages of the innovation process (Page and Rosenbaum 1992). This is frequently attributed to companies experiencing uncertainty when attempting to identify user needs (Souder and Moenaert 1992).

Once moving away from purely functional and task based needs, it appears to be further compounded by the fact that psychologists estimate that 80% of all communication is non-verbal (Birdwhistell 1970). Simonson (1993) also suggests that customers' wants are often fuzzy, unstable and susceptible to influence from a variety of seemingly irrelevant factors. Zaltman (2003) expresses that "ninety-five percent of thinking takes place in our unconscious minds …and other cognitive processes we're not aware of or that we can't articulate". It is

therefore not difficult to understand why many conventional consumer research methods are failing to break through to the surreptitious and out of sight aspirations of today's consumers. Travis (2000) makes the case that the need for emotional research is connected to the failure of conventional research to determine what is actually going on in the consumer's mind. Zaltman (2003) argues that conventional consumer research method errors fall into three categories: (1) mistaking descriptive information for insight; (2) confusing customer data with understanding; (3) and focusing on the wrong elements of the customer experience.

Even with these apparent problems of dealing with fuzzy, hidden and difficult to communicate issues many organisations are starting to see the value of interpretive consumer research tools for identifying and decoding latent consumer aspirations. Knight (2008) contextualises this issue by suggesting that emotional and aspirational based issues are becoming more important for brands competing in mature categories, where technical breakthroughs are often harder to achieve, who are finding the most compelling way to connect with consumers is on an emotional basis.

Chinese Product Design Growth and Needs

In past two decades, China has shifted "planned economy" (from 1949 to the early 1980s) to "market economy" (emerged in the 1980s). Since then, the Chinese market has changed rapidly. Consumers have already started to demand better-designed and high-quality commodities. In comparison with other forms of design in China, product design was and is less developed. There are many unresolved problems in the economic reform program, but the inference here, is that the development of design and practice is unbalanced (Wang Shou Zhi, 1989). Professor Liu Guanzhong (2005) said, "Our understanding on product design is still too superficial." Although the fast development of contemporary China's society and the more requirements of design, design have only been considered as a kind of way of clever add-on visual effects, most of people think design is only used to please consumers. The perception here is that peoples' notions about design seems to merely stay on the level of appearance. It is not only to endow an object with an attractive appearance, but also more importantly, to provide useable functional products for people. In short, meaning is derived from experiences and engagement with products, of which aesthetic value is only one factor. If Chinese product design is to develop effectively, it must develop in more than one dimension and move beyond simply acting on aesthetic appeal as a bolt-on activity.

There is a significant economic policy in China's reform and opening-up policy, which indicates that the implementation of China's regional economic development has two main phases: 1, firstly, to accelerate the progress of opening southeast coastal region to outside

world in order to make them be proper developed. 2, in the end of year 2000, the focus of China's regional economic development will move to developing middle and western part economy. After the process of phase one, the coastal cities around southeast of China have benefited from their geographical advantages and open policy, and have developed well. Nowadays, there are lots of leading companies that have emerged in the southeast of China. For example, in electronic industry sector, some medium/ large size companies have realized the importance of industrial design that can add or even create value to their business. Therefore, they invest more in establishing their own industrial design department in order to contribute to their product research and development, such as 'Midea' one of the largest manufacturers of the world in the home appliance industry, they are concerned with the investment in product design development and employ more capable designers which has good design skills and creative thinking, aims to build an integrated design department to contribute to its business. 'Midea' said that because of their talent creative designers, the design becomes crucial for their innovation. Moreover, 'Lenovo' and 'Haire' established their own product design department one after the other. Those pioneer and leading companies not merely grow their business by just making new products, but also influence other small medium sized companies to pay attention on developing their product design capabilities for growing their business. In 2009, the 'Changxiang' series of electric water heater designed by 'Haire' won Germany's IF Industrial Design Award. It was the only brand that was granted this award in domestic electric water heater industry, which indicated Haier's strength in designing up-to-date home appliances with high science and technology. It imply the Chinese design, ready for takeoff

Although the huge potential domestic design market is growing fast, it's still in the primary market stage. Nowadays, a considerable amount of foreign design institutions have seen the fast growing Chinese market as a growing opportunity. Since 2005, Chinese design festival has began to co-operate with many foreign design companies and institutions (e.g. UK Design Council). This remarkable opportunity not only provides a tunnel which Chinese designers are able to communicate with outside designers all over the world, but also opens up a new prospect of a frequent contact between Chinese product design and foreign design.

In 2001 ICSID (International Council of Societies of Industrial Design) design education conference, Cai Jun proposes three phases of Chinese industrial design education (figure 1-1): The Creation and Enlightenment stage (from early of 1980s to end of 1980s), Universal stage (from end of 1980s to middle of 1990s), and Growth stage (from early of 1990s to early 2000s) . It indicates the three stages in the development of the Chinese industrial design education in last 30 years, it demonstrates the cultural background, aims and issues for each stage. This can be considered as the basis that provides the significant context and clear direction for innovating design education.

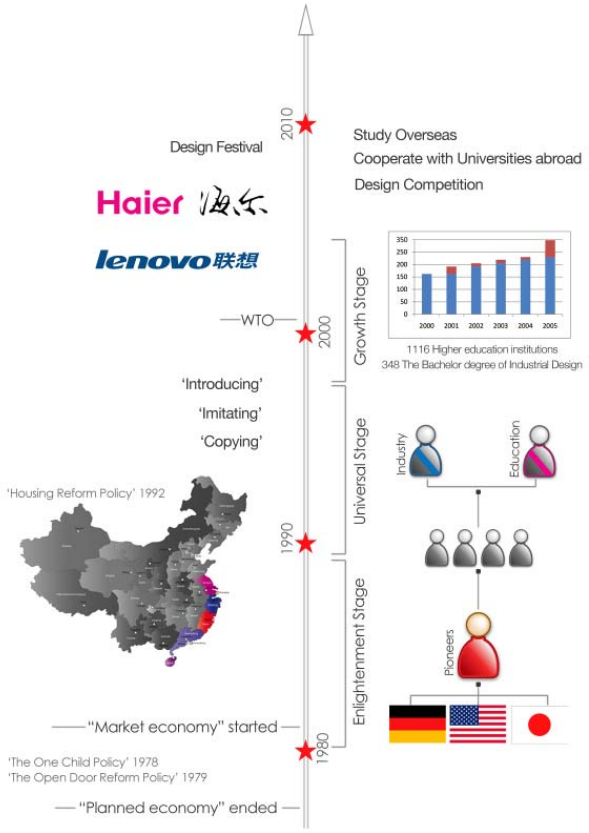

Figure 1: The development of Chinese Industrial design education

Product design education has evolved rapidly in China. On one hand, the amount of universities and colleges that have the Bachelor degree of product design has grown. According to the statistic in 2005, 348 universities and colleges have the Bachelor degree of product design in total of 1166 higher education institutions. Moreover, 179,800 students were going broad for study during 2008, in which there were over 60,000 students study in UK. As a result, there are more than 50,000 students who finish their study go back to China every year, moreover, UK universities have extended the corporation with many Chinese universities. Developing the Chinese product design from its education based on Chinese own culture and characteristics are much more important.

Professor Liu Guanzhong pointed out that universities have established design courses, over 30% of them have product design course. However, in terms of the development of design skills, almost 95% of the universities only concentrate on 'Form' design. Most of students are educated in 'appearance' design through learning drawing techniques. The Chinese product design education has developed for almost 30 years, only few people were concerned about innovation in design education. Chinese universities can be considered more as a training ground for product designers, rather than an education system from product design and product designers' perspective. Today, the Chinese design graduates have strong basic

drawing skills, but less ability of identifying, analysing and solving problems, and lack practical experience as well.

Richard Buchanan (2004) attended the conference, "Equipping for the future: An International Conference on Design Education in China", which is the first national conference on Chinese design education. He proposed the focusing question is whether and how China can be transformed from the market of products designed elsewhere in the world to an original source of design. He also discussed what changes must take place in Chinese design education if design itself is to play a significant role in preparing Chinese industry for competition in international market. He concluded with three deeper and important questions about Chinese design education: (1)"What are the philosophical and theoretical roots of Chinese design and design education that will continue to influence the development of design in China? (2) "Can those roots lead to new forms of practice and education that are suited to the emerging environment of international competition in the market place?" (3) "How will those roots help Chinese design make an original contribution to design thinking that is more than an imitation of the west? "

"Made in China" can indicate Chinese advanced manufacturing, but it could not conceal the lack of original design ability. Western design experience and Empathic Design methodology may help China anticipate the issues of "consumer needs". The question is: Can we apply Empathic Design methodology on Chinese culture to make an original contribution to Chinese product design? Ann (2003) pointed out that in Ethnographic Research methods originated from the United States are based on a Western model of thought, which can have problems leading to cross-cultural conflicts and misinterpretation of data when applied to China without considering the fundamental differences in culture. She discusses 4 key issues when Western Ethnographic Research Method in China as follows:

Issues	Culture difference	Implications
Language translation vs. Conceptual translation	Differences in culture concept and domain knowledge	Important of having translators capable of communicating in both language fluently as well as interpreting conceptual, cultural differences and domain knowledge
Recruiting respondents	Relationships as pre-requisites to business in China	Establish network of friends in China with continued relationships to smoothen the recruitment process for more accurate research results
Interviewing methods and observational research	Scientific/rational of the west vs. intuitive/subjective mentality of the Chinese	Treat Chinese respondents as friends during research and best introduced through a middle person with established relationship. Adapt for less intrusive research methods, obtaining insights reading 'in between the line'.
Culture insights	Cultural insights beyond research findings	Provides opportunities for companies and type of social structure

Figure 2: 4 key issues when Western Ethnographic Research Method in China

Pilot Study

A pilot study was developed to attempt to identify the recognition and needs of Empathic design methods from both industry and education. Based on the findings of the preliminary scoping activities by visiting universities, leading industrial companies and design studios in Beijing, it is not difficult to see that:

- China are rapidly developing their design capability, employing the advantage of learning from the 'best of the west' as well as building on their own significant creative and cultural backgrounds. Technology is a huge driver of innovation in China and design is clearly perceived as a key translator of science and technology as well as increasingly seen as being a contributor to social needs.
- Design is understood to be an essential part of innovation and is used extensively by industry. Though understanding consumer needs is recognized as the most important factor in achieving business success, inadequate methods/tools for identifying, analysis and insight development.
- Most designers work in in-house teams, although the consultancy sector is growing with several design firms already bigger than many UK firms. Design research is recognized as a crucial aspect in design process, however, research methods and tools use are inadequate and lack of effectiveness.
- The rich heritage of craft and culture has a strong influence on contemporary design, and emotional consumer needs are also recognized.

In addition, by introducing the Empathic design methods to 95 participants (product design students) in total through a 5 weeks "learning by teaching" case study in BA Product Design (Level 3) at Zhengzhou University of Light industry, and a design workshop at Beijing Beihang University, Students responded on the use and their demand of the methods (see figure 3).

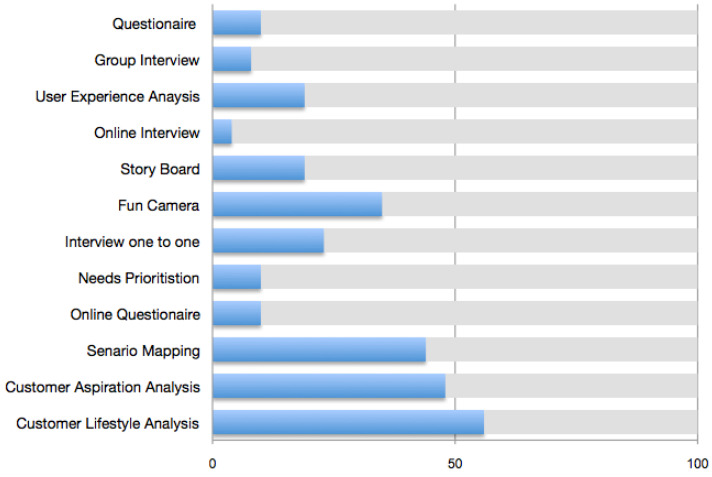

Figure 3: The proportion of usage of Empathic Design Methods/Tools

As a result, the 95 students ranked 17 aspects of what students are concerned about product design study. ‘Lifestyle analysis (79%), Customer need analysis (86%), emotional customer research (74%), Current product analysis (66%), and Sketch & CAD (68%) and design management (57%)were ranked as the most desired elements in design education.

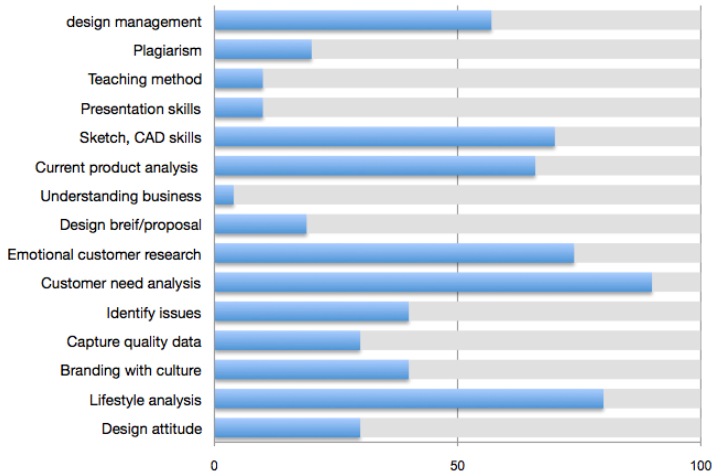

Figure 4: Main factors in product design education

Conclusion

When reviewing and examining the study it appears that though Chinese product design is growing and has been recognized as essential part and strategic tool in achieving business success, it is still in the primary stage and its infrastructure is inadequate. And more importantly, the reason that cause the people’s notion of design is biased is that product design professionals’ knowledge and methodology on ‘understanding consumer needs’ are lack, fragmented and superficial. Product design education is fundamental to deliver qualified design students who are the most creative intellectual of all to link the people's demands to industry. Although the ongoing evidence indicating that building in the voice of the consumer is one of the crucial factors in achieving new business success, many organisations still do not do it properly. This failure to engage is frequently attributed to companies experiencing uncertainty when attempting to identify user needs. The Empathic Design is able to provide the effective methods and tools for designers to generate ideas through observing people’s behavior and user involvement, and help them learn from practice. Both design students and industry companies desire to learn more. The research is still on going. The next step is to undertake a more extensive study comparing how business and designers use and develop Empathic Design methods and the implications this has for educators.

A transferrable Empathic Design methodology will make original contribution knowledge to Chinese product design. Consumer understanding methods/tools, and process will influence

the early stage of design process as creation by product designers. In addition, there are huge potential in Chinese market for many European brands, companies, education etc. the research will also contribute to UK industry and education. Mapping the abundant structure of product design education within Chinese particular context may provide a potential opportunity for development of future UK product design. Also Empathic Design Methodology will gain a perspective from China for further development.

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Understanding Design-Driven Innovation: The Role of Strategic Design 'Postures'

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Keywords: innovation, design-driven innovation, design postures

The purpose of this research is to develop further our understanding of firms' design-oriented innovation strategies. We present the findings of a longitudinal, iterative exploratory study based on a convergent interviewing process. Key industry informants support a sense-making process that has led to three categories of design-driven innovation strategies. We term these 'design postures': ***'Veneer'***; ***'Signature'***; and ***'Soul'***. We consider these postures within the framework of innovation as proposed by Verganti (2003). Each posture has strategic and tactical implications for marketing practice, including: innovation processes; market acceptance and adoption; product category development; and the underlying organizational resources and competencies. We suggest a number of 'propositions' for each posture as ways to consider them in theory and practice, and to suggest future areas of study.

INTRODUCTION

We contend that excellence in design is a key ingredient in both a vibrant society and commercial success. For example, European research suggests that clusters of design-driven firms residing within "free-floating" communities of creative craftspeople and professionals can lead to both transformative innovation and increased wealth, employment and country exports (Utterback et al. 2006). Verganti (2008) terms this "design-driven innovation", which is separate from the two prevailing norms of innovation: "technology-push" or "market-pull".

We also contend that different countries, regions, and industry sectors may have their own set of innovation perspectives and imperatives with respect to how they strive for commercial success internationally. In New Zealand's case, in a recent New Zealand Trade and

Enterprise pamphlet, *New Zealand Performance* (2011), it was argued that: *"Being a long way from the rest of the world makes us see things a little differently – and we know only the best products and services will open international doors."*

For example, the *Wall Street Journal* (2011) offers an on-line wine-promotion operation. In their discussion of New Zealand's offerings they note that: *"In the grand scheme of things, New Zealand only makes a tiny amount of wine - so right from the start, its winemakers decided to concentrate on quality instead. They have enjoyed astonishing success… The combination of a cool climate and meticulous, perfectionist high-tech winemaking has enabled development of a signature style… In all cases, what is distinctive is the combination of typical New-World fruitiness, Old-World lightness of touch and an exhilaratingly breezy, fresh quality that is all their own."*

The impetus for this research emerged from a series of interviews that began with senior executives in the New Zealand apparel industry, in firms held by industry experts to be exemplary competitors. In retrospect, the selected companies possibly fall within Dell'Era and Verganti's (2010) 'Innovative Leaders' category. We were searching for insights into the drivers of successful organic growth. We found that in this particular industry (perhaps not surprisingly) 'design' was seen to be the way forward. However as we proceeded with our sense-making in other industries, including wine, it became apparent that the 'logic' of design, while intuitively apparent to our executives, was not clear in the mainstream academic marketing literature.

LITERATURE REVIEW

The academic business literature is showing a growing interest in the topic (e.g. a special issue of *The Journal of Business Strategy*, 28 (4), 2007 was devoted to 'Design in Business'). However, despite a growing body of research about 'design thinking' (Brown 2008; Junginger 2007, and Verganti 2006; 2008); the role and value of trends in product design (Wood, Moultrie and Eckert, 2008); consumer responses to product form (Crilly et al. 2004), function (Creusen and Schoormans 2005) and signs, such as product materials (Dell'Era and Verganti 2010); and the possible linking of traditional strategy concepts to design thinking (Stevens, Moultrie and Crilly 2008), construct clarity and linkages within the marketing discipline that are not yet fully delineated and agreed.

In recent literature there does appear to be a tendency to view the design role as shifting away from traditional notions of 'design making' and 'design doing' (i.e. an artifact-focused perspective) and towards active leadership, or 'design thinking', involving a process-focused perspective (Perks et al. 2005). Brown (2008 p.86) defines design thinking as *"a methodology that imbues the full spectrum of innovation activities with a human-centered design ethos"*.

Some proponents of design-focused enterprises equate design leadership with a user-centered or user-led approach in product concept generation (Lojacono and Zaccai 2004; Veryzer and de Mozota 2005). As Lojacono and Zaccai (2004, p.76) say: *"In a design-focused enterprise, the front-end activity is design research, a systematic process for understanding the consumer's unexpressed needs and desires, then envisioning and testing new ways to meet them"*.

Verganti (2008, p.438) uses a similar term, "design-driven innovation", to express a perspective that appears to run counter to mainstream marketing theory and practice: *"Design-driven innovation does not start from users' insights… Design-driven innovation is (therefore) pushed by a firm's vision about possible breakthrough meanings and product languages that could emerge in the future"*.

Verganti (2006, p.117) cites Apple's iMac as an example of a design-driven innovation, as it successfully challenged *"the received view of PCs as chiefly office products. By wrapping the iMac in friendly, translucent colors and ovoid forms, Apple declared it to be an appliance for the home. The message contained in the design hastened a transformation in how the public understood the device."*

As led by Steve Jobs, Apple is held by many as the epitome of design-driven innovation. In 2009 FORTUNE (Lashinsk 2009, p.68) selected Jobs as CEO of the decade: *"In the past 10 years alone he has radically and lucratively reordered three markets – music, movies, and mobile telephones – and his impact on his original industry, computing, has only grown… Remaking any one business is a career-defining achievement; four is unheard of."*

A few years after Steve Jobs reclaimed the top role at the near-bankrupt Apple, he discussed his perspectives on design with FORTUNE (Schendler 2000, pp.50-51). In retrospect, he was also signalling Apple's thinking about marketing strategy and its programme of innovation for the next decade and beyond: *"In most people's vocabularies, design means veneer. It's interior decorating. It's the fabric of the curtains and the sofa. But to me, nothing could be further from the meaning of design. Design is the fundamental soul of a man-made creation that ends up expressing itself in successive outer layers of the product or service. The iMac is not just the colour or translucence or the shape of the shell. The essence of the iMac is to be the finest possible consumer computer in which each element plays together…*

"That is what customers pay us for – to sweat all these details so it's easy and pleasant for them to use our computers. We're supposed to be really really good at this. That doesn't mean we don't listen to customers, but it's hard for them to tell you what they want when they've never seen anything remotely like it. Take desktop video editing. I never got one

request from someone who wanted to edit movies on his computer. Yet now that people see it, they say 'Oh my God, that's great!'…

"We're still heavily into the box. We love the box. We have amazing computers today, and amazing hardware in the pipeline. I still spend a lot of my time working on new computers, and it will always be a primal thing for Apple. But the user experience is what we care about most, and we're expanding that experience beyond the box by making better use of the Internet. The user experience now entails four things: the hardware, the operating system, the applications and the Net. We want to do all four uniquely well for our customers."

Apple may be fifth-time successful in transforming another industry. Over Easter week-end, 2010, it introduced the iPad. Typically, its launch elicited extensive international media coverage, and its first-day sales were some 300,000 units. However, many industry observers - and potential customers - were unclear about what the iPad actually was, and what specific market need and use it would serve.

Waters (2010, p.9) said the iPad exemplified Apple's ability to produce *"shiny objects of techno-lust"*; it was *"an extension of the most significant new development in computing since the birth of the personal computer"*; and its power *"lies in the new forms of behavior it makes possible, most of which can't be anticipated"*. Levy (2010, p.76-77) said that *"The iPad is the first embodiment of an entirely new category, one that Jobs hopes will write the obituary for the computing paradigm that Apple itself helped develop... Ten years from now, we will look back at the tablet and see it as an end point, not a beginning. The tablet may turn out to be the final stage of an extraordinary era of textual innovation, powered by 30 years of exponential increases in computation, connection, and portability."*

Apple is considered a unique organization where its design and commercial success is the result of a number of factors, not least the driving (some followers might say 'divine') intensity of Steve Jobs, and that its approach is unlikely to be replicated by other organizations. Nonetheless there are learnings that can be taken from design-driven companies, from Apple to Alessi. For example, when asked by Mendonca and Rao (2008, p.5) what were the roles of incentives in creating a culture where innovation flourishes, Tim Brown, President and CEO of IDEO replied: *"…if you want to be an effective innovation organization, to motivate your people as innovators, you've got to be prepared to measure yourself by the impact you have on the world – not just your sales or your margins, which are important."*

As Jobs said (Lewis, 2005, p.24): *"Apple is a company that takes complex technology and makes it easier and simpler to use… Our goal is to stand at the intersection of technology and the humanities"*. And yet, observed Grossman (2010, p.23): *"Apple never holds focus groups. It doesn't ask people what they want; it tells them what they're going to want next…*

Steve Jobs didn't invent the tablet computer… The iPad isn't wildly feature-rich… But you will care about it, because whoever designed its graceful lines and intuitive interface cared about you."

This argument has a parallel in the marketing literature dealing with a firm's approach to innovation and new product development. For example, on the one hand Berthon, Hulbert, and Pitt (1999, p.37) said: "*The marketing concept has its genesis in this focus on the customer – finding out what the customer needs, wants, and values, and then delivering this as expeditiously and economically as possible"*.

On the other hand, Narver, Slater and MacLachlan (2004, p.344), argue that in most earlier studies of the market orientation-performance relationship, the measure of market orientation has largely been where an organization is responsive to expressed needs. They acknowledge that a potential weakness of this approach is that responsive market orientation decisions could be imitated and thus current superior customer benefits can become parity benefits over time. They therefore also argue that *"for any business to create and to maintain sustainable competitive advantage continually, it must increase its proactive market orientation continually"*.

In this largely academic argument about a responsive versus proactive approach to innovation what is not clear are the characteristics of a firm successfully practicing a proactive market orientation. As noted earlier, while Apple is held up as an exponent of the approach, it is also considered unique, and dependent on the vision and personal forcefulness of its leader.

Background to our journey: The Contemporary Marketing Practices (CMP) Programme

The genesis to our current interest in design-driven innovation began in the mid-1990s, when a new programme of research into changing marketing practices began at The University of Auckland, New Zealand. The impetus came mostly from a small group of Department of Marketing staff involved in executive MBA and Post-Graduate Diploma teaching of mid-career executives from a range of private, public and not-for-profit organizations.

Through a combination of in-class discussions and reportage by participants about the organisations they worked for, the staff realized there was an emerging gap between the then current academic discourse and emerging marketing practices. The result was the launch of a formal research programme in 1996, now known as Contemporary Marketing Practices (CMP): *"to profile marketing practices in a contemporary environment, and in particular to examine the relevance of relational marketing in different organisational, economic, and cultural contexts"* (Brodie et al., 1997).

From the start the programme embraced different but complementary research methodologies, incorporating both quantitative and qualitative methods, and delivering cross-sectional, longitudinal and contextual understandings contemporaneously. Nearly 50 CMP-derived journal publications now provide considerable insights into the theory and practices of marketing. A special issue of the *Journal of Business and Industrial Marketing* (eg. Brodie et al., 2008 and Little et al., 2008) provides coverage of the programme and recent findings.

As the group's efforts to bridge the marketing practitioner/researcher divide (Anderson 2001) evolved, so too has the range of research philosophies and the application of multi-methodological approaches. For example, qualitative research has moved beyond the traditional case method to apply 'action learning' (Mead 2006) with 'living case studies' (Little, et al., 2008). Action learning is a problem-solving approach initially developed for managers in industry (Revans 1990). A characteristic of our approach and underlying philosophy is the democratic creation of knowledge. For example, a complex problem is identified, and a defined group of researchers embark on various cycles of investigation, action and reflection, in order to arrive at a more informed understanding and practical solutions.

One such cycle of enquiry has been our interest in the changing nature of innovation theory and practice. We began by considering what characterises particularly innovative firms in New Zealand, especially whilst the economy is in recession. Increasingly, for example, New Zealand apparel firms are gaining international success, and our initial selection of apparel case study examples led us to consider their approaches to design from a 'design-driven' innovation perspective. Our research journey has then led us to explore what might characterize other 'design-inspired' or 'design-focused' enterprises (Lojacono and Zaccai 2004), and the possible resulting relationship with the co-creational process of innovation. This is consistent with Prahalad and Ramaswamy's view (2004) that, for co-creation to take place, the market will be seen as a forum where the firm and the consumer converge, as opposed to the traditional view of the market as a target, where the firm and the consumer are separate, with each having specific predetermined roles.

Key findings

In the initial stage of the convergent interviewing process we engaged in a process of ongoing dialogue with the design leaders of two exemplary consumer apparel manufacturing firms. The executives were the CEO of an intimate apparel specialist (we term this firm 'Intimatebrand'), and the CEO and Head Designer of a children's apparel specialist (we term this firm 'Kidsbrand'). These two firms are noted for leveraging design properties (including brand and business systems) internationally, and are generally held to be design-driven, as adjudged by exposure in the business press, their corporate reputation and by a government body supporting design-led entrepreneurial exporting effort (see for example www.betterbydesign.org.nz).

To this pair we later added an on-going dialogue with the CEO and other executives of an entrepreneurial furniture manufacturer (which we term 'Schoolbrand') in a niche market (school class-room furniture) with core values to do with cutting-edge design and industry-changing innovation. Previously they competed largely on price and personal relationships within schools, selling what was basically a commodity product, and focusing on the local market. After several years of what turned out to be an intensive and expensive co-creational research and development process with various school stakeholders (teachers, students, principals, school board members, caretakers and parents), they now offer a premium range of products that provide a solution to what has been a long-time class-room learning problem: that children become uncomfortable when sitting in 'one-size-fits-all' chairs, and this affects their ability and motivation to concentrate and engage in a learning process. Based on their success and the knowledge gained in New Zealand, they are undertaking a staged international expansion strategy based on their service-orientation goals, as stated by their CEO: *"I don't sell desks and chairs, I sell an experience in a healthy learning environment"*.

Over time our conversations and interactions with these case firms, including site visits and discussions with other executives in them, have resulted in the development and refinement of our conceptual frameworks and propositions. We present here the current state of our understanding – which will be the point of departure for richer comparisons with future data.

Three overarching findings result from our conversations. In the first stage of our analysis we realised that 'design' was one of the key factors underpinning the domestic and international commercial thrust of these firms. While this was obvious in hindsight, the extent to which design thinking penetrated all aspects of the firms was not visible at the outset. What was also not obvious was the nature of 'design'. Similarly to 'quality' and 'value', 'design' is a subjective, ambiguous, and context-specific construct that is heavily interwoven with an organisation's cultural fabric and purpose. Furthermore, the notion of design can be considered at the micro level, pertaining to artefacts and outputs (e.g. new product development, marketing communications or retail environments), and/or at the macro level, pertaining to the firm's core values, structures and wider systems.

In on-going discussions with the executives it became clear that a design-based competitive advantage can only be sustained if the macro level design thinking determines the micro processes, and not vice versa. For example, in an invited address to managerial students, the CEO of Intimatebrand proposed that design-integrated businesses attend to three core aspects: (1) **the business foundation**, consisting of an inspiring purpose, its competitive strategy and the business/financial model; (2) **the brand/marketing design**, consisting of marketing strategy, design philosophy and brand essence, and (3) **the product/channel**, consisting of NPD process, channel management and organisational design.

While we can agree with the basis of these elements, we argue that organisational design and design strategy form part of the business foundation, and that the underlying logic is that

resources and capabilities underpin a 'design-integrated business'. We term this notion of design integration, or macro level design, as 'BIG-D' design. Conversely, design at the level of products and artefacts, or micro level, is considered as 'small-d' design (Little et al. 2009). The extent to which 'BIG-D' design permeates a firm's business processes becomes apparent in, for instance, the decision by Kidsbrand to route all supply chains from production source (largely China) through the New Zealand headquarters before sending the clothing to wholesalers, in order to ensure final control of quality and design consistency. Or the decision by Schoolbrand to infuse its salesforce with the capabilities to not sell a product, but to render service to schools, which is the essence of the service-dominant logic (Vargo and Lusch 2004). Further, the histories of all three companies demonstrate how a consistent focus on 'BIG-D' processes have allowed the companies to successfully innovate at a higher value-level in what might be termed 'cut-throat industries' prevailing in the current recession.

The resource-based view (Brush, Green et al. 2001; Srivastava, Fahey et al. 2001) offers a further perspective on 'BIG-D' and 'small-d' design. Value creation is the focus of three central organizational tasks or processes: the development of new or reinvigorated customer solutions (product/service innovation); continual enhancement of the acquisition of new inputs and their transformation into desired customer outputs (supply chain management); and the creation and leveraging of linkages and relationships to external marketplace entities, especially channels and end users (Srivastava, Shervani et al. 1999). We argue that 'BIG-D' design is concerned with the orchestration and integration of all three processes, whereas 'small-d' design is confined primarily to product and service innovation processes. We further argue that a 'small-d' focus is necessary but not necessarily sufficient to create and sustain competitive advantage, especially in mature markets such as the one we examined.

The second major finding confirms previous work holding that design is an important source of customer value, and that value is based on understanding how customer's react more to the experience of using products than to the price paid at the point of purchase. As the Head Designer of Kidsbrand notes: *"Kids love Kidsbrand [because] they get a reaction and it makes them feel good. People are paying them attention, and I think that's good for their self esteem."* In the same vein, the CEO of Intimatebrand remarked *"…we've come to the end of [competing on scale and quality]. The next field of competition is design… [that's because]we've got so much stuff… what you want is actually less stuff but it has to be amazing, has to be cool, has to be emotional… [Consumers] want to pay 20% for the stuff and 80% for the coolness and to express themselves through it."*

The third major finding considered our insights into what form an idealised design-led business could resemble. As the CEO of Intimatebrand explained to a class of executive students in an invited address, design underpinned purpose, was a source of energy and inspiration to staff, and permeated the physical and cultural environment of the organisation. His people worked collaboratively, and with the objective of creating and delivering value to passionate customers, who were prepared to pay a premium for a branded and appropriately differentiated product. His firm sought high growth and high margins, aiming for high ROI in

the medium (rather than short) term. Design was therefore seen as an investment, not an expense or cost.

Integral to this kind of view is an overarching goal supported by competencies based on knowledge, for example, and as stated by the CEO of Schoolbrand, in order to: "*vastly improve the quality of the 15,000 to 19,000 hours on average we attend school in a lifetime… When you ask children to 'sit still' you are asking them to do something that does not come naturally. Do you want them to sit still, or do you want them to concentrate?... I have witnessed the power of using schools as a knowledge base for our learning, our testing, and questioning. Particularly through student feedback we find out what we need to deliver to improve their comfort and ability to achieve… Our point of difference is that we listen. We know, I know, more about my customer than my customer knows… I don't sell desks and chairs, I sell an experience in a healthy learning environment*".

His comments are similar to what Steve Jobs (Lewis 2005, p.24) said: "*Apple is a company that takes complex technology and makes it easier and simpler to use… Our goal is to stand at the intersection of technology and the humanities*".

IMPLICATIONS FOR THEORY/PRACTICE

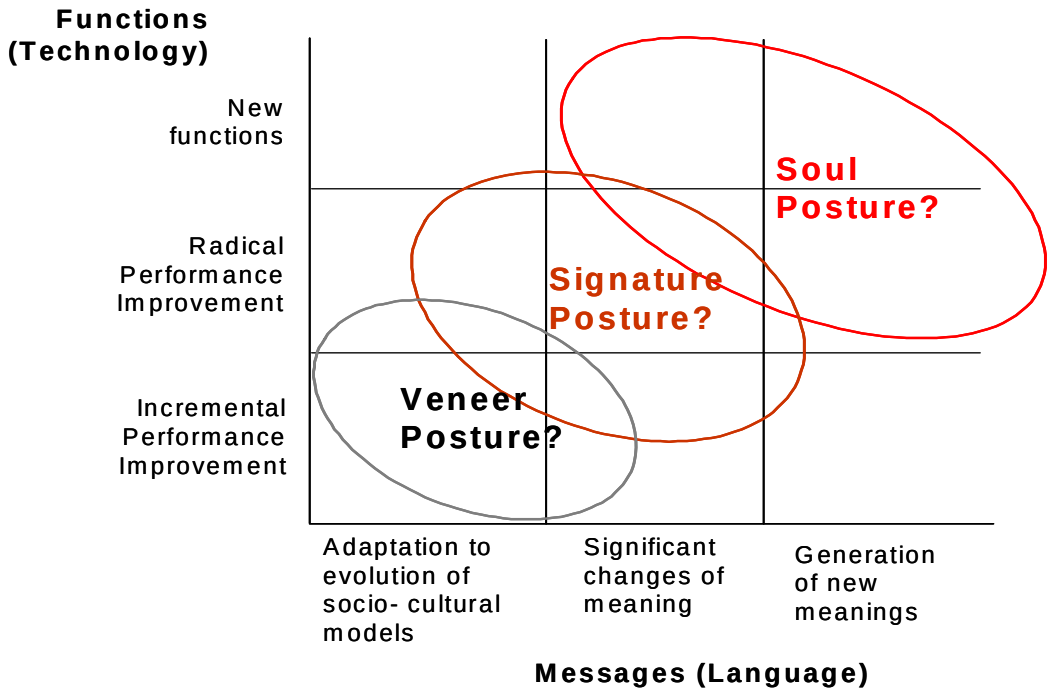
Our cycle of enquiry began with our concern about the changing nature of innovation theories and practices. We considered what characterizes particularly innovative firms in New Zealand, especially whilst the economy is in recession. For example, some local apparel firms were continuing with international success, and our initial selection of two apparel case study examples, followed by a school furniture maker - all considered by industry experts to be exemplary competitors - led us to consider their approaches to, and perspectives on, 'design-driven' innovation.

Stage one led to the major insight that design logic (while intuitively apparent to our executives), was not clear in the academic marketing literature. Research in marketing and management for example, treats design in terms of a dichotomy. *Strategic, or 'BIG-D'*, design relates to long-term investments (e.g. brands and organizational configuration). *Tactical, or 'small-d'*, design relates to production of artefacts (e.g. products and packaging), and to the 'doing' of design (Kristensen and Lojacono 2002). Based on our findings, we conclude that both approaches are necessary but not necessarily sufficient to explain how design-driven firms create long-run competitive advantage and country prosperity.

Our next step was in parallel with the above, and has been to explore other enterprises in general well-regarded. Cases have ranged from an airline to a shoe manufacturer to a cluster of fast moving consumer goods (fmcg) companies, including breakfast cereals, tea and coffee, and wine producers.

The second stage of our research therefore focused on developing insights into the nature of 'design' in general; into the relationship of design to competitive strategy; and to the role of the firm's resources and processes in design-driven innovation and competition. Our key finding is a three-way categorization of possible design 'postures'. Each has its own characteristics and requirements, and these postures can be mapped and explored within the framework of innovation proposed by Verganti (2003), as shown in Figure 1:

Figure 1: **A Framework for Design Postures (adapted from Verganti, 2003)**



Our propositions are that design postures reflect how firms view the strategic and tactical roles and impacts of their approach to design:

1. ***'Veneer'*** - Design (1) that is base-line sufficient for the customer and competitive requirements of the market; (2) where the main objective is to make the (possibly improved) brand (product and message) visible and accessible in its category; (3) where the target buyers' purchasing needs, especially, are reinforced; and (4) where the firm's competencies are comparable with its category competitors.
2. ***'Signature'*** - Design (1) that delivers uniquely identifiable market differentiation and competitive positioning; (2) where the main objective is to ensure the brand (product and message) is clearly differentiated, believable and aspirational; (3) where the target market's motivational needs, especially, are enhanced; and (4) where the firm's competencies are superior and sustainable with respect to its market competitors.

3. ***'Soul'*** - Design that (1) clearly expresses the culture and values of the firm and its brands (what Clark and Fujimoto, 1990, term *"the power of product integrity"*); (2) where the main objective is to transform brand performance and meanings, and customer experiences (what Verganti, 2006, terms products *"that initially confound consumers and then convert them"*); (3) where market behaviours, and possibly even markets (or categories) are also transformed, as new needs, motivations and experiences are being discovered; and (4) where the firm's core competencies, especially its underlying knowledge competencies, have been uniquely configured and are continuously improved.

The postures reflect firms' respective underlying strategic philosophies, and help explain their differences in marketing practices, including approaches to innovation and the marshaling of competencies. Each design 'posture' therefore has both strategic and tactical implications for four aspects of marketing: design and innovation processes; market acceptance and adoption patterns; product category development; and underlying organizational resources and competencies.

Our contribution is a logic for design-driven innovation strategies, explaining how and why firms configure assets, processes and systems for sustainable customer value creation. This logic, based on the three design postures, contributes to theoretical knowledge in design, innovation, and strategic marketing, and to advancing industry practice.

This series of discussions and interactions with reflective senior executives over a number of years led us to develop a typology of strategic design postures and an associated set of propositions. While these are built on a limited data set, the ideas and 'propositions' above are in their formative stages, and are designed to stimulate debate and further research at this interface of theory and practice. To develop our typology further, we invite researchers working in marketing and design to explore the varied and creative ways in which firms create customer value and competitive advantage through design-driven strategies internationally. Lastly, we encourage research into industry and national sources of competitive advantage through design.

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A Typology of Services for Managing Touchpoint Design

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Keywords: Touchpoint, Touchpoint design, Service design, Service types

The paper firstly introduces the notion of touchpoint and identifies the design elements at touchpoints. Secondly, five key influential factors for managing touchpoint design are identified from literature review and experts' interviews. They are: intangibility, dependence on design elements at touchpoints, interaction with design elements at touchpoints, perceived risk, and duration of service. These key factors are then applied to the Korean Standard Industries Classification. Six service types are emerged as a result of the analysis: retail type, dining type, telecom type, banking type, credit card type, and hospital type. The typology is constructed with considerations to the general requirements of design for service, as well as specific characteristics of different service types. The typology, the main findings of the research, could be used for establishing specific management guidelines for touchpoint design.

INTRODUCTION

Coherent, integrated, and systematic approaches to design management in service have been attempted by several researchers. They are particularly necessary in order to address the different characteristics of services from those of goods. However, specific design management guidelines for the various design elements at touchpoints have rarely been introduced. Moreover, studies on service design tended to be limited to particular service industries due to the vastness and diversity of services. In contrast, this research attempts to establish a typology of services that could be used as a basis for sets of design management guidelines appropriate for each service type. The classification is by the status of the 'key influential factors' of service identified for the purpose in the research.

The first aim of the research is to establish the notion of touchpoint and identify the design elements at touchpoints. The second aim is to identify key influential factors for touchpoint design management (TDM) and establish the criteria for a service typology for TDM. Key

influential factors for TDM were identified by interviews with service marketing and branding experts in relation with design management, as well as the literature review specifically relating to design management in services. These key influential factors were then applied to the Korean Standard Industries Classification to set the representative service pool.

The final aim is to establish a typology of services for TDM based on the analysis of how the key factors act on different types of services. The typology is basically established through classifying the representative service pool from the Korean Standard Industries Classification by the status of key influential factors.

TOUCHPOINT AND DESIGN

Touchpoint

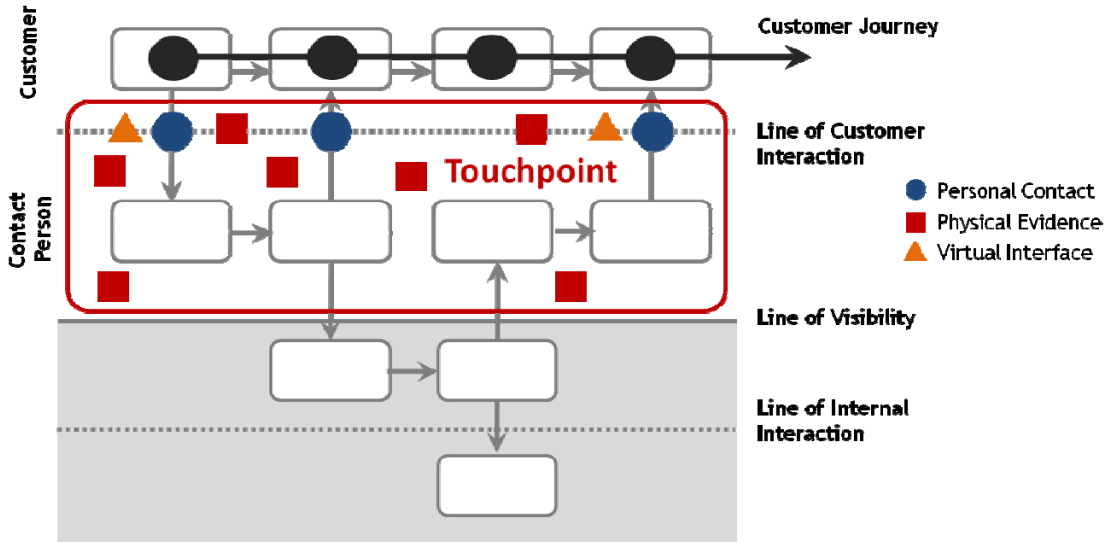
Touchpoint is a unique concept to describe the inter-relationship experience between the customers and corporations. Touchpoint is being used in service design domain because most services are experience goods.

Most service is deployed through touch points. There could be in the form or virtual interfaces, physical interfaces, and people. (Danish Design Center, 2008)

The tangible evidence and touch-points that make up the obvious parts of the service interface, often is connected with each other in sequences and chains. (Holmid, 2008)

In marketing field, touchpoint is understood as every point that customers touches or connects with your company throughout the entire product/service delivery; pre-, during and post-purchase. (Touchpoint Experience, 2004) Another definition is that touchpoint is all physical, communication, and human interactions that your customers experience during their relatiohship cycle with your company. (Intervox Group, 2003)

However, the definition is not concretely developed yet even though touchpoint is important concept in customer service journey. Below diagram could explain what touchpoint is.



[Figure 1. Touchpoint in Customer Journey]
Modified from Thomson Corporation (Now known as Thomson Reuter) Service Blueprint Model, 2008

Based on previous definitions, some clarification for touchpoint could be made.

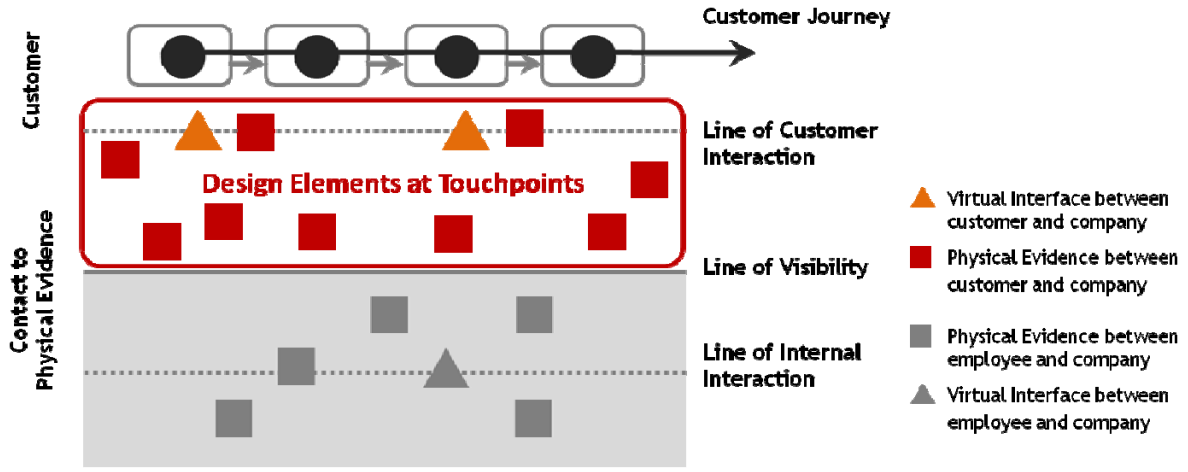
(1) Touchpoint is strongly associated with the relationship between customer and front line contact person and front line contact environment.

(2) Touchpoints include physical evidences, virtual interfaces, and people in front stage.

(3) Therefore, physical evidences and virtual interfaces beyond the line of visibility and internal personal contact within service corporations are not included.

Design Elements at Touchpoints

There are three channels in touchpoints; people, physical evidences, and virtual interfaces. Physical evidences and virtual interfaces out of touchpoints are defined as design elements at touchpoints in this study. It is because most physical evidences and virtual interfaces between the customers and service providing companies are delivered to customers with high intention of design. Below illustrates what design elements at touchpoints are.



[Figure 2. Design Elements at Touchpoints]

Design elements at touchpoints are usually being classified under design disciplines such as interior design, graphic design, product design, and etc. in the previous researches and in practices. In this research, design elements would be also classified by discipline bases. Below are major design elements at touchpoints.

Touchpoints by Space Design:

Retail space, exhibition space

Touchpoints by Product Design:

Product, furniture, chairs, kiosk, ATM

Touchpoints by Identity Design:

Logo, letterhead, business card, signage, banners, carrier bag, vehicle graphic,

Touchpoints by Information Design:

Leaflet, advertisement, brochure, DM, bill, newsletter, advertorial

Touchpoints by Digital Media Design:

Website, blog, email flyer, SNS site

Touchpoint Design Management (TDM)

Touchpoint design management (TDM) can be described as how effectively the design elements arising at various touchpoints are planned, designed, and managed in services. The design management in service requires collaboration among multiple design disciplines such as architectural design, graphic design, interaction design, industrial design, and interior design (Gloppen, 2009; Holmid, 2008) Further, Gloppen argues that service design requires a coherent and systematic view considering none of the touchpoints in a service journey work in isolation. Conclaves and Sato (2009) also insist that service design is a holistic approach, which considers in an integrated way of strategy, system, process and touchpoint design decisions.

TDM is being considered as one of plausible approach to achieve the holistic and integrated design management in service. As a further study, TDM is planning to find out the key design management parameters to plan and implement an integrated and holistic approach across multiple design elements at touchpoints. Further, the inter-dynamic relationship of those parameters per service type will be investigated.

SERVICE TYPE CLASSIFICATION FOR TDM

Services are vast and diverse. A relevant typology for TDM can provide a basic framework in planning and implementing design management in a specific service. Several previous

researchers such as Lovelock (1983) and Bitner (1990) have tried to classify services to understand the characteristics of service and overview whole picture of service. In addition, reflecting the trend of service marketing from interaction to relationship (Schmitt, 1999; Vargo et al, 2008), new classifications are still in researchers' interests. For example, Cautela, Rizzo, & Zurio (2009) introduced the classification of interaction based service, relationship focused service, and network centred service. In this research, service classification for managing design elements has been attempted to bring specific guidelines per service type.

Key Influential Factors for TDM

In order to establish a typology of services, determining key influential factors from the perspective of design management in services is critical. To generate the full list of influential factors, general service characteristics were firstly studied from literature review. Intangibility, heterogeneity, inseparability, perishability, perceived risk, perceived control, participation of customers, duration of service delivery; continuous vs. discrete, customization flexibility, non-ownership were major features to understand services. Following table is major service characteristics that previous researchers found out.

	Description	Source
Intangibility	Services lack the palpable or tactile quality of goods.	Parasuraman, Zeithaml, Berry, 1985
Heterogeneity	Unlike goods, services cannot be standardized	Parasuraman, Zeithaml, Berry, 1985
Inseparability	Services are simultaneously produced and consumed.	Parasuraman, Zeithaml, Berry, 1985
Perishability	Services cannot be produced ahead of time and inventoried.	Parasuraman, Zeithaml, Berry, 1985
Perceived Risk	Consumers perceive services to be more risky than goods, especially perceive greater overall pre-choice risk for services than for goods.	Murray & Schlacter, 1990; Mitchell & Greatorex, 1993; Mitra et al, 1999
Perceived Control	Giving more choice to the consumer in the service encounter is one alternative to contribute to exploring different ways to create a more pleasant service experience.	Hui & Bateson, 1991
Participation of Customers	Services occur through interactions of customers and resources of service organization including physical resources, system and employee. In many cases, services require customers' participation.	Qunn et al, 1987; Lovelock, 1991; Cabrio Cautela, Francesca Rizzo, Francesco Zurlo 2009

Duration of Service Delivery; Continuous vs.Discrete	Services can be provided for certain period of time according to service contract at initial purchase. On the other hand, certain services are terminated at every sole transaction.	Lovelock, 1991
Customization Flexibility	Service providers can control the width and/or depth of service due to customers' requirement.	Lovelock, 1991
Nonownership	Consumers can take benefits of acquiring temporary ownership by paying fees for using, not owning.	Lovelock & Gummesson, 2007

[**Table 1.** Service Characteristics]

Secondly, those service characteristics were reviewed in relation with managing design elements at touchpoints from literature search. In addition, four marketing and branding experts were recruited to select key influential factors in managing design elements. Two factors were added based on discussions of service marketing experts; dependence on design elements at touchpoints and interaction with design elements at touchpoints. Below table shows the summary.

	Relevance to Design Elements at Touchpoints (Literature Search)	**Relevance to Design Elements at Touchpoints (Experts Interview)**	**Overall Evaluation**
Intangibility	The utmost task of service design is to deliver the service as valuable tangibles to customers….The prominent example of service design is brand logos which enable transforming intangibility to tangibility of service. (Pyo, 2008)	Communication and information design take a major role to overcome intangibility of service.	High
Heterogeneity	Fast food restaurants overcome heterogeneity by giving consistent look of employees' uniforms or standardized interior space design. (Pyo, 2008)	Identity design's main role is to overcome heterogeneity of service.	Medium
Inseparability		Inseparability doesn't seem to be influenced by design elements at touchpoints.	Low
Perishability	Service providers of beauty shops, restaurants, bookstores and hospitals often make mileage cards or send birthday cards to customers as physical evidences to increase the awareness even after their services terminate. (Pyo, 2009)	Several design elements at touchpoints are utilized to attract customers after service purchase. However, intangibility seems to be more important characteristic to explain the role of design over perishability.	Medium

Perceived Risk		Perceived risk is a very critical characteristic in service purchase. Customers' response to design elements at touch-points might not be identical in accordance with the status of perceived risk of services.	High
Perceived Control		Perceived control is not of the issue related to service types.	Low
Participation of Customers		Participation of customers is closely related with human factors. Relevance to design elements at touchpoints might be weak.	Low
Duration of Service Delivery; Continuous vs.Discrete		Service loyalty acquisition activity, which is the most critical factor in repurchase, differs from continuous service to discrete service. Therefore, TDM in continuous services and in discrete services might be different.	High
Customization Flexibility		Less related with design elements at touchpoints	Low
Nonownership		Less related with design elements at touchpoints	Low
Dependence on Design Elements at Touchpoints	The importance of physical setting depends on the nature of the job and the nature of consumption experience… Not all service firms and industries are alike (Lovelock, 1983; Schemener 1986)	Majority of physical evidences meet customers in designed forms. Dependence on design elements at touchpoints varies in accordance with service types.	High
Interaction with Design Elements at Touchpoints	Bitner (1992) explains that physical evidence affects the nature of social interaction in terms of the duration of interaction and the actual progression of events.	Customers' interaction degree with design elements at touchpoints might influence TDM pattern in various service types.	High

[**Table 2.** Influential factors for managing touchpoints through design]

As a result, the five factors out of twelve were evaluated as high. The five key factors are: intangibility, dependence on design elements at touchpoints, interaction with design elements at touchpoints, perceived risk, and duration of service delivery; continuous vs. discrete. The five influential factors are defined as follows.

Intangibility

Customers are not able to see or touch certain services throughout whole service process. Therefore, customers hardly understand or imagine certain services due to lack of expertise knowledge or information.

Dependence on Design Elements at Touchpoints

In the process of customer service journey, certain services highly require the support of design elements at touchpoints than other services.

Interaction with Design Elements at Touchpoints

In the process of customer service journey, customers more directly interact with design elements at touchpoints in certain services compare to in others.

Perceived Risk

Customers perceive certain services to be more risky than others, especially when services are related with life or monetary issues.

Duration of Service Delivery

Certain services can be provided for certain period of time according to service contract at initial purchase. On the other hand, certain services are terminated at every sole transaction.

Typology of Services for TDM

The above five key influential factors were applied to a representative service pool. In this research, Korean Standard Industries Classification from National Statistical Office was reviewed to select representative service types. There are thirteen service categories in Korean Standard Industries Classification as below.

	Grand Classification	Representative Service
G	Whole sale & Retail	Department store, Discount department store, Super market, Convenience store, Gas station, Bookstore, Cosmetics store
H	Transportation	Railroad, Airline, Bus, Taxi
I	Lodging & Restaurant	Hotel, Condo, Inn, Restaurant
J	Publication, Broadcasting and Communication	Cinema, Wire Telecom, Wireless Telecom, Satellite Communication
K	Finance & Insurance	Bank, Asset Management, Credit Card, Life Insurance, Indemnity insurance
L	Real estate & Rental	Real Estate, Car rental, Rental

M	Expertise, Science & Technology	Legal advice, Patent agency, Advertising, Business Consulting, Accounting, Architecture & engineering, Interior design,
N	Facility management and Business support	Landscape architecture, Travel agent, Bodyguard, Head hunting, Convention
P	Education	School, University, Kindergarten, Private educational institution
Q	Healthcare and Social welfare	Clinic, General hospital
R	Arts, Sports and Leisure	Golf course, Ski resort, Fitness club, Concert
S	Repair & Personal (including associations)	Hairdressing, Laundry, Nail art, Massage
E	Sewage & Waste disposal	Sewage & Waste disposal

[**Table 3.** Service classification from Korean Standard Industry Classification]

In order to establish a typology of services for managing design elements at touchpoints, following five screening criteria were deployed.

1. Business to Consumer service only (Not Business to Business)
2. Generally used service for majority of people (Not professional services)
3. Offline service only
4. Corporations with an awareness of design management
5. Representative service within similar group

The representative service pool from Korean Standard Industry Classification was arranged with above screening criteria into fourteen services. They are: department store, discount department store, gas station, rail road, airline, hotel, restaurant, cinema, mobile telecom, bank, credit card, hospital, ski resort, and fitness club. Then, they were classified by the status of the five key influential factors.

	Intangibility	**Dependence on Design Elements**	**Interaction with Design Elements**	**Perceived Risk**	**Duration of Service**	
1.Department store	Low	High	High	Low	Discrete	Type 1
2.Discount department store	Low	High	High	Low	Discrete	
3. Ski resort	Low	High	High	Low	Discrete	
4. Hotel	Low	High	High	Low	Discrete	
5. Gas station	Low	High	Low	Low	Discrete	Type 2

6.Restaurant	Low	High	Low	Low	Discrete	
7.Cinema	Low	High	Low	Low	Discrete	
8.Fitness club	Low	High	High	Low	Continuous	Type3
9.Mobile telecom	High	Low	Low	Low	Continuous	Type4
10.Bank	High	High	Low	High	Continuous	Type5
11.Credit card	High	Low	Low	High	Continuous	Type6
12.Hospital	High	High	High	High	Discrete	Type7
13.Airline	High	High	High	High	Discrete	
14.Rail road	High	High	High	Low	Discrete	Type8

[**Table 4.** Service classification by 5 influential factors]

After classifying fourteen services with five influential factors, there happen to be resulted into eight groups. Two of them are discarded because fitness club and rail road are relatively less general services compare to others. Six service types are finally emerged. Below is the table of six service types.

Service Type	**Intangibility**	**Dependence on Design Elements at Touchpoints**	**Interaction with Design Elements at Touchpoints**	**Perceived Risk**	**Duration of Service**	**Examples**
Retail Type	Low	High	High	Low	Discrete	Department store, Discount department store, Ski resort, Hotel
Dining Type	Low	High	Low	Low	Discrete	Gas station, Restaurant, Cinema
Telecom Type	High	Low	Low	Low	Continuous	Mobile telecom, Wire telecom
Banking Type	High	High	Low	High	Continuous	Bank
Credit Card Type	High	Low	Low	High	Continuous	Credit card, Life insurance, Indemnity insurance, Asset management
Hospital Type	High	High	High	High	Discrete	General hospital, Airline

[**Table 5** Typology of services for TDM]

Retail Type

Intangibility is low; dependence on design elements at touchpoints is high; interaction with design elements at touchpoints is high; perceived risk is low; duration of service delivery is discrete.

Most retail services and ski resort belong to this type. Interaction with design elements is critical. In retail type, customers interact actively with design elements in their service journey.

Dining Type

Intangibility is low; dependence on design elements at touchpoints is high; interaction with design elements at touchpoints is low; perceived risk is low; duration of service delivery is discrete.

Restaurant, gas station, and cinema belong to this type. In dining type, customers' interaction with design elements is passive.

Telecom Type

Intangibility is high; dependence on design elements at touchpoints is low; interaction with design elements at touchpoints is low; perceived risk is low; duration of service delivery is continuous.

Wire and wireless telecom services belong to this type. Customers do not clearly understand the whole telecom service providing process. During the service contract period, the service continues.

Banking Type

Intangibility is high; dependence on design elements at touchpoints is high; interaction with design elements at touchpoints is low; perceived risk is high; duration of service delivery is continuous.

Banking service belongs to this type. Perceived risk is high because customers deposit their financial asset on banks. In this type, dependence on design elements is high due to retail space of banks.

Credit Card Type

Intangibility is high; dependence on design elements at touchpoints is low; interaction with design elements at touchpoints is low; perceived risk is high; duration of service delivery is continuous.

Credit card and most other financial services such as asset management, life insurance, indemnity insurance belong to this type.

Hospital Type

Intangibility is high; dependence on design elements at touchpoints is high; interaction with design elements at touchpoints is high; perceived risk is high; duration of service delivery is discrete.

General hospital service belongs to this type. Perceived risk is high because customers' life issue rely on this service. Especially in general hospital, customers are highly interacted with various design elements.

The six types presented above are typical services that most of people encounter in everyday life. Therefore, this typology could be deployed as framing out services for people in general. In the field of design management for services, this typology could be used as a basic framework for TDM in the majority of service industry. Further, the five key influential factors could also be applied to the other services not included in the six types above managing touchpoint design.

CONCLUSIONS

Identifying key influential factors to TDM is one of major findings in this research. Critical differences of intangibility, dependence on design elements at touchpoints, and interaction with design elements at touchpoints in significance for TDM were clarified. Further, perceived risk and duration of service were introduced and considered as major influential factors in service design management.

Another finding of this research is a typology of services based on reviewing the full list of Korean Standard Industries Classification. The typology of services from this research provides a basic framework for the management of touchpoint design for specific service types while considering the general requirements of design for service, as well as specific characteristics of different service types.

A further development of this research, to a comparative study of TDM per service type could widen and deepen the body of knowledge in service design in more practical terms. This typology of services is the result of a preliminary study to the provision of specific TDM guidelines for each service type. The five key influential factors need to be further examined in the real service contexts to determine their credibility for managing touchpoint designs. The evaluation of the influential factors will be conducted in the future empirical studies.

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Design Capabilities in Dynamic Environments

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Design, according to the literature, is playing an increasingly important role in the strategic management of firms. Meanwhile the strategic management literature pays little attention to the role of design. This paper explores the concept of design capabilities, or the resources and knowledge which give companies the ability to carry out a particular type of design. This paper presents a case study of design in the New Product Introduction (NPI) process of a large engineering company which has made a strategic transition to deliver service offerings. The case study is based on semi structured interviews with 23 informants representing various strategic, management and operational levels in the organisation. In the case company design capabilities, rather than marketing or manufacturing, are argued to have been the crucial enabler of a strategic change. This strategic change, in turn, is observed to require the development of new design capabilities and their integration into the NPI process. The paper argues that design is a dynamic capability, which enables the renewal and reorganisation of resources in response to changing environments, while design capabilities are themselves resources which offer a source of competitiveness.

Introduction

Amid claims of design's and designers' importance to strategic management, the literature on strategic management is strangely quiet on the role of design. The topic of design thinking (Brown, 2008, Martin, 2009) has stimulated considerable debate among design and leadership scholars, but largely views design as a way of thinking. The roots of this topic have been traced back to the design methods movement of the 1960s (e.g. Archer, 1965) but more commonly to Herbert Simon's work "Sciences of the artificial" (Simon, 1969) and Donald Schön's "The reflective practitioner" (Schön, 1991). Debate in the literature concerns whether managers are taught the right skills by Business Schools. It is argued that their

decision making could be improved by teaching them to think like designers (Boland and Collopy, 2004) or to combine intuition with analysis (Martin, 2009).

Another stream of the literature sees a collection of studies which focused on design as a business function and its impact on business performance (Gemser and Leenders, 2001, Hertenstein et al., 2005). Mutanen (2008) argued that such studies view design as something which exists and can be purchased. She highlighted the dearth of studies which view design as a capability that is developed over time. Indeed, Azadegan et al (2008) claimed that design, or more specifically the creativity of designers, is an inherent ability which must be 'bought' rather than made. There is a danger that design capability can be viewed as simply a resource which can be purchased by any company. Meanwhile some researchers present design as the key to the competitiveness of some companies and therefore something deeply embedded within the organisation (Lorenz, 1986, Verganti, 2008). Such processes, which are embedded within an organisation and enable the reconfiguration of resources have been termed dynamic capabilities (Teece et al., 1997).

This paper identifies commonalities between the design management literature and the dynamic capabilities concept. Firstly, it argues that design is a dynamic capability, in contrast to a previous study which made claims to the contrary. Secondly, it identifies design capabilities as the key enabler of a manufacturer's transition to a service strategy, in contrast to other researchers' claims for marketing or manufacturing capabilities. A concise review of literature will introduce the key concepts related to this study. Subsequently, a description of the methodology will explain how the case study was developed, before the case company is described. Some key findings are presented, which are related to the concepts in the literature. Finally, conclusions are made along with implications for research and practice, to suggest how the contribution of this paper can be furthered.

Background

The strategic management literature has, in recent years, paid increasing attention to the concept of dynamic capabilities. Dynamic capabilities (Teece et al., 1997) are processes which enable the renewal and reorganisation of resources in response to changing environments. This concept is widely used in the strategic management literature to explain the processes firms use to renew or re-organise their resources in order to compete in 'dynamic' environments. The dynamic capabilities perspective therefore follows from the resource based view (RBV, Barney, 1991) of the firm, in which a firm's resources are seen as the source of competitiveness in firms. This is regarded as a static view (Lockett et al., 2009) whereas the dynamic capabilities perspective assumes that these resources must evolve over time in order to sustain competitiveness. Studies of dynamic capabilities have examined various organisational processes, including mergers and acquisitions as well as Research and Development (R&D) and New Product Development (NPD). A review of some of these studies is presented by Ambrosini and Bowman (2009), which serves to highlight the lack of studies focused on design.

Design as a dynamic capability

Today designers are keen to present their credentials as strategists and management consultants (Nussbaum, 2004, Brown, 2008). This role does not feature prominently in the recent strategic management literature (Boland and Collopy, 2004). Design, or specifically design creativity, has been presented as a "static capability" by Azadegan et al (2008), who argued that companies are forced to 'buy' design capabilities, rather than 'make' them. On the contrary, Makadok (2001) stated that dynamic capabilities are embedded in an organisation and must be built rather than bought in the market. Ambrosini and Bowman (2009) argue that the word dynamic is a source of confusion and that it may be helpful to leave aside the RBV use of the word capability to understand dynamic capabilities. Rather than decomposing the concept into two words, it should be seen as a single construct.

> *"A dynamic capability is not a capability in the RBV sense, a dynamic capability is not a resource. A dynamic capability is a process that impacts upon resources."*
>
> (Ambrosini and Bowman, 2009)

Eisenhardt and Martin (2000) argued that New Product Development is a dynamic capability. If new products are part of a firm's resource base, then this argument would be hard to dispute. Design can also be seen as a dynamic capability since, for many researchers, design is inextricably linked to NPD, even if the relationship is perceived differently (Perks et al., 2005, Goffin and Micheli, 2010). Danneels (2002), described capabilities as the ability to accomplish something by using a set of material and immaterial resources. He argued that product innovation both results from and contributes to the renewal of technology and market related capabilities. His distinction is similar to Livesey and Moultrie's (2009) divide between technical design (related to engineering and technology) and non-technical (related to customers and communication). Design has long been considered to act as a link between a company's capabilities in these two areas (Kline and Rosenberg, 1986, Rothwell, 1992), contributing to design being seen as an important strategic tool (Kotler and Rath, 1984) rather than simply a resource.

Development of capabilities

Through a longitudinal analysis, Mutanen (2008) studied the development of design capability in a technology based company. She identified four perspectives on design in the literature: expert-centred, tool-centred, process-centred and strategy-centred. The earliest involvement of design in the company was the introduction of industrial designers (i.e. experts). This proved, however, to be only the first step in the development, which then became more formal over time, through the development of tools, embedded processes and then a more strategic role in the organisation. Martin (2009) also described a similar developmental process, which he referred to as the knowledge funnel, a central part of any 'design thinking' organisation. He considered that the success of some companies lay in finding solutions to new problems, while others excelled in refining old solutions into efficient processes. He argued that long term success required both – i.e. rewarding experts or

‘design thinkers’ for creating new solutions, rather than applying them, allowing the solutions to be refined and scaled up to minimise cost and maximise profit. Design is seen in this knowledge funnel, not only as a resource, but as the ability to move through these stages, creating knowledge and new capabilities.

Integration of design capabilities

At a strategic level, design is arguably a dynamic capability, yet it is also a business function, which combines a range of expertise, so that the knowledge and tools used to conduct design can be considered as resources or capabilities. Martin (2009) recommended the creation of integrated design teams as an important strategic tool. He argued that when individuals come together in a team, to tackle a difficult design problem, this acts as a source of motivation, making them “want to come to work every day” until they solve the problem. Martin saw such design teams as a means of creating knowledge and transferring it to other areas of the organisation. Takeuchi and Nonaka (1986) considered the integration of different functional specialists in project teams as a great improvement on the traditional ‘over-the-wall’ approaches. They considered that these teams, when given responsibility, were able to combine and build on their varied areas of expertise. This enabled them to analyse complex problems, deliver innovative responses and reduce the time taken. The result, in Takeuchi and Nonaka’s studies, was that project teams encourage learning among individuals, who are pushed to overcome unfamiliar design challenges as well as work with colleagues from unfamiliar functions. The benefit of maintaining temporary teams was that the team members would return to their own functions, enabling knowledge gained to be transferred to their colleagues. Design, in these examples, was seen as a means of creating knowledge and distributing it across the organisation. The ability to carry out the projects, however, relies on the expertise of the team members, i.e. the design capabilities they possess.

Research questions

The literature supports a view of design as a capability which is developed over time, as shown in Mutanen’s study. Conducting design also demands capabilities such as the technical specialisations which are required to populate the integrated teams described here. And design has been proposed as a capability which reconfigures knowledge and resources in an organisation. Despite this, the literature does not tend to explicitly identify design as a dynamic capability. Dynamic capabilities are so called because they involve change in a dynamic environment. Therefore to investigate design as a dynamic capability, a dynamic strategic environment is a necessary context. Two questions can be asked, related to the influence of design on the strategic environment and the impact of the environment on design capabilities.

- What role does design play in a dynamic environment?
- How are design capabilities affected by a dynamic environment?

The context chosen for this study is that of an organisation which is in the process of making a strategic change in its business model, namely a manufacturing organisation moving towards the provision of services.

Context

A recent trend, observed in the literature, has been for manufacturing companies to offer services which are integrated into their products (Vandermerwe and Rada, 1988, Neely, 2008). This involves a move 'downstream' (Wise and Baumgartner, 1999) to deliver services to customers and capture revenues through long term relationships (Oke, 2007). It is considered to be an evolution through a number of stages (Pawar et al., 2009). The evolution begins with 'pure' manufacturing, where offering service is a necessary cost of business (Mathieu, 2001). This is followed by increased service provision as a valuable offering in its own right and finally to integrated packages of product and service which create a unique form of value for customers (Mont, 2002). The reasons for making this transition are to reduce risks and responsibility for customers, who would be able to pay only for what they use and focus their efforts on their core business; and to reduce the volatility of revenue for the producer, who could achieve more predictable long term deals and build relationships with key customers.

According to some writers, moving to a service strategy is dependent upon the marketing capabilities of a company (Grönroos, 2000). Some even go as far as to claim that manufacturing resources are a hindrance and that the only competence which matters is marketing (Vargo and Lusch, 2004). It has also been recommended that such a strategy demands a high level of customer centricity (Galbraith, 2005). Meanwhile, some writers have been criticised for their belief that companies can deliver any thing that can be generated by their imagination rather than what can their manufacturing capabilities can produce (Mintzberg et al., 1998). Some would argue, therefore that manufacturing, rather than marketing, capabilities enable a service strategy (Chase and Garvin, 1989). As stated above, design is seen as a link between marketing, manufacturing and other business functions. Therefore the role of design in this context appears to be an interesting topic for investigation.

Approach

A previous study (Moultrie et al., 2008) sought to investigate spending on design in UK firms, a measure of design resources. The study measured two constructs – technical and non-technical design and reported an estimated spend on technical design to be four times that of non-technical (Livesey and Moultrie, 2009). While technical design can be expected to include costly equipment and engineering effort, there is a danger that non-technical design was underestimated by respondents since it captures resources that are out-with a company's design department or otherwise not readily considered as design effort. Additionally, a survey approach is useful for generating data but is limited to a snapshot in time.

In this study, an effort was made to investigate different types of design, particularly those conducted outside of the design departments. This was due to the expectation that design capabilities being developed would not be as formalised as the more established ones (Mutanen, 2008). A qualitative approach was adopted, since this was considered more suitable for capturing such 'silent design' (Gorb and Dumas, 1987). A case study approach (Stake, 1995, Yin, 2003) was used for its ability to study phenomena in their context and to examine numerous perspectives on the topic of investigation. Semi-structured interviews were conducted with 23 managers at various levels of authority and with responsibilities across the whole of the company's NPI process, to investigate technical and non-technical design capabilities. Interviews were transcribed and coded to identify emerging themes. The codes were reviewed and refined progressively, to develop a structure for further coding and analysis. Reliability checks were conducted with the assistance of independent researchers who repeated the coding of a percentage of the transcripts, as recommended by Miles and Huberman (Miles and Huberman, 1994).

A theoretical sampling approach (Glaser and Strauss, 1967, Eisenhardt, 1989) was taken to identifying interviewees, with contacts helping to identify colleagues who could shed light on areas where data were lacking. This involved selecting interviewees according to their ability to shed light on issues identified during analysis, which ran concurrently with data collection. Using a broad definition of design, the interviewees were asked to describe design activities they and their immediate colleagues carried out or managed, as well as the impact of the company's strategic shift towards service provision. In this way, the changing nature of design capabilities was explored.

Case Study

The case company – referred to here as Eng Co. – is a well established manufacturer of engineering products and, increasingly, support services. A recent strategic shift towards a focus on services has seen revenue and market share grow rapidly. The company now offers its products as part of a service agreement, which ensures that the customer receives uninterrupted access to functionality, without the risks and responsibilities of ownership. Through condition monitoring and scheduling of repairs and maintenance, Eng Co. is able to manage the products in use more efficiently than their customers, enabling services to be offered profitably.

Eng Co's products form a vital part of an overall system developed by one of a number of OEMs – one of which will be referred to here as Sys Co. – to whom the company acts as a supplier. This means that the products are developed to meet the specifications set by Sys Co. The customers purchasing these systems can, in most cases, select either Eng Co.'s product or that of a rival. Since the technical performance is necessarily similar, services provide an effective means of differentiation at this stage. Due to differences in operating requirements, customers typically demand customised products, meaning that the design process involves two main stages. Firstly designing and developing a product to satisfy the requirements of

Sys Co and secondly developing customised products to meet customers' specific operating requirements and to facilitate service offerings. At the first stage, innovation and product performance are vital to provide a competitive advantage over rivals (R&D Manager, Eng Co.) while at the second stage, the customers are mainly concerned with the reliability and cost effectiveness of the products (Marketing Executive, Eng Co.).

Product development

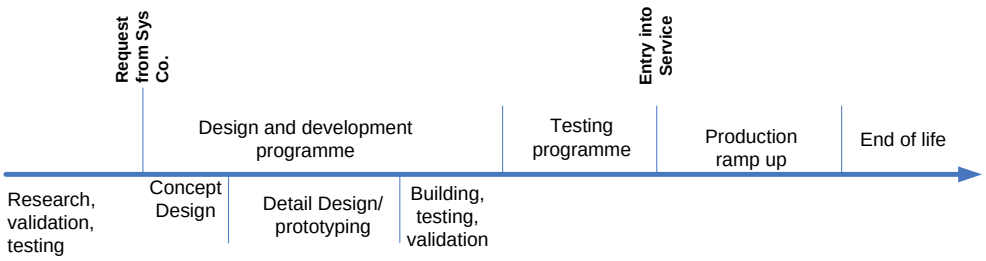

Figure 1 – a representation of the NPI process in Eng Co.

The typical NPI process is shown in figure 1, which demonstrates some of the key phases. The design and development officially begins with a request from Sys Co. and takes several years due to the complexity of the products under development. Eng Co. will compete with rivals to deliver to Sys Co. on the basis of innovative technology, product performance and development lead time. Attempts to speed up the process have seen technology development and testing conducted independently of projects. This enables a proposal to be made in response to a request from Sys Co. and allow a preliminary concept design to be produced early. Product safety is paramount and industry requirements demand a rigorous programme of testing before safety certificates are awarded. This contributes to a desire in the company to make use of components and technologies which have already been developed and tested, in previous products or technology development programmes. Development time is also reduced by the use of virtual modelling and testing, building upon the knowledge gained through previous projects and experience of products in service. The process is governed by a series of design reviews, which over time have become more challenging for the design teams. The tools and product knowledge available mean that a greater level of analysis is demanded than was previously possible (R&D Manager, Eng Co.). Additionally, 'non-technical' design is included in most design reviews (Strategic Executive, Eng Co.). This typically involves consideration and planning of sourcing, production, maintenance and other processes which impact on the cost of maintaining the product over its lifetime as part of a service package.

Product customisation

During the NPI process, the company typically begins making contact with potential customers. Confidence in the technology, processes and engineering personnel enable the commercial teams to offer the product under development along with a service package that

guarantees its reliability. Long term agreements are signed, for products which do not yet exist, with the conviction that a solution will be provided, or as one interview claimed:

> *"We don't sell products, we sell the promise of a solution"*
> (Strategic Executive, Eng Co.)

This solution includes the technical design of a customised version of the product under development. The differing requirements of customers mean that a standard product platform is developed, which is then customised. As a result

> *"…if a programme is really working well, the biggest programmes are 5000 or 6000 products and the first and the last one look different."*
> (Operations Manager, Eng Co.)

In addition to the technical design, however, the design process includes 'non-technical' design activities and the company has sought to increase its capabilities in some of these areas. One example was the introduction of a standard role for designing supply chains. This role is required in the design of products, largely to assess the cost and viability of delivering the solutions designed by the technical experts. It is also required to re-design the supply chain in order to manage components required for customised products as well as maintenance services. Development of this standard role has involved identifying the activities undertaken and seeking to formalise their implementation. Processes and modelling tools have been developed while training has been used to increase the skills of people responsible for this role. The aim was to support supply chain designers in making senior decisions and contributing more effectively to product design, and to "try to give them more teeth" (Operations Executive, Eng Co.).

Design organisation

In moving towards a service focused strategy, Eng Co. has increased the importance placed on both customer interaction and certain non-technical design activities. The organisational structure has been modified to accommodate both. Firstly, as described in the integrated solutions literature (e.g. Foote et al., 2001, Galbraith, 2002), a customer facing front end was developed, which enables the company to build relationships with customers and co-ordinate the delivery of services. Secondly, the development of integrated teams which include the required technical and non-technical specialists enables the multi-faceted nature of service offerings to be addressed more effectively in design.

In Eng Co. the integrated teams help to ensure that technical and non-technical specialists are involved in design decisions. In this respect, they involve non-designers in the design of products and associated services, helping to make silent design less silent. The complexity of products means that designers tend to be experts in a particular engineering function, carrying out stress analysis for example. The integrated teams, therefore, combine all of the appropriate technical functions for the component or subsystem to be designed, including, where appropriate, engineers from suppliers who will manufacture components. They also include non-technical experts, such as supply chain designers and those responsible for

purchasing, testing and so on. These teams are required to report to both technical and non-technical managers, as indicated in figure Figure 2. Upon completion of the team's duty, each of the functional specialists returns to their own function and is likely to be involved in different types of project in future. For example, an employee based in a manufacturing group, with experience in an integrated team, will have gained knowledge of service management, by designing products for a service offering.

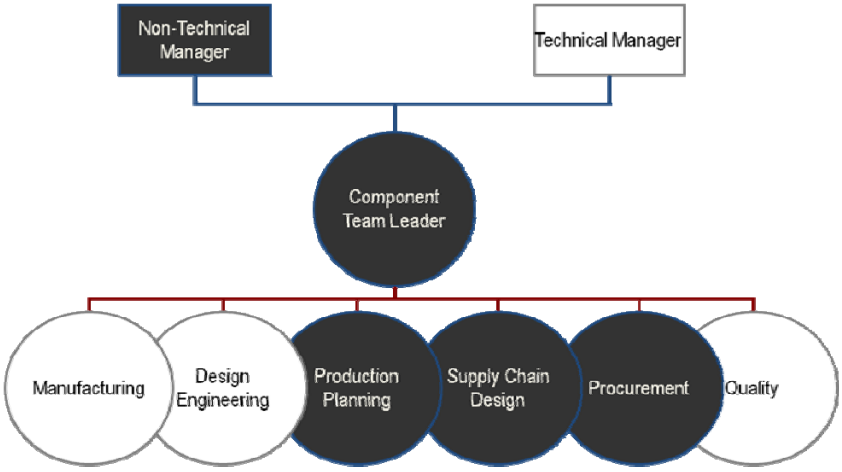

Figure 2 – a typical integrated team, charged with designing a component in Eng Co.

Key Findings

As described previously, the literature argues that either marketing or manufacturing is the key capability which enables a manufacturer to move to a service business model. From the evidence of this case study, it would appear that both are important but neither critical. Clearly, services involve a greater degree of customer interaction and therefore Eng Co. has become more customer centric (Galbraith, 2005) through its organisational changes. On the other hand, it cannot be said that the transition to service offerings began with the company's marketing capabilities. Equally, the manufacturing capabilities of the company cannot be seen as the critical factor in the success of its service transition, for the simple reason that manufacturing operations have largely been outsourced, with the exception of around 20% of components. What marks the 20% out is the advanced technology or design of these components, which leads to a desire to protect intellectual property. Arguably, the ability to design complex products, using technology which is difficult to imitate, provided a platform for the company to increase its earnings through services.

The ability to design products which cannot be imitated requires an unmatched knowledge of products, components, materials and processes. This knowledge represents a design capability which rival companies do not possess. One interviewee suggested that it would be possible for the company to usurp Sys Co. since he considered Eng Co.'s product to be the most complex component of the system (Strategic Executive, Eng Co.). Conversely, he did not consider it feasible for Eng Co. to be replaced since other companies could not design similar products. This design capability is arguably what allows Eng Co. to offer products

directly to customers, as opposed to being merely a supplier to Sys Co. Additionally, service can be delivered more efficiently by Eng Co. due to the superior product knowledge required to design the products. This was recognised by customers who requested that Eng Co. develop service offerings, initiating the present strategic change (Marketing Executive, Eng Co.).

In the context of the strategic shift to a service business model, the company's technical design capabilities can be seen to have changed. Notably, some of the non-technical capabilities have been developed, with the role of supply chain designer being a clear example. This development can be seen to mirror the development of industrial design described by Mutanen (2008). The use of integrated teams is seen as an effective means of combining the different technical and non-technical functions. As identified by Takeuchi and Nonaka (1986), however, these teams also have the benefit of transferring knowledge throughout the organisation. These design teams may also provide another benefit, namely the dissemination of a new organisational culture.

Design is seen as the function which integrates different units operating in different sub-environments, creating a bridge (Walsh, 1996) between, product focused departments such as R&D and customer focused departments such as marketing (Rothwell, 1992). Whereas some attribute this to the skill of the designer (Brown, 2008), the design process also enables the integration of different functions, in this case through the use of integrated teams for the design of products and service offerings. Additionally, some have argued that moving to a service strategy requires the implementation of a service culture (Galbraith, 2005) which is likely to be alien to the organisation (Oliva and Kallenberg, 2003). It could be argued, therefore, that the design process enables this cultural change in an organic manner, as opposed to a sudden and violent change being attempted.

Implications

This paper contributes to the literature on design by applying the concept of dynamic capabilities as a theoretical framework to explain the reconfiguration and renewal of a company's design resources. The concept of dynamic capabilities seems useful for studies of design in organisations. While R&D and NPD have been studied using this concept, design researchers have, overlooked it, or even focused on design as a resource rather than a strategic capability. Further research is recommended to bridge the gap between the literatures on design thinking and dynamic capabilities, which this paper has sought to highlight.

For managers, the paper provides examples of the importance of design capabilities to adapt to dynamic environments. It offers insights into how one successful organisation has used design as a platform for a strategic shift to cope with a dynamic market environment and how this has supported the development of new design capabilities, suitable to the new strategic position. The paper argues that the knowledge and resources which enable the design of

competitive products also offer the opportunity to capitalise through services. While marketing capabilities can be built up and manufacturing capabilities can be outsourced, design capabilities seem to be, from the evidence of Eng Co., a core competence which should be protected and exploited. Finally, the design process, by enabling the transfer of knowledge and working practices, can arguably be used to slowly enact a cultural change, which may be required by the strategic transition.

Conclusion

The research questions proposed earlier concerned the role of design in the strategic change of Eng Co. towards a service business model and the impact of this change on the role of design. From the case study, some observations can be made on the subject of these research questions. Firstly, the role of design can be considered crucial in allowing the company to make a strategic change. In this respect, the capabilities which enable design are a key competence (Prahalad and Hamel, 1990). Secondly, the transition requires the reconfiguration of these capabilities, to incorporate different functions into the design process. In this respect, the design process is dynamic in its reconfiguration of the design capabilities as well as the culture of the organisation.

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The Strategic Role of Design in Cultural Products and Services

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Keywords: Strategic Design Management, Cultural Products

In this conceptual paper we review the strategic use of design within the cultural industries. In order to do this we reference a number of bodies of theory, for example organisational strategy, services' and experiential services' design, culture and cultural industries' production, all of which are relevant to the understanding of the design factors that contribute to strategic success in the cultural industries. The strategic use of design is an undeservedly neglected area of design and design management theory in any context, but is especially so in these sectors. This is regrettable given their importance to the economy and/or well-being of the societies in which they are found (Hesmondhalgh, 2006).

Following a discussion of how design may be used strategically in most industries, we use examples to develop an understanding of the role of design in various cultural sectors.

The strategic use of design

Strategy is "the set of actions through which an organisation … develops resources and uses them to deliver services or products in a way which its users find valuable, while meeting the financial and other objectives and constraints imposed by key stakeholders" (Haberberg and Rieple, 2007, p7). Strategies include decisions as to the types, number and characteristics of the organisation's products or services, the physical locations where they are made and sold, the ways in which growth is to be achieved, for example through acquisitions or new product development, as well as the numbers of business divisions owned by a corporation. Most successful strategies give an organisation some property that is unique, or at least rare, that makes consumers want to buy their goods from it, as well as the means for renewing its

competitive advantage as the environment changes. For example, an organisation that has made a strategic decision to invest in developing the ability to create innovative products, or to develop a strong brand identity, may be better able to survive a hostile economic environment such as a recession better than an organisation that has not.

If we use this definition, we arrive at a number of ways in which design may contribute to an organisation's strategic success. It can:

- create products or services that consumers find valuable and wish to buy, that differentiate products from competitors' offerings (Pitsaki, 2010) and which competitors are unable to imitate or substitute. Such products conform to the definition of a strategic resource (Barney, 2001; Penrose, 1959); they are valuable, inimitable, rare and un-substitutable (Haberberg and Rieple, 2007, p 285).
- help to interpret, and make visible (Martin, 2009; Brown, 2008), the organisational and consumer factors that would enable executives to make better, more valuable, decisions
- shape an organizational or product-group identity or brand so that employees and consumers alike understand what the organisation is about. This:
    - reduces consumer search costs and emotional risk (Kuksov, 2004)
    - maximises consumers and employees' satisfaction and fosters long-lasting attachment to the organization (Pitsaki, 2010)
    - directs organizational decision making towards products and services that consumers wish to purchase and that produce value for both consumer and company alike (Rosenbaum-Elliott et al., 2011)
    - provides tacit guidelines that shape employees' behaviour, ensuring coherence and predictability in the organisation's products and services whilst also allowing product development to respond to changing consumer needs (ibid.)

Design can create both a new vision of what the organization 'is' and reinforce and anchor its established 'essence' through the creation of artefacts and symbols that others interpret and use to shape what they do. It may also provide an important element in the implementation of strategy, through focusing on product or service functionality or the creation of emotional or affective bonds. Understanding how design can aid the crafting and implementation of strategy is what we attempt to do in this paper, focusing specifically on products in which design is likely to be an especially important function – cultural products and services.

Cultural products and services

Culture is the sharing of an identity amongst a group of people. At one level, therefore, cultural products are those that engender a sense of belonging to a group. However, most authors assume that they are more heterogeneous than that, and encompass a broad range of product / service types, ranging from those that are heavily weighted towards the creation of a shared identity to those with a more aesthetic or emotional purpose. There is as yet no single

definition of a cultural product or service, although a number of different classifications have been devised (Table 1).

1. UK DCMS model	2. Symbolic texts model	3. Concentric circles model	4. WIPO copyright model
Advertising	**Core cultural industries**	**Core creative arts**	**Core copyright industries**
Architecture	Advertising	Literature	Advertising
Art and antiques market	Film	Music	Collecting societies
Crafts	Internet	Performing arts	Film and video
Design	Music	Visual arts	Music
Fashion	Publishing		Performing arts
Film and video	Television and radio	**Other core cultural industries**	Publishing
Music	Video and computer games	Film	Software
Performing arts		Museums and libraries	Television and radio
Publishing	**Peripheral cultural industries**		Visual and graphic art
Software	Creative arts	**Wider cultural industries**	
Television and radio		Heritage services	**Interdependent copyright industries**
Video and computer games	**Borderline cultural industries**	Publishing	Blank recording material
	Consumer electronics	Sound recording	Consumer electronics
	Fashion	Television and radio	Musical instruments
	Software	Video and computer games	Paper
	Sport		Photocopiers, photographic equipment
		Related industries	
		Advertising	**Partial copyright industries**
		Architecture	Architecture
		Design	Clothing, footwear
		Fashion	Design
			Fashion
			Household goods
			Toys

Table 1

Classifications of cultural industries (UNCTAD 2008, p 13)

For Hirsch (1972) cultural products are "'nonmaterial' (sic) goods directed at a public of consumers, for whom they generally serve an esthetic (sic) or expressive, rather than a clearly utilitarian function" (Hirsch 1972 p. 641). Many arise from an 'intentionally creative and/or intellectual act' (Colbert and Cuadrado, 2003: 17), although they are not wholly synonymous with creative products (CITF, 2001; Caves, 2000; Cunningham, 2009; Hesmondhalgh, 2007; Howkins, 2001); software or R&D, for example, have little or no aesthetic or emotional component. Some cultural products have the aim of enlightenment and education (Throsby, 2001) and therefore embody, potentially at least, some form of intellectual property as well as the generation and communication of symbolic meaning.

This definition produces a large and heterogeneous group of cultural products and services. It encompasses books, art, museum and art exhibitions, fashion apparel, recorded music, theatrical and musical events, amongst many others. These vary according to their degree of creativity, intellectual, emotional or symbolic component as well as a greater or lesser degree of tangible elements or ephemerality. These may be further categorized according to a range of factors: business to business (architecture, TV production) or business to consumer (software, performing arts); emotional involvement with the producer (theatre, music); emotional involvement with co-consumers (fashion, music); intellectual content (museums, art galleries); social wellbeing aims (museums, theatre outreach); economic aims (publishing; theatre); permanence (books, art); ephemerality (music shows, theatre). These various aims require different production and promotion methods, and therefore different design interventions if the strategic ambitions of the organisation are to be achieved.

For the purposes of this paper we focus on a small number of cultural products and services that require creativity in their development but also have an aesthetic, emotional, and/or identity-forming purpose. We tend to favour the categorisations of the DCMS and the Concentric Circles in Table 1; all of these cultural sectors have the four attributes that we wish to focus on. However, this provided us with too many sectors to discuss in a single paper. Hence we narrow down our focus to five cultural sectors: performing arts, fashion, museums and art galleries and publishing. This is a purposive sample, based partly on the fact that the authors have some knowledge of these sectors, but also because they provide illuminatory contexts in which to examine the strategic use of design.

The strategic use of design in cultural products and services

As introduced above, design can be used strategically in a number of different ways in organizations. Many of these apply to virtually all industries. They include making visible organisational decision-making factors (Eppler and Platts, 2009) such as organisational communications or interactions (for example diagrams of value chains or organisation charts), mapping or other visual representation of market research, purchasing patterns or consumer buying behaviour (such as charts, graphs and multimedia), marketing communications (such as brand guidelines, author or book series guidelines or advertising storyboards), video recording of audience reactions, or mapping of customer paths / interactions in an exhibition space or shop.

Design also has a strong role at an organisational level. Design can make a strategic contribution in building an organisational or brand identity and creating and controlling a coherent competitive stance. A clear corporate identity or brand works in a similar way to a product brand. It signals what the organisation is and does. This reduces consumers' search costs, helps to build loyalty and attachment to the firm and its products, and helps to create a 'tribe' of similar customers who gain further benefits from the associative value of being part of a group of individuals with similar preferences. Examples are 'Apple' or 'Boden' customers who not only like the products that these companies make (and would probably be blind to their faults in any case) but also enjoy being identified with the values that they believe the companies espouse. This is a deeply selective and interpretive process.

Competitive stance is the organisation's structure, operations, product price and quality positioning. Coherence in this helps customers to understand what they are getting in terms of quality or style, and the price that they are likely to have to pay. The competitive stance shapes employees' decisions about what products to make, to what price/quality standards, and how those products qualities are communicated, and also guides staff behaviour towards customers. Design's role here is to interpret and create the organization's products and services so that they are within coherent limits, or, if innovation is required, that they do not exceed the levels of acceptable differences.

Here, there are some definite industry-specific differences. In some industries, such as low-frills airlines, paring costs to the absolute minimum is the route to success, expressed through price competition and relatively little focus on product or service quality. Design in low cost airlines, for example, has to concentrate on the service build out – features that typically involve alliance partners which specialise in specific aspects of the value system. In this sector critically-important partners include caterers, cleaners, airports, airplane manufacturers and air traffic control agencies. Without these being coordinated, in terms of logistics, costs and quality, the fast turnarounds and efficient space utilisation on which the airlines depend would not happen and low prices could not be achieved. Design's role therefore is to create interaction points in which tangible elements are moved or transferred; to define and map service 'journeys' (involving customers, service providers and tangible elements) (Bitner et al., 2008); and to design environments in which customers' and employees' emotions can be managed (through using colours, light or textures to reduce tension at likely bottlenecks for example), or behaviour shaped.

In other industries, such as the manufacturing of luxury cars, product design and quality is equally important, but has a different focus and emphasis. The company's competitive stance is mostly achieved through internal control systems rather than through supply contracts or inter-connected systems. Although the firm normally works with suppliers, and supply chains may be tightly integrated, there is not usually the need to coordinate a number of external partners- the relationship is unidirectional rather than multidirectional. Internally, design may be used to achieve coherence through standards' manuals that define the required qualities or colours of materials, and through the design of buildings or showrooms to attract the desired type of consumer.

For the cultural industries, design has to achieve other outcomes such as aesthetic effects, the creation of an emotional tie between the service provider and the consumer, or the sense of belonging to a community. In some cultural sectors, design has to create a sense of identity that attracts some consumers and strongly deters others. In many cultural sectors there is also a much more direct connection between the producer of the cultural good and its consumer, so design also has a role in attracting the creator to the place in which their products are consumed.

Table 1 summarises the key design applications in our chosen cultural sectors.

Cultural sector	Product examples	Main function / services	Examples of strategic design applications
Performing arts	Dance Theatre Opera / musicals	Aesthetic Entertainment Attracting performing artists	Experience design Creating spectacle Use of visual, aural, olfactory senses shaping emotions
Fashion	Clothing Footwear Accessories	Functional Aesthetic Identity forming	Service touchpoints Design of fashion shows Creating spectacle Use of visual, aural, olfactory senses Manipulating emotions Product quality and style
Museums (non-commercial)	Events and exhibitions Dissemination of research · Publications · Books · Digital media	Education Aesthetic Public good Socio-cultural Intellectual property management Cultural heritage preservation	Experience design Designing interaction touchpoints Exhibition space Selection and commissioning of exhibits
Art galleries (commercial)	Exhibitions Art works – paintings, sculpture etc.) Publications Books	Identity forming Aesthetic Intermediary between artists and buyers Commercialization of cultural goods Star system Socio -cultural	Experience design Design of promotional materials Designing service and interaction (artist, and artefacts) touchpoints Exhibition space design Selection and commissioning of exhibits
Print publishing	Books e-books Magazines and journals	Education, Entertainment	Design of values • Aesthetic • Content Design of publishing /production processes

Table 1 Design applications in cultural sectors

Performing arts

The performing arts include dance, theatre, opera and musical theatre. Design is intrinsic to these sectors because they are an inherent aspect of the aesthetic or entertainment qualities of the product. The design of the performance area, the stage, also has to be spatially functional, as well as visually and/or aurally effective.

But design in the performing arts has a number of strategic applications beyond the product itself. There are a number of areas where design can shape organisational performance in recognising that customers co-create their hedonic experiences (Holbrook and Hirschman, 1982) and their experience 'journey' and creating an organisational identity that attracts performers and customers alike. Design also has a role to play in the design of quality into supporting services such as workflow, crowd control and ticketing; all areas that are "commonly under-emphasized and which warrant more prominence" (Hume, 2008).

Certain design elements are likely to increase repeat purchase (Radbourne et al., 2009). Customers are likely to be repeat attenders to events in which they feel emotionally comfortable and to which they have a social affinity (Andreasen and Belk, 1980). Design can shape consumers' emotions through using a range of visual, aural, and olfactory stimuli (Kotler, 1997) applied to a range of key elements - stage set-up, costume/dress, instrument placement, technology usage, lighting and movement. All affect musical aesthetics (Jones, 2011) and the overall emotional response to a performance.

Design inputs to emotional experiences range from:

- the shape of the performance space - intimate (theatre in the round), frightening (proximity of lions / sharks in circuses);
- the creation of ambience - such as rowdiness or the use of tatty rooms for stand-up comedy);
- aural inputs such as loudness (the volume of rock concerts); quiet (classical music recitals), or the shape of supporting spaces, for example designing the entrance to be crowded so that audiences feel part of a popular event.
- olfactory - the smell of stale beer to create the 'studenty' atmosphere that attracts a youthful audience to some categories of events

In the performing arts, consumers also benefit from associative power. Audiences gain additional benefits if they share the experience with others, for example if they laugh when others in the audience are laughing at the same thing. Arts' customers gain from feeling that they are part of a group of like-minded individuals, for example because they dress alike or share similar musical tastes. Sometimes the performance is a ritual in which the audience is complicit with the designer of the experience - examples being where both the audience and the performers dress up either under specific instruction to do so (Olde Time Music Hall) or through being in the know (opera audiences). Similarly, cross referencing design elements to other cultural events or genres increases the feeling of being part of a distinct, exclusive, group. Examples, include the use of 'gothic' graphics and imagery on music show tickets, confirmed when much of the audience turns up in goth makeup and clothing.

Fashion

The fashion industry includes the design and manufacturing of clothing, footwear, and other items of apparel such as jewellery and accessories. For many companies it also includes retailing, as many apparel design companies are integrated throughout the whole value chain. The fashion industry is thus a complex one, with possibly the widest diversity of organisational types and sizes of any industry. Its products are similarly diverse, including those which are purely functional (work clothes) to those which are wholly aesthetic (jewellery). For some apparel firms such as workwear manufacturers belonging to the 'fashion' industry is a misnomer as they produce garments that are unchanging from year to year; for others, they are part of an identity-based and fast-moving trend movement whose designs change on a regular basis.

Design's contribution depends on the strategic contingencies of the firm and the products it makes. In the non-fashion, commoditised, sectors such as workwear but which also include products such as t-shirts or jeans which reproduce the same designs over and over again (Rieple and Gander, 2009), critical success factors are the standardisation of low-cost manufacturing and distribution of functional garments. Because commoditised apparel cannot by most definitions be considered a cultural product we do not discuss it in depth here. At the other extreme, however, although manufacturing and distribution costs are important, the most critical success factors are highly cultural, relating to socially-constructed aspects such as membership of 'tribes' and trends, and emotional attachment to products and brands.

Design, for example, has a role in nodes such as fashion shows, within which the 'meaning' of a design is negotiated and reified. Fashion shows are theatre, like the performing arts and need similar design inputs such as lighting, space and sound in order to create specific reactions in the audience, and like the performing arts, need to have coherence between the product and the theatre in which it is displayed. However they have a different purpose; instead of proving entertainment or enlightenment, fashion shows exist to create a buzz around the clothes, and often the designer - who nearly always takes a theatrical bow at the end of the 'performance'. Although shows have the ultimate objective of increasing the firm's sales and/or profits, they do this partly through the working up of a distinct genre identity that other designers will participate in through mimesis, thereby creating an economically viable pool of competitors and buyers who both have to buy in to this season's must-have colours or styles. The shows, in order to do this, must capture the attention of the media as well as the fashion community as a whole, so that themes and trends may be disseminated to suppliers as well as buyers and competitors. Designer fashion is an example of a co-opetitive process (Brandenburger and Nalebuff, 1997) in which competitors are co-dependent for success, but differs from other co-opetive industries such as digital video disks because there are no formal contracts to agree areas of collaboration.

Design is also important further down the value chain. One of the reasons that fashion companies are forward integrated into their own stores is so that they can control the experiences and emotional reactions that customers have to their clothes through

manipulating the environment in which they view and buy them. This is both an inclusive and an exclusive process, and is another way in which customers can identify themselves as, for example, Gucci or Westwood 'types'. Design within retail environments uses layouts, space, lighting and sound to create an atmosphere of value or quality. It can also shape how employees interact with customers in terms of frequency or physical proximity at the various service touchpoints within the store.

Museums (non-commercial)

In the case of museums and art galleries we have chosen to distinguish between those that have a non commercial purpose (in this case museums), and those whose primary function is to sell the works exhibited (we use the example of art galleries). Design is used similarly in some aspects of each, such as the creation of experiences and exhibition layout, but has some important differences between the different types of organisation.

Events and exhibitions in non commercial museum settings have a public good function - to manage research resources, preserve cultural heritage and manage intellectual property. They typically have to educate and disseminate information about their work, and often, therefore, to provide additional materials such as books and digital media which can be used by other participants in the dissemination process - schools, universities or government agencies.

In the first place, therefore, design has a role in the creation of effective and efficient storage and retrieval systems in which collections can be catalogued and retrieved at will for use by researchers and the public alike. The second aspect is to create exhibitions that are coherent with the museum's objectives and competitive stance, and that are both functional and aesthetically attractive to visitors (Scott, 2009); design has an important role in the selection and commissioning of exhibits so that they form a coherent whole. Two components are particularly relevant here - space and footfall pathway design and experience design. Many museums have become expert at using defined routes to shape visitors' experiences as a sequence of narratives, emphasised through the use of appropriate sound and lighting. Some use interactive equipment to engage visitors' emotions and reduce boredom - particularly relevant where children are the desired demographic.

Art galleries (commercial)

Commercial art galleries use design in many of the same ways as non commercial museums to - to create an aesthetic display of art works such as paintings or sculpture, around which visitors may move and experience emotional reactions to the exhibits. These have to be chosen with the same attention to coherence, whether they are works produced by the same artist or different artists. Print and digital media materials also need to be developed, on this occasion mostly for publicity purposes.

But in the case of commercial art galleries, like in the fashion industry, part of design's function is to create an identity around the artist *and* the buying community that visit the galleries and buy the art. Customers have to feel that they belong – that they are part of a group of like-minded individuals. Part of the benefits of attending galleries is the sense of performance or occasion, often enhanced by interactions with the 'star' - the artist, who, like fashion designers, is complicit in the performance element of the display.

Print publishing

Print publishing includes books, e-books, magazines and journals. These have a varied purpose from education to entertainment and therefore a number of target consumers. There are a number of different roles for design, depending on the type of product. For 'star' authors, design's role is to create an aura through identifying and promoting the author's 'brand' values in exactly the same way as a corporate or product brand might be created (Pitsaki, 2010). This is through identifying iconographic elements that can be added to any promotional materials or book designs, to theatrical 'shows' such as 'meet the author' events that in some cases aim to create a mythology around the person/brand. A similar process can be applied to a story's characters, turning them into branded "stars", Harry Potter or the Batman comics being good examples. However, Hesmondhalgh cautions that "until the author becomes a star, genre is paramount" (Hesmondhalgh, 2002: 21).

Thus design also has an important role in communicating an imprint, book or book series' values. This may be through coherent graphics on a series' jackets, through the quality of paper, or the use of 'classic' versus 'creative' fonts or colours. Aesthetic principles signalling quality have to mirror the publication's content, so that there is a coherent stance between the tangible artifact, its content and the consumer segments being targeted. Such coherence has to extend to distribution channels (for example the design of browsing areas in bookshops) and product extensions such as websites.

Publishing a branded and coherent book series provides benefits to both the publisher and the public alike. The use of consistent thematic graphic design on the books' covers makes the series easily recognizable at sales points, and helps stimulate associations with other works in the series that persuades consumers to buy other series books. Series brands reduce customers' search costs and risks. It also encourages the development of a shared identity, of readers who gain associative benefits by being grouped with other like-minded individuals - Harry Potter or comic book fans. Sometimes, as with music or fashion products, cross-referencing takes the form of the adoption of shared clothes' styles or music.

Having a strong series identity also reduces the chances of management errors or improvisation during the development process, and increases the probability that production costs will be minimised.

Conclusion

In this paper, we have identified a number of areas in which design can contribute strategically to the success of an organisation, and used a small number of cultural sectors to illustrate this. Our paper is necessarily short, and does not pretend to provide any detailed evidence on the specific aspects of design that create the most effective organisational performance in each sector. That research remains to be done; the cultural industries are undeservedly neglected in respect of the relationship between design and performance.

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Old industry, new thinking: towards a model of design management in the fashion retail industry

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Though design management is widely acknowledged as valuable, there is a shortage of recent research findings. Consequently, contemporary practice amongst rapidly evolving service industries may diverge significantly from established thinking. Retailing in particular has received scant attention, in spite of the sector's maturity, degree of design intensity and agile nature. This paper seeks to help redress this imbalance with interview-based case studies of design management in six leading fashion retailers. The findings reveal a distinct 'strategic design leader' role privileged by formal design training and another 'strategic manager of design' role. These provide the foundations of a preliminary model, by depicting more accurately the current role of design management in the fashion retail industry, thereby helping to develop understanding in both academic and practical contexts.

INTRODUCTION

Retailing is an ancient industry dating back millennia (Kieser, 2009) and is of enormous economic and social importance both in the UK and globally. Estimates suggest by 2015 the UK retail market alone will be valued at £312 billion (Datamonitor, 2011). Changes to patterns of consumption (Solomon, 2010) and increased competition have led certain sectors such as apparel to develop highly volatile properties (Christopher, 2005) especially in fashion segments (Cachon and Swinney, 2009). Fashion is characterized by three strategic elements: shortening lead times, (Barnes and Lea-Greenwood, 2006) downward cost pressures (McColl and Moore, 2011) and higher fashion design content (Hines and Bruce, 2007). Key fashion retailers have responded by internalizing design resources where greater control of these factors is afforded, particularly with the evolution of own brands (Abecassis-Moedas, 2006). Commensurately, the requirement for design management has increased over the past 20 years.

Despite these intriguing aspects there is a paucity of research in the retail field (Vasquez and Bruce, 2002) and more generally in the service sector, (Hollins et al., 2003; Kimbell, 2009) where the nature of design management may have diverged significantly from that described to date. Moreover, research '*per se'* in design management is "remarkably scarce", (Chiva and Alegre, 2009) is principally hierarchical and concentrated along a process-orientated tract. Kent and Stone (2008) contend whilst these approaches contribute to knowledge they are out of step with practices in the retail sector. More critically, McDermott (2007) warns much current thinking lacks rigor and is based on academic theorizing producing a "debased 'airport paperback' genre that relies on anecdotal evidence" p.85.

Addressing these shortcomings, this exploratory study examines the role of design management in six leading fashion retailers. Evidence from in-depth case study interviews provides individual narratives and aggregated analysis generates broader trends. Whilst, these support elements of extant literature, we also find greater complexity in practice that contradicts some current thinking. This is characterised by a distinct division in these organizations, between 'strategic design leaders' with formal design training, simultaneously leading and managing and others we term 'strategic managers of design'. From these findings, a preliminary model of the role of design management in the fashion retail industry is developed that shall be validated as part of a broader on-going study.

LITERATURE REVIEW

Design management emerged as a distinct entity of academic interest with Farr's (1966) description of a 'design manager' role, responsible for coordinating activity between design agencies and clients. Gorb (1990) 'codifies' design management as the "effective deployment by line managers of the design resources available to an organization in the pursuance of its corporate objectives" p.2. Design is recognized as a powerful strategic tool (Best et al., 2010; Kotler and Rath, 1984) if nurtured in organizations, (Verganti, 2008) offering a combination of differentiation (Jun, 2007) and cost attributes (Borja de Mozato, 2003) in addition to developing the culture and identity of a firm (Cooper and Press, 1995).

Because of its origins rooted in a paradigm of design as a science (Sebastian, 2005) articulated by the Bauhaus movement, further enhanced by Simon's (1969) notion of rationality, design management research typically adopts either a functionalist (Johansson and Woodilla, 2008) Porterian (1985) value chain construct or an NPD stage gate process orientation (Bruce and Bessant, 2002). Thus, the role is described as principally focusing on managing the design process, (Bruce et al., 1999; Sebastian, 2005) organizing a problem solving activity that adds value (Chiva and Alegre, 2009) at several levels depending on the maturity, (Borja de Mozato, 2003) strategic positioning of the firm or philosophy of founder or CEO (Song and Chung, 2008).

Design management encompasses a range of diverse activities and literature typically sets these hierarchically in either two (Topalian, 1986, 1994) or three strata. Borja de Mozato (2003) terms these operational, functional and strategic. Cooper and Press (1995) present a comprehensive approach with first, "Design Activity Management" administrating design projects. Second, "Middle/Functional Management" responsible for integrating design into all business functions and third, "Board/Top Management" accountable for defining and embedding 'design vision' encompassing product, communications and environment into corporate strategy. A summary of the design management activity literature at these levels is presented in table 1 on page 16.

Taking the limited retail specific literature related to the role in practice, Vasquez and Bruce

(2002) outline a set of design management activities in food retailing inline with the stage gate process. These scholars conclude, design management is a 'management' as opposed to a 'design' activity in accord with the earlier assertions of Cooper and Press, (1995) requiring detailed planning, coordinating and evaluation activities in a highly complex multi-factorial process with numerous stakeholders (Cooper et al., 2003). Hence, the role primarily focuses on communicating and integrating brand values company wide, ensuring consistent execution of all design elements (Vasquez and Bruce, 2002) supporting Olin's reasoning (1985).

Similarly, Abecassis-Moedas (2006) proposes that the role in the clothing value chain focuses on active integration and coordination, particularly in fashion driven organizations with shortening lead times. Indeed, Cooper et al., (2003) argue design quality and the facilitation of optimal knowledge transfer are contingent upon these roles, in association with 'adept' communication and negotiation between the 'nodes' in knowledge intensive organizations (Capetta and Cillo, 2008). Hence, this reinforces the notion of a "project management, problem tracking management" role (Montana et al., 2007). However, Kent and Stone (2008) argue practice in sectors such as retailing exhibit greater complexity and require flexible thinking as opposed to top down or linear approaches. Others, concur, arguing a process orientation has "straight jacketed" creative elements (Amabile and Khaire, 2008, p. 105).

Contemporary discourse at a 'strategic' level also reveals contradictory views. Certain scholars for example, make distinctions between management dealing with the status quo and leadership that deals in change (Kotter, 1990). According to Gloppen (2009) and Turner (2000) these are distinct entities - "design leadership helps define the future, design management is a tool for getting there". Turner and Topalian (2002) for example, introduce a 'design leadership' role: "leading through design, … sustaining design leadership over time and gaining acknowledgement for achievements through design". Six activities are identified: "Envisioning of the future, manifesting strategic intent, directing design investment, managing corporate reputation, creating and nurturing an environment of innovation and training for design leadership".

Hargadon (2005) alternatively argues the role shifts from an exclusively product and brand focus to a mode of "strategic conversation" using 'designerly' principles generating new business ventures. Similarly, Gloppen (2009) moves the frame from "strategic design management" to a "leadership philosophy". However, little literature identifies any direct linkages between "design activities [and] the process of strategy formulation" (Ravasi and Lojacona, 2004). Hence, the role at a 'strategic' level remains nebulous (Roald, 2006).

Drawing literature together, on one side scholars reinforce the notion of a "project management" role orientated around active coordination, (Montana et al., 2007) effective communication, planning and integration (Chiva and Alegre, 2007). These, in association with regular audits and evaluation deliver high quality design outputs (Bruce and Bessant, 2002). Strategically, design management's role at lower levels either implements or potentially informs the design strategy development process (Best, 2006; Jun, 2007). On the other, academics argue the constant focus on linear process (Kent and Stone, 2008) and a fascination with evaluation (Joziasse et al., 2008) fail to address the needs of contemporary practice.

At a 'strategic' level the role is more confused. On one hand, it is a 'strategic planning' role formulating and communicating design policy, optimizing resources (Siegel in Best, 2006). On the other hand, it is a 'leadership' role envisioning a future state (Turner and Topalian, 2002) or going further, an entirely new way of conceptualising organizations (Hargadon, 2005). Perhaps, these debates allude to the difficulties of developing a unified approach in a

field characterized by the diversity of industries within which design management operates and a lack of empirical studies. Andrew Van de Ven (2011) offers sage advise, suggesting complex problems such as these are more likely to be understood through engagement with practitioners, as opposed to dichotomous approaches to research and practice. Hence, the next section sets out the methodological approach adopted to address these issues, before drawing together the findings and enfolding the literature to develop a preliminary model of design management in the retail industry.

METHODOLOGY

The aim of this study is to further understanding of the role of design management in the fashion retail industry and it forms part of a wider ongoing study. Fashion comprises apparel, footwear and accessories (Hines and Bruce, 2007). The rationale for focusing on this sector is twofold: first, it presents an opportunity to examine the role of design management in a mature, design intensive sector that exhibits a high degree of environmental velocity (McCarthy et al., 2010). Second, the researcher's previous experience in the industry provides valuable access opportunities and though this may prejudice impartial inquiry, Collins (2004c) argues "interactional expertise is a third kind of knowledge".

As this study seeks to develop an in-depth understanding of the current role of design management the following research question is investigated: "What are the key roles of design management in large fashion retailers?" Exploring practices and perceptions in retail organizations suggests a critical realist (interpretive) approach is adopted "as social science has no absolute, universal…or… value free truths" (Van de Ven, 2011).

Six large retailers were selected for case studies according to Eisenhardt's (1989) recommendation. To fulfil the selection criteria all are UK based, employ over 500 people, (BRC, 2010) in-house design teams and are 'design leaders' in the market segment in which the firm operates. 'Design leaders' may be defined as design driven organizations (Lili et al., 2009) that explicitly acknowledge design's centrality at a corporate level (Ravasi and Lojacono, 2004). Approaches were made through personal contacts and snowball sampling (Robson, 2006). Data was collected in twenty-four semi-structured interviews lasting between 60-180 minutes between March and July 2011 with the senior individuals responsible for design management in each organization (table. 2). Additional interviews were conducted with senior commercial management in each organization to triangulate data. References to individuals and organisations are anonymised due to retail industry sensitivity.

Firm		H	I	K	L	M	N	Group total
CEO								
Director	Group A	1	1	1	1	1	1	6
	Group B	4	3	1	2	1	3	13
	Group C	2	1	1	1	-	1	5
	Firm total	7	4	3	4	2	4	24

Table 2: Summary of participant firms and interviewees

Following the literature review, where much previous research adopts a hierarchical and/or a process orientation, a graphical research framework was developed to both engage practitioners (Robson, 2006) and allow data to be elicited and represented visually (Crilly et al., 2006) without a priori assumptions. Initial inputs for the framework were synthesized from the roles described in literature: planning, integrating, coordinating, selecting, communicating, protecting, evaluating, auditing and envisioning. Several formats were

piloted before a non-linear ‘mosaic’ approach (fig. 1) was adopted.

Figure 1: Synthesised roles of design management ‘mosaic’

Initially, interviewees were asked about their background, experience and position in the firm. Subsequently, they were invited to describe their role in detail before the ‘mosaic’ was introduced, interviewees then elaborated on the roles they perceived as relevant and roles could be rejected or added. The researcher only provided information if the interviewees explicitly requested clarification. A Likert Scale of 1-10 was also employed to elicit comparative numeric data with sufficient granularity on the perceived level of importance of the roles. Data collection and analysis was an iterative process so as new roles were raised by interviewees these were added in subsequent interviews. Following three interviews, the ‘mosaic’ was reviewed and in light of the possibility a hierarchy from the relative position of the roles was subliminally perceived, (Crilly et al., 2006) the ‘mosaic’ was deconstructed into role cards. Subsequently, interviewees were asked to sort/add/reject and rate the role cards and the visual results were scanned, producing interviewee specific ‘mosaics’. All interviews were recorded, fully transcribed and coded manually in preparation for analysis.

RESULTS AND ANALYSIS

Initially, this section sets out the results following analysis of the numeric data collected on the perceived relevance of the roles. Subsequently, the descriptive data generated in interviews is used to elaborate on the roles of design management before a preliminary model of design management in the fashion retail industry (Fig. 3) is introduced and described.

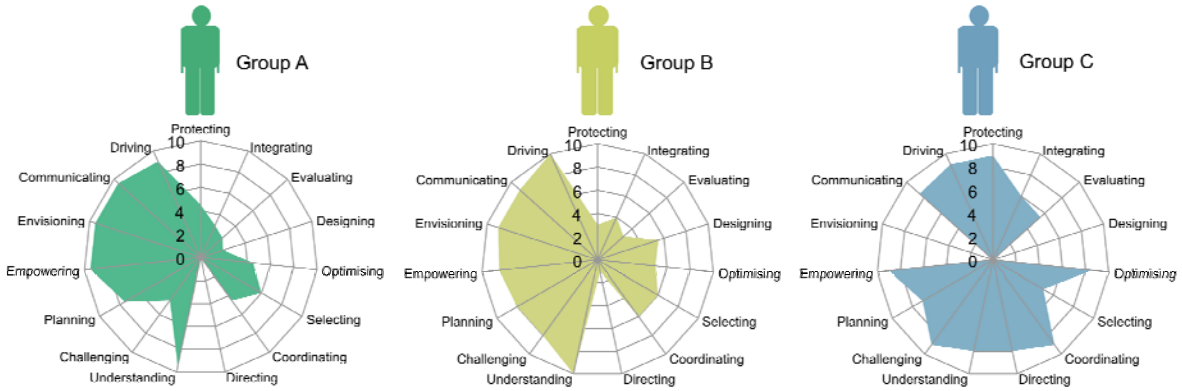
Numeric Data Handling

First, the numeric data from each interviewee’s perceptions of the roles was tabulated to produce an individual scorecard. Second, using the interviewee’s position in an organisation, data was aggregated into three groups, A, B and C. Third, in order to generate comparable results, total values for each role were then calculated (fig. 2). Within each of the groups a degree of variance is evident in perceptions to the roles; in certain cases this was low where there was a high level of consensus between interviewees. In others, it reveals significant differences. Radar diagrams (Fig. 2) were then produced using the values.

Results by group

Group A show a distinct trend with five roles (and a high level of consensus) scoring 9 or over, listed in descending order: envisioning, understanding, empowering, communicating and driving. The next two roles planning and selecting, scored 7.5 and 6 respectively. There

was then a step down to protecting, optimizing, challenging, coordinating, integrating, evaluating and designing. Both directing and auditing were rejected.



Role	Value	Variation in perceptions
Protecting	4.5	High
Integrating	3	Low
Evaluating	2.5	Low
Designing	2	High
Optimising	4.5	High
Selecting	6	High
Coordinating	4.5	Low
Directing	0	n/a
Understanding	9.5	Low
Challenging	4.5	Low
Planning	7.5	Low
Empowering	9.5	Low
Envisioning	9.5	Low
Communicating	9.5	Low
Driving	9	Low

Role	Value	Variation in perceptions
Protecting	3	High
Integrating	4	Low
Evaluating	3	Low
Designing	5.5	High
Optimising	5	High
Selecting	6	High
Coordinating	6	High
Directing	1	n/a
Understanding	10	Low
Challenging	8	Low
Planning	8	Low
Empowering	8.5	Low
Envisioning	9	Low
Communicating	9	Low
Driving	10	Low

Role	Value	Variation in perceptions
Protecting	9	Low
Integrating	6	High
Evaluating	5.5	High
Designing	0	n/a
Optimising	8.5	High
Selecting	5	High
Coordinating	9	Low
Directing	8	Low
Understanding	8	Low
Challenging	9	Low
Planning	7	Low
Empowering	9	Low
Envisioning	0	n/a
Communicating	8.5	Low
Driving	9	Low

Figure: 2 Results of perceptions of roles by group shown as Radar diagrams

Group B exhibit a very similar profile to Group A, with understanding, driving, envisioning, communicating and empowering as the top roles in descending order. Following closely, planning and challenging were rated with scores over 8. Below, coordinating, designing and selecting scored 5.5 and above. Lower scores were recorded for the integrating, protecting, evaluating and directing roles. Again, this group rejected auditing.

Group C display a distinctly different pattern from both other groups. Five roles score 9 or more: driving, empowering, challenging, coordinating and protecting. Followed closely in descending order by; communicating, optimizing, understanding and directing - all scoring 8 and over. Continuing down in importance were planning, integrating, evaluating and selecting. Notably, envisioning and designing were rejected by this group, as was auditing.

Overall 15 roles were identified from the interviews (auditing was rejected) and the results indicate a strong correlation between the roles of Groups A and B with a cluster of 5 roles in distinct contrast to the characteristics displayed for Group C. Two roles also emerge as specific to Group A and B, namely envisioning and designing. At this juncture it is important to note all these individuals have formal design training whereas those in Group C do not. Given these findings, Groups A and B may be considered as a homogenous entity so shall forthwith be referred to as Group AB.

Summarising these results, we reveal the relative weighting and both new and rejected roles in comparison to literature. The next section uses verbatim interview extracts from each group (interviewee reference codes in brackets are derived from table 2) to both elaborate on these findings and provide the rationale for the preliminary model.

Rejected role

Although auditing is strongly positioned in literature (Gorb, 1990; Topalian, 1994) it was rejected by all and this extract provides some commentary as one head of design pointed out:

> *"It's not a 'designy' word is it…does it refer to the finance team… why [would] I be paid to spend my time looking backwards when the value is all about looking forwards… it's not a design management role" (N B1)*

Group AB - Perceptions of the design management roles

Overall Group AB's results diverged from the roles described to date in literature to a greater degree than Group C and are particularly aligned to a design centric nature and this is evident throughout all the roles. Five roles were dominant in the perceptions of this group and underline this design centricity, the first two are Group AB specific:

Envisioning

Literature describes defining and embedding design vision at a senior level (Best 2006, Borja de Mozato, 2003) and "envisioning the future" (Turner and Topalian, 2002). However, this also relates to leading specific design activity as a design director explained:

> *"I have a view that if it's out there it exists so it's all about being unique and creating space for uniqueness and an opportunity to shine. It's not about having a formula and not about compromising …it is about keeping the purity. We are designers so we lead, not follow and are not driven by anything other than our passion. I see the design team every day, we are about to start Winter '12 so it could be that particular yellow could be great for knitwear… it's about a conversation… starting with a blank sheet of paper." (K A1)*

Others go further, not only imagining a fashion specific vision, but constantly driving strategy across the entire business:

> *"Every single day it's about outside the box thinking, free, free thinking that's how design should be, that's why we have got to where we are… to be light on our toes… be young, spirited and creative. I have lots of ideas not just about fashion, but about other parts of the business, that comes naturally and I'm allowed by the business to be like that… I suppose I need to be fluid, young minded and a risk taker." (L B2)*

These results reveal a dynamic unstructured approach to creating strategy in stark contrast to formulaic approaches based on design audits (Topalian, 1984) SWOT analysis or Porter's (1985) value chain constructs (Borja de Mozato, 2003).

Designing

Closely linked to envisioning is a fundamental design role that questions Olins (1985) assertions and contrasts with the findings in food retailing (Vasquez and Bruce, 2002) and is either a 'hands on' role as described by one design director:

> *"I am also the designer, it's not that you let go, I love clothes, fabrics, colour and love creating them…I start with my ideas and then … discuss it with the 'Heads of' they'll are also part of it, they bring their ideas …but I retain creative control…to create the collections" (M A1)*

Alternatively, it takes the form of a proxy role as this head of design explained:

> *"Even though I am now leading the teams here, I am designing everyday, it's just that I think of the design team are an extension of myself, kind of design by proxy" (J B2)*

Communicating

Effective communication is widely described (Borja de Mozato, 2003, Cooper and Press,

1995) as both direct communication between design management and designers and the transmission of information to broader groups to engage stakeholders (Chiva-Gomez, 2004) and the results are strongly supportive. Group C describe a role 'translating' communications cross functionally. However, what is evident is a specific non-verbal creative slant Group AB individuals regularly use to convey knowledge at a senior level:

> *"I…like to articulate what the end thing should look like, I always want to draw. It's deeply rooted in my love of colour and form. A picture speaks a thousand words so the main board can understand complex issues" (J A1)*

Understanding

Building on the previous interview extract, scholars argue effective design management is contingent upon understanding both the external market and the internal capabilities of the firm through a process of research (Bruce and Bessant, 2002). Results do indeed indicate this role is critically important but go beyond this to reveal layers of complexity that have not been described in literature to date encompassing both a creative side:

> *"I understand the formula of a collection, all the ingredients. I understand about grading patterns, ordering the best buttons and the perfect fabric for a particular garment. You either have the ability to do this role or not "(K A1)*

> *"What's key to understand is that an important part of design management is the constant continuity… holding the history, but also the present and future. My role is to ensure everyone in the business understands that…it's also about understanding our heartland heritage … the intrinsic value …and …what beautiful things are" (H A1)*

In addition this role also has a strong commercial orientation:

> *"I understand about margins… what a customer is thinking, how a customer compares products…you know fair exchange is the engine of trade. Without value, there is no trade" (H B2)*

Group C share elements of this centred on customers, production, costs and risk.

Empowering

In association with the roles outlined above, empowering is perceived as a primary role and one part correlates, in terms of providing a supportive environment for designers, (Cooper and Press, 1995) balancing "autonomy and control" (Bruce and Bessant, 2002, p.164). Another part is inadequately described to date; particularly where management provides guidance and confidence from a design angle in these high velocity retail environments:

> *"It's …really, really important that they have ownership over what they have to work on for the next 6 to 9 months. If it's just me putting my thoughts on to them, there could be a struggle so that's why …I'm there to kind of hint and suggest "this would be good …but it's important that they have ownership [and] believe in it themselves" (J B3)*

Empowering was also strongly rated by Group C, though this related directly to the management of the design resources and did not have a creative element. One other role was of high importance to both Group AB and Group C and provides a valuable insight into the nature of the design management role in the fashion retail industry:

Driving

Typically design management is described in passive tones. In practice, a driving role is consistently strong for both groups. One interviewee in Group AB described typical activity:

> *"Every Monday…we look at best sellers, then we all ask as the board - okay that's fabulous… what's new? And that's always the question… it's part of our culture. People*

all look for … new innovation, new fabrics etc… taking risks, driving the innovative heart. If you don't do that you decline, it's about understanding 'outstanding' and having a vision and you never stop - you have this divine discontent" (J A1).

An interviewee in Group C stressed this is also about engendering this throughout the team:

"Driving is really key, it is linked to resilience. It's a balance so you don't become … dominating. But someone has to drive it…so they can all drive it as a team." (N C1)

Planning

In the case of planning where there is a close correlation with literature with a detailed role, (Borja de Mozato, 2001) a surprising depth and detail is revealed for Group AB. This is evident even where planning is delegated downwards, as this response illustrated:

"Planning is absolutely vital… how to make things strictly to timing… for example we have started Autumn 2012 already, so must plan how we coordinate our 35 pattern cutters on the collections to ensure we meet our deadlines for the catwalk"(L A1)

Group C - Perceptions of the design management roles

Whilst, the roles above set out certain generic roles that are also important for Group C, this section looks at the roles highlighted by Group C. These are with the exception of one, namely directing, also relevant to Group AB so where appropriate a commentary is added:

Optimising

Part of the results supports the view that design management both sets high standards and constantly strives for improvement (Vasquez and Bruce, 2002). Descriptions generated in the interviews also infer an extension to this with a highly dynamic role, constantly seeking to leverage both actual and potential design resources. Further, this suggests both groups are strategically active and opportunistic as one Group C interviewee stated:

"I work closely with the DD looking at where we can have a greater impact and deciding where we think we can push harder… I am constantly thinking about where the opportunities lie and whether we have the right design and technical resources in place… thinking in advance so we can optimise the work we put in" (H C2)

Challenging

Challenging is a key role that was introduced during the course of the interviews and reinforces the notion introduced above, of the proactive nature of design management and is rarely evident in previous studies other than in relation to conflict in organisations (Cooper et al., 2003). The results relate it primarily to efficiency as echoed below:

"A key part is challenging the status quo regarding the pattern room…its essential to the development of new concept garments… it slips down the agenda as people just expect it to be ready when they want something running up… so I'm constantly raising this issue with the design director as it's my job to ensure it runs efficiently" (H C1)

Group AB not only challenge the organisational 'status quo', but from a specific design perspective perceive a valuable element of the role is challenging customers:

"We constantly need to make sure we don't sit back and do… what people expect…we are design leaders. You have got to challenge what they [customers] think of us…it's a tightrope we walk between safety and excitement and that's a constant challenge" (J B2)

Protecting

In relation to the protecting role, all of Group C perceived this as critical, particularly in relation to the firm's strategic assets including IP (Best, 2006; Topalian, 1994). Select individuals also broadened this role:

> *"It's about protecting our place in the market... the brand, protecting our kind of ethics, the way we do …business and nurturing my team" (J C1)*

However, the majority of Group AB voiced views at the opposite end of the spectrum:

> *"Really, I don't think it's a protecting job. It's about kind of looking forward…so for me it's only about ensuring we are really fashion forward" (H B1)*

Evaluating

Numerous scholars position the evaluating role as central to design management, (Best, 2006: Borja de Mozato, 2003) yet in practice this is deemed a low priority. Overall, interviewees held a deep antipathy towards the formal analytical evaluation techniques purported in established literature such as KPIs (Borja de Mozato, 2003). For Group C, this role typically encompassed budgetary components related to design teams needs:

> *"[I] justify…the budgets spent on new technology for the design teams so I [analyze]… what we need and work out where we will get the maximum value" (N C1)*

Integrating

Similarly, perceptions to integrating diverge from much established thinking, as on one side Group C related this primarily to technology:

> *"I act between technology and design, integrating either new technology into design or vice versa… currently I looking at new technology for fabric printing" (J C1)*

Group AB's score was very low and suggests integrating is not relevant as there is a high level of design integration in these retail organisations, supporting earlier studies (Vasquez and Bruce, 2002). However, certain individuals suggested the term 'collaborating' more closely matched their role as:

> *"The designers are very embedded in the departments… they 'gel' as a team. And what I've really driven … is that it isn't design and buying, it is one team." This is driven from the top as (H A1) is… passionate about team… collaboration, respect." (H B2)*

Coordinating

The high level of integration raised above also relates closely to coordinating as one Group C interviewee's response revealed:

> *"Would it be coordinating the team or other people? I think that's quite a boring thing, I can't comment as people… just instinctively understand what they need to do" (K C1)*

From an alternative angle coordinating is important from a highly product orientated perspective for Group AB as one head of design recounted:

> *"Making sure it works for the brief… coordinating with the rest of the collection. But also making sure …it doesn't coordinate too closely. You don't want everything looking like… a matching part of a jigsaw, that's what gives us our product differentiation" (M B1)*

Selecting

Results both support and build on views that selecting is a core design management role (Borja de Mozato, 2003; Topalian, 1994). However, there was considerable variance as certain Group C individuals rarely recruited designers. These organizations are also characterized by stability and low turnover so this is a lesser role for Group AB too.

Potentially, however the results belie the importance of this role as recruiting the highest calibre designers was paramount. Interestingly, a second design related strand previously only described as a collaborative buying and design approach by Varley (2008) surfaced and is a considerable part of this role for some individuals:

> *"As I talk to the press a lot, I show them an edited collection that …look[s] newest and [is] what we want to push. I spend quite a lot of time putting it together, to show how we are evolving… in a way it's not about selecting it's about curating." (L B1)*

Directing

A directing role was also introduced early in the interview phase and is evidently important to Group C, as explained by one interviewee in the brief extract below. Virtually all of Group AB were however perplexed by this term, suggesting greater scrutiny is required before conclusions can be drawn from this particular role's results.

> *"I am orchestrating and directing the team to ensure we deliver the womenswear specs [design specifications] on time… we have no slippage so I constantly have my finger on the pulse" (J C1)*

Describing the model

From the transcripts key words/terms for the 15 roles were extracted. Two distinct sets emerged that describe the perceptions of what we term 'strategic design leaders' and 'strategic managers of design'. Together these form a model composed of three elements:

- A central block of the 15 design management roles, split by 2 specific roles, namely envisioning and designing at the top and 13 generic design management roles below.
- On the left side of the model in green, are the perceptions using key descriptive terms of 'strategic design leaders' synthesised from Group AB to the 15 roles listed in the central block.
- On the right side of the model in blue, are the perceptions using key descriptive terms of 'strategic managers of design' synthesised from Group C to the 13 generic roles.

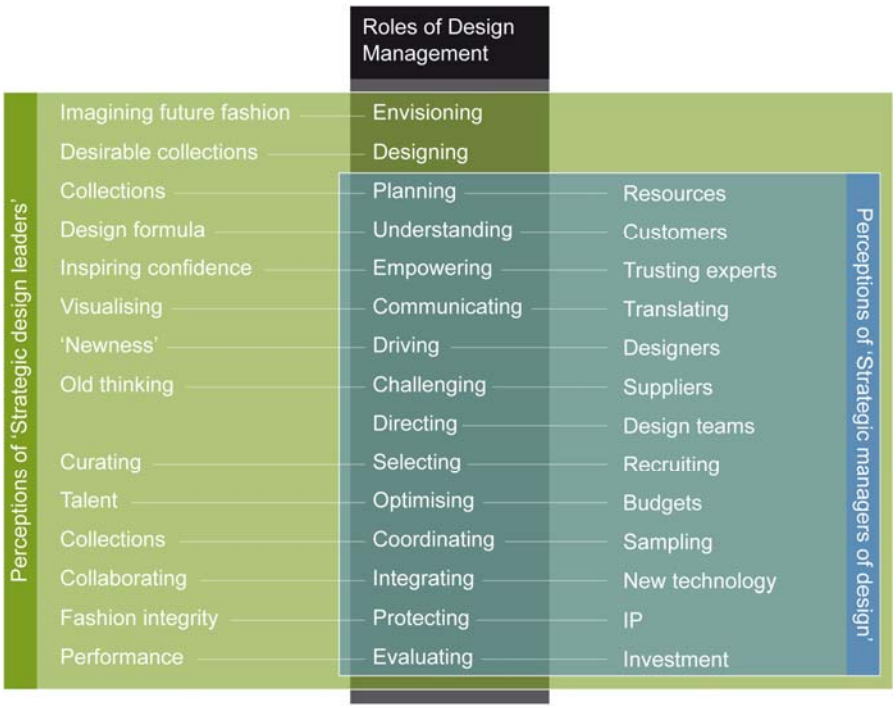


Figure: 3 Preliminary model of design management in the fashion retail industry

Overall the model depicts two universes in design management in the fashion retail industry: First, the broad 'strategic design leaders' universe across the entire green rectangular model, composed of both design specific and generic roles as they segue between leading and managing modes. Second, the smaller 'strategic managers of design' universe shown as the blue square on the right, occupies only the generic managing mode.

DISCUSSION

Design management has been studied before. Unfortunately, the results do not allow for a simple conclusion as the field is characterised by studies in a diverse set of industries with conflicting views, particularly related to the specifics of the design management role. This created a valuable research opportunity and the largely unexplored fashion retail industry provided a lens through which management roles can be studied (Cillo and Verona, 2008). Through our study several key issues have emerged.

First and most importantly, a direct link is made between design and management in this industry thus bridging a gap originally promulgated by Olins (1985). Further, this goes towards reconciling a debate on the 'fundamental contradiction' in the term design management, (Cooper and Press, 1995) as individuals at a senior level synthesise these elements. Our assertion is not only supported by evidence related to the specific designing role identified in this study, but clearly design is imbued throughout all the roles described to a greater or lesser extent. In some cases this adopts a profoundly 'hands on' approach. Second, linked to the previous point, access to the most senior levels of design management in these fashion retailers is contingent upon formal design training and extensive experience. Some literature alludes to this, Gornick (2008) for example reveals certain specialist design managers in large firms are design trained, yet this has not been explored in detail to date.

Third, we contend design management at these senior levels operating in high velocity environments, has an ability to undertake not only a 'strategic design leader' role but to simultaneously manage. This challenges the views held by some scholars (Gloppen, 2009; Kotter, 1990; Turner, 2002) that leadership (dealing with change) and management (dealing with complexity) are distinct entities. Broader management theory already describes ambidextrous leaders who move between "exploration and exploitation" modes (Rosing et al., 2011). This study also reveals strategy is not the preserve of the most senior members of the team, but is generated and driven at all levels both by individuals and through collaborative working, supporting Kent and Stone (2008) earlier assertions. Hence, we adopt the term 'strategic managers of design' for non-design individuals as this avoids confusion with the overarching domain term 'design management' that we support.

Finally, our approach has generated more accurate descriptions of the roles and reveals a greater level of complexity in practice in this industry. It also builds finer detail on the findings of Vasquez and Bruce (2002) in relation to the degree of design integration and sophistication within leading large UK retailers and fills a gap in knowledge in relation to the valuable service sector in answer to calls by Hollins et al.,(2003). We do however acknowledge the findings reported above should be viewed in light of this studies exploratory nature and the limitations of research in a single sector of the retail industry.

CONCLUSIONS AND FURTHER RESEARCH

In this exploratory study, we began by claiming that design management in agile industries may have diverged from established literature. Following this, a review of the role of design management provided by literature identified first, a lack of clarity particularly associated with the role at more senior level. Second, having summarised the literature, the research then identified a problem associated with the hierarchical structure of the roles and limitations of a process orientation. It then set out a synthesised set of design management roles, using a graphical research framework as a non-hierarchical/non-process approach using role cards that were empirically evaluated with senior individuals in design management in leading UK fashion retailers. The results were then enfolded with literature into a preliminary model of

design management in the retail industry that will be tested as part of an ongoing study. Overall, the results of the research to date may be summarised as follows:

- A direct link is made between design and management in this industry.
- A 'strategic design leader' role privileged by formal design training and extensive experience is revealed at the most senior levels.
- 'Strategic design leaders' exhibit ambidextrous qualities, both leading and managing design resources.
- This study also identifies a distinct 'strategic manager of design' role. This role exhibits a duality of short and long-term non-design activities.
- Greater complexity is evident in practice in this high velocity environment.

Thus, we propose the paper's main academic contribution is a valuable re-evaluation of the role of design management in a contemporary context. Through its engagement with practitioners, it also helps to build greater understanding of the value of design management in industry. This paper presents the first stage of a larger study and as part of the ongoing research the preliminary model described earlier shall be validated. We also recommend further empirical research in other industries is required particularly pertaining to the direct link between design and management.

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Activity	Strategy	Policy	Planning	Structure	Finance	Human Resources	Communication	Projects/Programmes	Evaluation
Strategic level	Define and embed coherent design 'vision' into corporate strategy relating to product, communications and environment. *Best, 2006; Borja de Mozota, 2003; Cooper and Press, 1995;Olins, 1985; Topalian, 1986, 1994*	Audit and approve corporate design policies/ metrics including quality/legal/ environmental standards. *Best, 2006; Borja de Mozota, 2003; Cooper and Press, 1995; Olins, 1985; Topalian, 1986, 1994, Vasquez and Bruce, 2002*	Schedule projects/ audits and define objectives/ requirements to optimize design resources. *Borja de Mozota, 2003; Cooper and Press, 1995; Jun, 2007*	Represent design at senior level, establish design hierarchy and select senior personnel. *Borja de Mozota, 2003; Cooper and Press, 1995*	Ensure design is resourced. Approve performance criteria including ROI/intangible asset metrics. *Best, 2006; Borja de Mozota, 2003; Cooper and Press, 1995; Topalian, 1994*	Position design and develop supportive environment. *Best, 2006; Borja de Mozota, 2003; Bruce and Bessant, 2002; Cooper and Press, 1995; Topalian, 1986, 1994*	Communicate design vision. Ensure coherent communication of brand values. *Borja de Mozota, 2003; Cooper and Press, 1995; Topalian, 1986, 1994*	Review/determine future priorities based on corporate objectives. *Borja de Mozota, 2003; Cooper and Press, 1995*	Evaluate performance against strategic targets with audits and review organizational efficiency in utilizing design. *Best, 2006; Borja de Mozota, 2003; Cooper and Press, 1995; Gorb, 1986; Olins, 1985; Topalian, 1986, 1994*
Functional level	Audit design to inform strategy. Coordinate and integrate strategy across business functions. *Borja de Mozota, 2003; Cooper and Press, 1995; Jun, 2007; Montana et al., 2007*	Develop coordinated corporate design policy. *Borja de Mozota, 2003; Bruce and Bessant, 2002; Bruce and Cooper, 1997; Cooper et al., 2003; Cooper and Press, 1995, Ughanwa, 1988; Vasquez and Bruce, 2002*	Plan/audit critical path. Establish budget and resource requirements. *Best, 2006; Borja de Mozota, 2003; Bruce and Bessant, 2002; Bruce and Cooper, 1997, Cooper et al., 2003; Cooper and Press, 1995; Ughanwa, 1988; Vasquez and Bruce, 2002*	Specify/recruit experienced design manager. Formulate design team. Agree roles/ responsibilities. *Best, 2006; Borja de Mozota, 2003; Cooper and Press, 1995; Ughanwa, 1988.*	Develop/ negotiate budgets to ensure adequate design funding. *Borja de Mozota, 2003; Bruce and Bessant, 2002; Cooper et al., 2003; Cooper and Press, 1995; Olins, 1985;*	Optimise design awareness to facilitate effective integration/co-creation. *Borja de Mozota, 2003; Bruce and Bessant, 2002; Cooper et al., 2003, Cooper and Press, 1995; Montana et al., 2007; Olins 1985; Ughanwa, 1988; Vasquez and Bruce, 2002*	Ensure design knowledge is disseminated internally and externally to stakeholders. *Best, 2006; Borja de Mozota, 2003; Bruce and Bessant, 2002; Cooper et al., 2003, Cooper and Press, 1995; Olins, 1985; Ughanwa, 1988; Vasquez and Bruce, 2002*	Develop design brief, coordinate cross-functional involvement particularly with marketing and production. *Best, 2006; Borja de Mozota, 2003; Bruce and Bessant, 2002; Bruce and Cooper, 1997, Cooper et al., 2003, Cooper and Press, 1995; Montana et al., 2007; Olins, 1985; Topalian, 1986, 1994; Ughanwa, 1988; Vasquez and Bruce, 2002*	Generate guidelines and regularly assess outputs of design i.e. ROI to inform learning. *Borja de Mozota, 2003; Bruce and Bessant, 2002; Cooper et al., 2003, Cooper and Press, 1995; Olins, 1995; Ughanwa, 1988; Vasquez and Bruce, 2002*
Operational level	Contribute to design strategy by researching current trends and markets. Define design for product, brand and communications. *Borja de Mozota, 2003; Bruce and Bessant, 2002; Chiva and Alegre, 2007; Cooper and Press, 1995*	Inform policies, develop documentation/ control procedures. *Borja de Mozota, 2003; Cooper and Press, 1995; Topalian, 1986, 1994*	Programme, manage and review projects. *Borja de Mozota, 2003; Cooper and Press, 1995; Topalian, 1986, 1994*	Create protocol and select designers/teams/ consultants. *Borja de Mozota, 2003; Bruce and Cooper, 1997, Cooper et al., 2003, Cooper and Press, 1995; Jun, 2007; Topalian, 1986, 1994,*	Estimate and manage project budgets. *Borja de Mozota, 2003; Cooper and Press, 1995; Topalian, 1986, 1994*	Integrate design cross functionally. Develop training programmes. *Borja de Mozota, 2003; Cooper and Press, 1995; Montana et al., 2007; Topalian, 1986, 1994*	Control design documentation/ guidelines and communicate to all stakeholders. *Borja de Mozota, 2003; Bruce and Cooper, 1997, Cooper et al., 2003, Cooper and Press, 1995; Topalian, 1986, 1994*	Instigate research and develop briefs. Cost and monitor activities. *Borja de Mozota, 2003; Bruce and Cooper, 1997, Cooper et al., 2003, Cooper and Press, 1995; Vasquez and Bruce, 2002*	Review design specifics i.e. final design against design brief. *Borja de Mozota, 2003; Bruce and Cooper, 1997, Cooper and Press, 1995; Jun, 2007; Topalian, 1986, 1994*

Table 1: Summary of design management literature

A Role-Based Design Performance Measurement Matrix for Improving Design Performance

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Keywords: design performance measurement, design team roles

This paper describes an investigation of a role-based Design Performance Measurement (DPM) matrix that incorporates design performance measures with three design team role-players: the top design manager, the middle design manager and the designer. Based on the author's previous research, a DPM matrix combining 25 criteria was developed to support DPM operation during a design process. A questionnaire survey was conducted to establish if different design team members would have diverse perceptions of the importance of 25 DPM criteria for the three types of design team roles. As a result, a role-based DPM matrix was developed, which demonstrated that the '*clear team goa*l' criterion should be regarded as the most important measure for the assessment of top design manager; the '*problem solving'*, '*delivering to the brief*', *'managing mistakes'*, *'build high morale within team'*, *'monitor team performance'* and '*define design responsibilities'* for the middle design manager; the '*high quality product design*' and '*adding perceived value to the design work*' for the designer. Furthermore, a role-based DPM matrix application was developed that enables the role-based DPM matrix to be flexibly implemented in different design projects by matching a project's features from three perspective: a design project strategies-based perspective, a stage-based design objectives perspective, and from a design staff role-based perspective.

INTRODUCTION

Design management is increasingly regarded as an important concept in the design industry, emphasizing the need for certain managerial activities and skills to optimize the design process and improve design performance (Chiva & Alegre, 2009). With the rapid growth of

global competition, design process is becoming more and more complex, due largely to cross-functional team collaboration, dynamic design processes, and unpredictable design outcomes (Shen et al, 2008; Brookes and Backhous, 1998). Due to such complexity, many design management studies concentrated on supporting and improving design efficiency and effectiveness during a design process (Naveh 2005; Hull, 2004; Hertenstein et al, 2001). Among these studies, many researchers have stressed the potential benefits of appraisal in design project performance, such as motivating design staff to achieve a positive business outcome, supporting decision-making, fostering organisational learning and continuous improvement (Chiesa et al, 2009; Busseri & Palmer, 2000). Furthermore, the significance of appropriate design performance measures in the success of design projects has been particularly highlighted (Carbonell-Foulquié et al, 2004). Therefore, a number of Design Performance Measurement (DPM) criteria have been identified and investigated from diverse perspectives to support DPM operation (Moultrie et al, 2007). Although the contributions of the identified DPM criteria studies are notable, few of them have considered the influence of team-roles on performance measurement criteria design. A great deal of research has emphasised the importance of role theory in project management, and suggests that the features of team-roles should be utilized as the basis for job descriptions, as well as for specifying project expectations, performance requirements, and measurement (Van Dyne et al, 1995; Ilgen & Hollenbeck, 1992). Despite this recognition of the importance of team-roles, and the fact that employees choose to perform multiple roles in their design teams, research has continued to measure design performance as if only single roles apply. As a result, by relying on the evaluation of only those work behaviours defined by an organisation as relating to a specific job, performance systems may exhibit deficiencies (Welbourne et al, 1998). Bourne et al (2000) point out that, to correct this measurement error, performance management systems need to account for multiple roles at work. Thus, there is a significant need to incorporate the concept of the team-role into a theory of DPM, so as to improve the accuracy of design performance results.

RESEARCH AIM

The study presented in this paper, based on the authors' previous research (Yin et al, 2011). It focused on the impact of diverse design team-roles on the design of DPM criteria. More specifically, in our previous research, a DPM matrix (Table 1) was established for key performance criteria, and this can be used for measuring design performance during a design process. 25 DPM criteria, which address five DPM indicators (efficiency, effectiveness, collaboration, management skill, and innovation) have been highlighted as the most critical factors for design performance measurement. Following the indicated suggestions of a possible significant impact from team-roles on DPM operation, the present study aims to develop a role-based DPM matrix, which can support design managers in improving the accuracy of performance measurement outcomes, by linking DPM criteria with three identifiable team-roles in a design team: those of the top manager, the middle manager, and the designer. These three roles were selected because they were broadly agreed to be the

essential components of design project teams, both in the design industry and in academia (Prasad, 1996; Bullinger et al, 1994). In this study, design was interpreted as an integrated product design and development process, which involves many participants from different disciplines and requires team members with varied knowledge and experience to work together (Adopt from Girard & Robin, 2006). In practice, the research concentrated on measuring and improving design performance from a project-level perspective.

Table 1: Design Performance Measurement Matrix

	Most Important →				**Less Important**
Efficiency	Decision-making efficiency	Problem solving	Personal motivation	Ability to work undertake pressure	R&D process well planned
Effectiveness	Delivering to the brief	Personally responsible/ work ownership	Understand design rationale	Fast and detailed feedback	Managing mistakes
Collaboration	Clear team goal/ objectives	Information sharing	Communication quality	Cross-functional collaboration	Shared problem-solving
Management Skill	Decision making	Define/fully understand role/s and responsibilities	Build high morale within team	Conflict management	Monitor/evaluate team performance
Innovation	Competitive advantage	Select the right creativity concept to implementation	Products lead to future opportunities	High quality product design	Perceived value

LITERATURE REVIEW

Design performance measurement

In the design management research field, many researchers have emphasised the potential benefits of DPM on design projects and concentrated on improving design performance by operating performance measurement activities (Mallick et al., 2005; Bryant et al., 2004; Huang et al., 2003). Implementing appropriate performance measurement has many advantages, such as motivating people, supporting decision-making, fostering organisational learning and continuous improvement (Neely et al, 2005). Additionally, performance measurement can be operated to influence project staff's behaviour to achieve a positive business outcome. For these reasons, many companies have spent considerable time and resources redesigning and implementing performance measurement positively to reflect their current environment and strategies (Kennerley & Neely, 2003).

With the intention of developing a successful DPM method, many researchers have focused on investigations of DPM criteria, because well-defined criteria ensure an understanding of the intent and expectations of design tasks, and increase the quality of team communication in the design process (Hart et al, 2003; Suomala & Jokioinen, 2001). These studies can be divided into two categories: product-focused DPM criteria; and project-focused DPM criteria (O'Donnell and Duffy, 2002). The former concentrate on exploring key factors of success and failure in New Product Development (NPD) and essential DPM criteria, such as market share, investment return rate, and customer feedback (Loch et al, 1996); and the latter focus on an investigation of efficiency and effectiveness-based, planning-based and product life-cycle duration-based measurement (Buganza &Verganti, 2006; Kušar, 2004; Salter & Torbett, 2003; Nachum, 1999). Although the contributions of these existing DPM criteria studies are notable, few of them have considered the influence of team-roles on design performance measurement.

Design team roles

Role theory has been well discussed in psychology, social psychology, sociology, organization behaviour, and human resource management research fields (Willcocks, 2006; Welbourne et al, 1998). Related researchers from these various fields have concluded that roles play an important part in social structure, and roles have been recognized as central to understanding and appraising employee behaviour in organizations (Partington & Harris, 1999; Fondas & Stewart, 1994). Especially in the performance measurement research area, a great deal of research has highlighted the influence of role theory on performance measurement operation. For instance, Welbourne et al (1998) have emphasized that an important contribution of role theory to performance management was its ability to provide direction for avoiding measurement errors in performance appraisal tools. Consequently, role theory recommends that the design of performance measurement criteria should consider differences in organizational requirements of specific job-roles (Blenkinsop & Maddison, 2007).

In a design project team, there are three essential team roles: the top design manager, the middle design manager and the designer (Prasad, 1998). These roles have various responsibilities and work focuses during a design project development process. Cooper & Press (1995) summarised the key duties of these three design team roles from multiple perspectives such as strategy; policy; programmes and procedures; people; structure; culture; and climate. For example, top design managers are responsible for providing direction, in terms of the programmes to be followed, in order to achieve strategic goals. The middle design manager's responsibilities involve setting design objectives for corporate communications, product and environments, having them approved by senior management, then developing strategies for achieving those objectives. Finally, designers at the design activity level can contribute to the project by setting up all procedures related to management control of design jobs, understanding the design needs of consumers, enabling the development of design objectives and strategies that are relevant and flexible, and responding

to changes in the market place and in design trends. These variations in responsibility between the three design team-roles make it very clear that their design performance should be measured against their team-role responsibilities and based on customized DPM criteria rather than generic and uniform measures. Therefore, this study aims to explore a role-based DPM criteria matrix that can match different design team-role responsibilities in turn, to produce more precise DPM results. Practically, based on our previously develop DPM matrix, this study explored 1) if there is a need to differentiate the importance of the 25 DPM criteria for different DPM users, and 2) relationships between the three design team roles and the 25 DPM criteria.

METHODOLOGY

In order to explore the identified research questions, a questionnaire survey was conducted with design managers and designers from industry. More specifically, 30 questions were designed to explore participants' opinions about the importance of 25 DPM criteria for each of the three design team roles. Four close-ended questions were designed to understand participants' background, 25 ranking questions were designed to classify the priorities of 25 DPM criteria for the three role players, and one open-ended question was designed to collect participant's suggestions and comments for this study. In addition, in the 25 close-ended classification questions, the participants were asked to rank the importance of the 25 DPM criteria with 1, 2, and 3 for the three design project team role players, where 1 denoted less important and 3 very important. A pilot study was then conducted with four participants to test and improve the questionnaire design. After the pilot study, the questionnaire survey was conducted via email, using contact details from web-based design company and research institute directories. 200 invitation emails were sent out, and 40 valid feedbacks were received, which comprised 14 from designers, 13 from middle design managers, and 13 from top design managers.

Among the 40 participants, 52.50% were working in design consultancies, and 47.50% were working in product design companies when they answered the questionnaire survey. Additionally, 40% of them focused on industrial design, 20% respondents concentrated on design management, 17.50% focused on design strategy, 15% focused on design research and the other 7.50% concentrated on engineering design.

FINDINGS

Based on the results of the questionnaire survey, Table 2 summarises feedback from the participants. Table 3 simplifies Table 2 in order to highlight the key results.

Table 2 DPM results from different design project role players

DPM items	Criteria		Respondents	Individual Designer		Middle DM		Top DM	
				Mean	Std. D	Mean	Std. D	Mean	Std. D
Efficiency (E)	E_1	Ability to work undertake pressure	Individual staff	**2.36**	.842	2.07	.475	1.57	.938
			Middle DM	2.08	.954	1.77	.599	**2.15**	.899
			Top DM	2.13	.725	**2.23**	.725	1.54	.877
	E_2	Decision-making efficiency	Individual staff	1.36	.633	2.00	.555	**2.64**	.745
			Middle DM	1.46	.877	1.92	.277	**2.62**	.768
			Top DM	**2.16**	.947	1.92	.494	2.03	.870
	E_3	Personal motivation	Individual staff	2.07	.997	**2.14**	.363	1.79	.975
			Middle DM	1.92	.862	**2.38**	.650	1.69	.855
			Top DM	2.08	.862	**2.15**	.689	1.77	.927
	E_4	Problem solving	Individual staff	2.07	.917	**2.43**	.646	1.50	.650
			Middle DM	1.77	.725	**2.46**	.660	1.77	.927
			Top DM	2.08	1.038	**2.15**	.555	1.77	.823
	E_5	R&D process well planned	Individual staff	1.71	.726	**2.50**	.650	1.79	.893
			Middle DM	1.62	.961	2.08	.494	**2.31**	.855
			Top DM	1.69	.630	2.00	.927	**2.23**	.913
Effectiveness (EE)	EE_1	Delivering to the design brief	Individual staff	2.14	.949	**2.29**	.469	1.57	.852
			Middle DM	2.08	.760	**2.46**	.660	1.46	.776
			Top DM	2.15	.801	**2.31**	.751	1.54	.776
	EE_2	Fast and detailed feedback	Individual staff	2.33	.646	**2.43**	.514	1.14	.535
			Middle DM	2.08	.862	**2.38**	.650	1.54	.776
			Top DM	**2.23**	.832	2.00	.707	1.77	.927
	EE_3	Managing mistakes	Individual staff	1.21	.579	**2.71**	.469	2.07	.616
			Middle DM	1.54	.776	**2.46**	.660	2.00	.816
			Top DM	1.69	.947	**2.23**	.599	2.08	.862
	EE_4	Personally responsible/ work ownership	Individual staff	1.93	.917	1.86	.535	**2.21**	.975
			Middle DM	2.00	.913	**2.31**	.439	1.92	1.038
			Top DM	2.08	1.038	**2.23**	.439	1.69	.855
	EE_5	Understand design rationale	Individual staff	1.71	.914	**2.29**	.469	2.00	.961
			Middle DM	**2.15**	.899	2.00	.577	1.85	.987
			Top DM	1.92	.862	2.00	.862	**2.08**	.816
Collaboration (C)	C_1	Clear team goal/objective	Individual staff	1.36	.745	2.21	.426	**2.43**	.852
			Middle DM	1.62	.650	2.00	.650	**2.38**	1.000
			Top DM	1.54	.776	2.00	.519	**2.46**	.913
	C_2	Communication quality	Individual staff	1.71	.726	**2.57**	.514	1.71	.914
			Middle DM	1.54	.660	**2.54**	.660	1.92	.862
			Top DM	**2.31**	.899	1.85	.630	1.85	.899
	C_3	Cross-functional collaboration	Individual staff	1.57	.852	**2.50**	.650	1.93	.730
			Middle DM	1.77	.725	**2.62**	.768	1.62	.650
			Top DM	2.23	.725	1.38	.650	**2.38**	.768
	C_4	Information sharing	Individual staff	1.64	.745	**2.36**	.497	2.00	1.038
			Middle DM	**2.38**	.768	2.23	.599	1.38	.768
			Top DM	**2.38**	.768	2.23	.725	1.38	.650
	C_5	Shared problem-solving	Individual staff	1.71	.914	**2.50**	.519	1.79	.802
			Middle DM	1.77	.832	**2.23**	.599	2.00	1.000
			Top DM	**2.38**	.870	2.08	.641	1.54	.776
Management Skill (M)	M_1	Build high morale within team	Individual staff	1.43	.646	**2.64**	.497	1.93	.829
			Middle DM	1.62	.768	**2.38**	.650	2.00	.913
			Top DM	1.54	.776	**2.54**	.660	1.92	.760
	M_2	Conflict management	Individual staff	1.43	.646	**2.36**	.497	2.21	.975
			Middle DM	1.69	.855	**2.31**	.630	2.00	.913
			Top DM	**2.46**	.832	1.77	.660	1.77	.832
	M_3	Decision making	Individual staff	1.29	.611	**2.50**	.519	2.21	.802
			Middle DM	1.38	.650	2.15	.519	**2.46**	.899
			Top DM	**2.31**	1.013	1.92	.494	1.77	.855
	M_4	Define/fully understand role/s and responsibilities	Individual staff	1.93	.730	**2.43**	.646	1.64	.929
			Middle DM	1.54	.877	**2.46**	.519	2.00	.816
			Top DM	1.77	.832	**2.38**	.650	1.85	.899
	M_5	Monitor/evaluate team performance	Individual staff	1.14	.363	**2.36**	.497	2.50	.760
			Middle DM	1.38	.768	**2.46**	.519	2.15	.801
			Top DM	1.69	.947	**2.38**	.506	1.92	.862
Innovation (I)	I_1	Competitive advantage	Individual staff	2.07	.929	**2.36**	.616	1.57	.756
			Middle DM	2.08	.954	**2.15**	.376	1.77	1.013
			Top DM	1.92	.801	1.92	.760	**2.15**	.954
	I_2	High quality product design	Individual staff	**2.14**	.949	2.00	.555	1.86	.949
			Middle DM	**2.32**	.870	1.62	.480	2.08	.954
			Top DM	**2.62**	.650	2.31	.480	1.08	.277
	I_3	Perceived value	Individual staff	**2.36**	.842	1.86	.663	1.93	.917
			Middle DM	**2.08**	.954	2.00	.577	1.92	.954
			Top DM	**2.23**	.913	2.00	.725	1.77	.832
	I_4	Products lead to future opportunities	Individual staff	1.21	.426	2.07	.616	**2.71**	.611
			Middle DM	1.46	.776	2.08	.494	**2.46**	.877
			Top DM	**2.31**	.725	1.92	.760	1.77	.947
	I_5	Select the right creativity concept to implementation	Individual staff	1.86	.949	**2.21**	.426	1.93	.997
			Middle DM	1.31	.751	2.15	.376	**2.54**	.776
			Top DM	1.62	.650	2.08	.855	**2.31**	.862

As shown in Table 3, the three design team role players shared some common opinions. For example, they thought that *delivering to the design brief* was more important for the middle design manager in comparison with the other two roles. In contrast, they also had opposing opinions. For instance, the top design managers believed that *ability to work under pressure*

was more important to the middle design managers, but the middle design managers thought it should be more essential for the top design managers. Moreover, the individual designers considered this DPM criterion was more important for them. The sections below present the details of their common and opposite opinions.

Table 3 Different perspectives for a role-based DPM matrix

DPM items	Criteria		Individual designer	Middle manager	Top Manager
Efficiency (E)	E_1	Ability to work undertake pressure	I	T	M
	E_2	Decision-making efficiency	T		I M
	E_3	Personal motivation		I M T	
	E_4	Problem solving		IMT	
	E_5	R&D process well planned		I	MT
Effectiveness (EE)	EE_1	Delivering to the design brief		IMT	
	EE_2	Fast and detailed feedback	T	IM	
	EE_3	Managing mistakes		IMT	
	EE_4	Personally responsible/ work ownership		MT	I
	EE_5	Understand design rationale	M	I	T
Collaboration (C)	C_1	Clear team goal/objective			IMT
	C_2	Communication quality	T	IM	
	C_3	Cross-functional collaboration		IM	T
	C_4	Information sharing	MT	I	
	C_5	Shared problem-solving	T	IM	
Management Skill (M)	M_1	Build high morale within team		IMT	
	M_2	Conflict management	T	IM	
	M_3	Decision making	T	I	M
	M_4	Define/fully understand role/s and responsibilities		IMT	
	M_5	Monitor/evaluate team performance		IMT	
Innovation (I)	I_1	Competitive advantage		I	MT
	I_2	High quality product design	IMT		
	I_3	Perceived value	IMT		
	I_4	Products lead to future opportunities	T		IM
	I_5	Select the right creativity concept to implementation		I	MT

I=data from Individual designer, M= data from Middle manager, T= data from Top manager

Convergent opinions

As shown in Table 4, ten DPM criteria received the common opinions. Firstly, ‘Clear team goal/objective’ was selected specifically for top design managers because they usually took charge of a macro level of strategic management. More specifically, the top design managers are key decision-makers for project strategies and objectives, and their major responsibility is to orient teams towards common strategic objectives which could be achieved by having clearing team goal/objectives. In addition, top managers could clearly indicate team goals so

that NPD cycle time could be reduced and the team members' emotional reaction could be improved. Secondly, seven DPM criteria were identified for the middle design managers probably because they play a very crucial link between top design managers and individual designers. In addition, their responsibilities become more important as the complexity of the design projects increased. Moreover, the middle design managers, who are responsible for improving everyday tasks and supervising individual designers, play the most important part in design development and have a big impact on final design performance. Thus, the middle managers' responsibilities are not replaceable by top design managers or individual designers, and the middle design managers are expected to satisfy both top managers and individual designers. Consequently, they should have high-quality skills in problem-solving, managing mistakes, monitoring/evaluating team performance, and so on. Ultimately, individual designers are those who effectively design the products, create and add design value to the products. Thus, their innovation performance has an important influence on final product design performance.

Table 4. The important DPM criteria with common opinions

Design Team Role Player	**Same opinions of the important DPM criteria**
Top Design Manager	Clear team goal/objective
Middle Design Manager	Personal motivation, Problem solving, Delivering to the brief, Managing mistakes, Build high morale within team, Monitor/evaluate team performance, and Define/fully understand role/s and responsibilities
Individual Designer	High quality product design, Perceived value

Divergent Opinions

The diversity of these results indicates that the three design team role players had different opinions about the relative importance of DPM criteria and the three design team roles. It seems that experience in different roles raised different expectations of the other roles. For example, the top design managers believed that the ability to work under pressure was more important for the middle design managers, but the middle design managers considered it should be more important for the top design managers. This result implies that the middle design managers should have a high ability to work under pressure as they always work with a high level of responsibility. Conversely, the middle design managers believed that the top design managers were under higher pressure than them. Figure 1 presents various expectations from different design team role players. And the list below summarised key conflicting opinions from the three design role players.

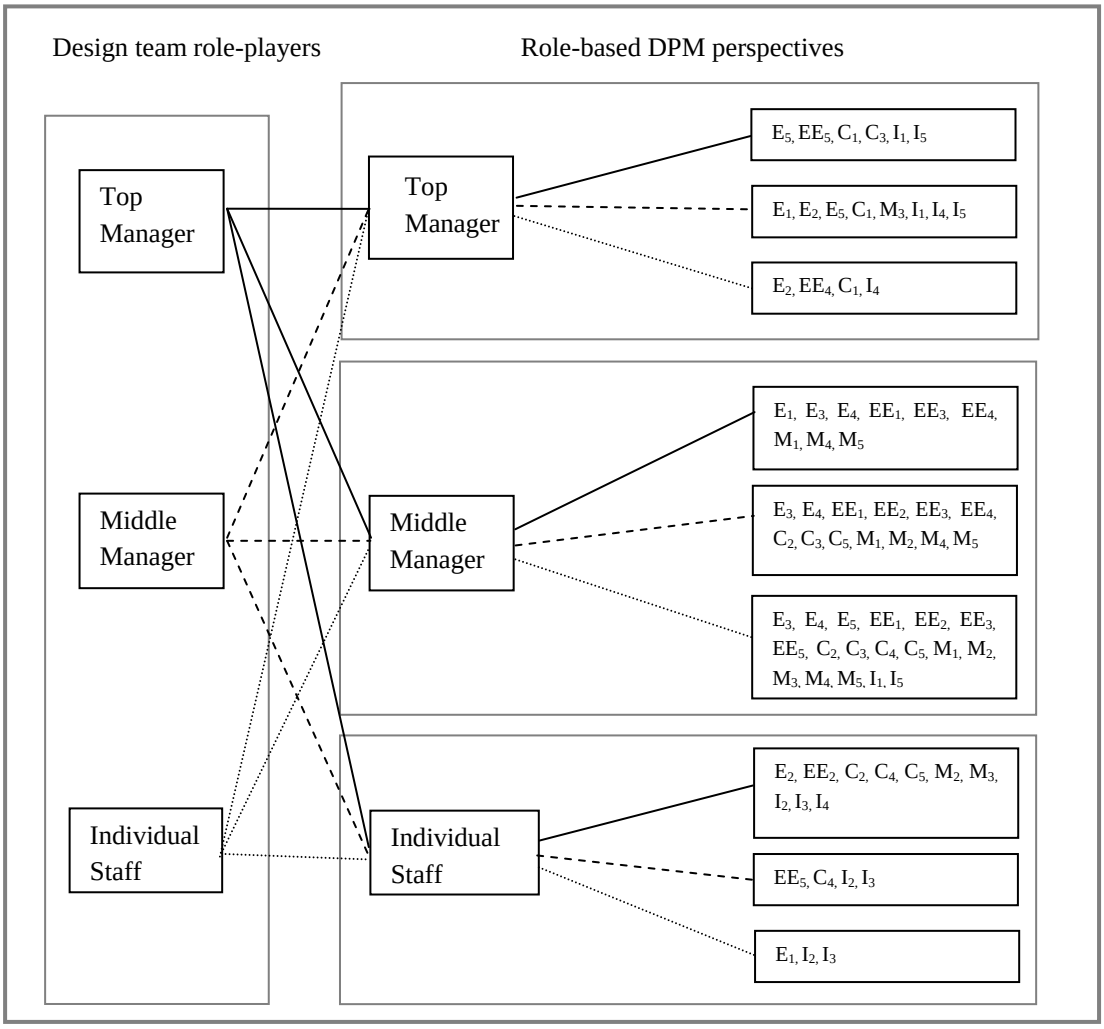

Figure 1. A role-based DPM matrix

- Efficiency performance- E_1: Ability to work under pressure
  - Top design managers thought E_1 was more important to middle design managers when compared with individual designers and top design managers
  - Middle design managers regarded E_1 was more important to top design managers when compared with individual designers and middle design managers
  - Individual designers thought E_1 was more important to them when compared with top and middle design managers
- Effectiveness performance - EE_5: Understand design rationale
  - Top design managers thought EE_5 was more important to top design managers when compared with individual designers and top design managers
  - Middle design managers thought EE_5 was more important to individual designers when compared with middle design managers and top design managers

- Individual designers thought EE_5 was more important to middle design managers when compared with individual designers and top design managers

- Management skill performance - M_3: Decision making
  - Top design managers thought M_3 was more important to individual designers when compared with middle design managers and top design managers
  - Middle design managers thought M_3 was more important to top design managers when compared with individual designers and middle design managers
  - Individual designers thought M_3 was more important to middle design managers when compared with individual designers and top design managers

DISCUSSION ON ROLE-BASED DPM MATRIX APPLICATION MODEL

Based on the results of the questionnaire survey, it has been demonstrated that design team members do have diverse apprehensions of the 25 DPM criteria for the three design team role-players. Several convergent and divergent opinions referring to the significance of the criteria for the three design roles were summarised. These results offer design team members a better understanding of how their responsibilities have been perceived from within other roles, and may help to avoid potential communication conflicts and improve team collaboration. The matrix will support design managers in setting up role-specific DPM criteria for the top design manager, the middle manager and the designer, which could enable DPM operations to be linked to diverse design team role features, so as to produce more precise DPM results, with which to lead design performance.

A review of the literature indicates that many studies have pointed out that failure to link project strategy in this way is a recognised barrier to the success of the performance measurement tool (Bourne et al, 2002). One of the major challenges that has been discussed was defining a set of measures that were clearly linked to the operational strategies of the project (Reilly et al, 2002). Neely et al (1997) suggest how to link DPM operations with a project's strategy from three levels: the set of criteria and performance measurement as a system; the relationship between the performance measurement system and its operational environment; and the individual performance measures. They also indicate the key to building up a successful DPM matrix is the assurance of a link between strategic objectives and performance criteria used at each level. Because complexity and uncertainty often feature in a design process, project strategies might need to be modified in the middle of the development process. Thus, if a DPM matrix could not be upgraded to match changes of project strategy, problems in project development could arise (Staw, 1981). A successful DPM matrix should be able to offer sufficient flexibility to match dynamic project strategies. Accordingly, based on the developed role-based DPM matrix and the foregoing recommendations, a role-based DPM matrix application model (Figure 2) was developed which addresses the application of the role-based DPM matrix at a design project system

level, by involving design project strategies; at an operational environment level, by accounting for the dynamic feature of the design process; and at an individual level, by considering each design staff member's role and responsibility.

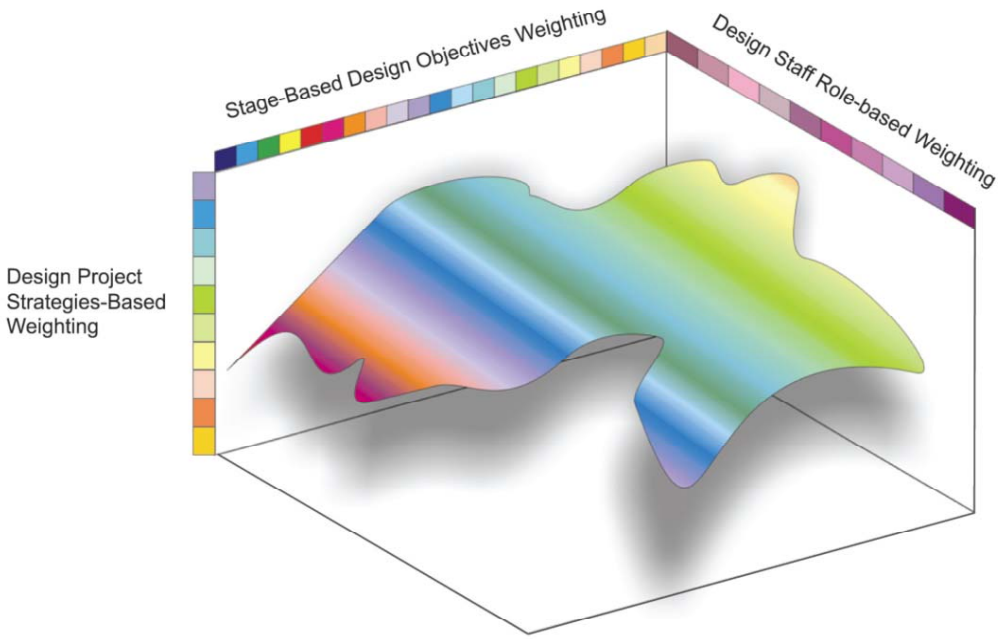

Figure 2. Role-based DPM matrix application model

CONCLUSIONS

In summary, a role-based DPM matrix was developed which incorporated DPM criteria into the hieratical design team structure. In addition, it was found that *clear team goal/objective* is the most important DPM criterion for top design managers; *problem solving, delivering to the brief, and building high morale within team* for middle design managers; and *high quality product design* and *perceived design value* for individual designers. Furthermore, a role-based DPM matrix application model was developed to enable the role-based DPM matrix to be flexibly implemented in different design projects by matching a project's features from a design project strategies-based perspective (project system level), from a stage-based design objectives perspective (operation environment level), and from a design staff role-based perspective (individual level). The matrix and the application model will support design managers operating a role-based DPM implementation that can produce accurate DPM results, and in turn maximise support for improving design performance.

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Conscious vs. Unconscious Design Decision-Making in NPD that Supports the Delivery of Corporate Social Responsibility (CSR)

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Keywords: corporate social responsibility (CSR), socially responsible design (SDR) decision- making, new product development (NPD)

The research identifies designers' perception of the relationship between CSR and design in terms of environmental, social, and economic issues. More specifically, the article seeks to investigate the designers' underlying motivation for socially-responsible design decision-making in an organisational context. By investigating the degree of the conscious decision-making and that of the unconscious decision-making at the operational level, the research finding intends to demonstrate where CSR decisions are being made, and how conscious and unconscious socially responsible design decisions affect CSR particularly in the new product development process, with special reference to the electronics industry in South Korea.

INTRODUCTION

Although a precise definition remains elusive, the term corporate social responsibility (CSR) is heard more and more often in business circles. CSR originally implied giving back to society in a philanthropic sense. It is now increasingly used in a strategic sense, to refer to a business practice that allows for the integration of social and environmental considerations with a firm's business operations through the effective alignment of philanthropic contributions with business goals and strategies (Drucker, 1984; Freeman and Gillbert, 1998; European Commission, 2002; Porter and Kramer, 2002; Stead and Stead, 2004). Moreover, this is done in a manner that respects the legitimate goals and demands of all stakeholders (Carroll, 1979; Clarkson 1995; Waddock et al. 2002; Business for Social Responsibility, 2003; and Heslin and Ochoa, 2008). For this reason, many argue that

addressing CSR is not just a task for an organization's public relations department; rather, if it is to be a holistic and strategic approach, it must permeate every facet of the company, from marketing to finance, production, and design(Freeman and Gilbert, 1998; Porter and Kramer, 2006; Carroll and Buchholtz, 2008; Green, 2010). It follows that if designers and design managers wish to continue to play a role in corporate strategy development, they must integrate CSR considerations into the key results they produce (Thackara, 2009; Hands, 2009).

Despite the existence of numerous studies which examine how design as a strategic marketing resource impacts business success and competitiveness, relatively little attention has been paid to the role of design in addressing corporate social responsibility and its relationship to strategic CSR management (Kotler and Rath, 1984; Gorb,1990; Mozota, 1990; Topalian, 1990; Olson et al., 1997). Recently, a great deal of research has articulated how to identify the area where a social dimension can be added to the basic business domains, linking business ethics with competitive advantage as well as a critical strategy concept (Kakabadse et al., 2005; Porter and Kramer, 2006; Heslin and Ochoa, 2008; Carroll and Buchholtz, 2008). However, much of this research has been conducted solely from the management perspective, rather than from the design perspective, as an integral part of realization of the principles of CSR; therefore, to a certain extent, a gap still exists between CSR strategies and tactics and their realistic implementation and performance achieved by design. Thus far, there has arguably been more limited research debate about the role of design in CSR-related decision-making and the impact of these elements on corporate social performance. Furthermore, little research has been done on the effect of design management capacity on translating the principles of CSR into manufactured goods as well as potential services (Hands, 2009). Whilst, in recent management literature many researchers began to pay attention to the perceptions of managers toward CSR and their real action they may take regarding socially responsible issues(Jamali and Sidani, 2008; Quazi and O'Brien 2000). This is because managers not only make decisions that reflect their assessment of the role of the company, but also make judgment as to whether there will be net benefits or net costs to the company associated with the CSR action. In a related vein, it can be argued that designer's perception and behavioural attitude regarding corporate social responsibility and socially responsible design issues are also a crucial part of organisational decision making notably in new product and service development, and further have a great impact on the firm's economic, environmental, and social performance. Therefore the objective of this study is to empirically investigate how designers perceive CSR in the context of South Korea companies and to what extent their perception of CSR-related issues influence their daily design practice and the firm's socially responsible design performance, with special reference to the electronics industry. This article aims to address the primary research questions: (i) what is the designers' awareness and knowledge of CSR-related issues?; and (ii) What are the designers' perceptions of the relationship between design and CSR?

DESIGNER INTERVIEW ANALYSIS

For the purpose of the investigation, the electronics sector in South Korea has been identified as the industrial limiting factor with three important theoretical considerations. This has been determined because (i) technology is advancing very quickly, and therefore many products are short-lived, causing a huge e-waste problem, (ii) there is a transportation issue of electronic products made from Korea and China, which is also a huge environmental issue associated to CSR, and (iii) the environmental and social issues are more associated in the electronic industry, which is directly related to CSR. A series of in-depth interviews were conducted with 31 designers involved in new product and service development processes in electronics companies, including the product, engineering, graphic user interface(GUI), user experience(UX), and packaging designers (see Appendix 1). The following analysis is based on the themes indentified trough the research process. Each theme will consist of analysis, comments and real examples derived from the 31 designers. To summarise, the following topics will be discussed:

- Corporate social responsibility- including designer's perceived awareness of CSR-related issues;
- Perspectives on the relationship between design activities and CSR including a discussion of the environmental, social, and economic responsibilities.

1. Awareness and knowledge of CSR-related issues

There was a consensus amongst all interviewees that CSR is becoming increasingly prevalent within the industry. However, when directly asked about CSR, most designers were not familiar with the concept; less than 10% of those interviewed viewed CSR as integrating the concerns for the welfare of society with the management processes of the firm from a strategic standpoint. Almost all of the interviewees discussed several areas including monetary donations, community involvement, environmental prevention, strengthening customer satisfaction, creating jobs, promoting win-win partnership with small and mid-sized companies and/or business ethics. This is encouraging as all of the issues mentioned are congruent with a current focal shift of CSR moving beyond philosophical consideration of social and moral concerns toward specific issues-oriented approach to better respond to external environment such as political and social situations.

With respect to the most common matters mentioned, almost 53% of respondents viewed CSR as something that would respond to environmental concerns such as minimising the impact on the environment through recycling, decreasing energy consumption, or acquiring eco-design qualification. Another key figure showed that 47% of interviewees viewed CSR as companies' community involvement through charitable contributions, investment in educational programs, art and culture, or employees' volunteer projects. For example, several interviewees mentioned that corporate giving failed to make a connection with their job role as a designer. This suggests knowledge of these areas without engaging operating design management in identifying value chain impacts and social

dimensions of the competitive context. This awareness of concerns without understanding their full thoughts is important, understanding the issues without understating its strategic implication or its importance relative to designing process makes it difficult to make a far greater positive impact on societal issues as well as a long-term business benefit. Attempting to design products and services on the basis of treating CSR as merely charitable giving or corporate image without understanding how either CSR interacts with operating design management or how strategic CSR positioning creates a unique and sustainable competitive position, may result in a fragmented, defensive stance of CSR. In addition, 18% of respondents thought that CSR embraced the ideas of fair business practices such as anti-corruption, including extortion and bribery. For instance, interviewee 30 saw CSR as eradicating illegalities and corruption, which have contributed to serious problems caused by the plutocracy in South Korea, whilst, interviewee 17 regarded CSR as a way of maintaining a win-win relationship with smaller enterprises. This opinion seemed to be pervaded by company policy aligned with government regulation that was specifically amended for the cooperative relationship in 2010. In addition to the above points, 12% of those interviewed mentioned enhancing consumer satisfaction through offering high quality after-sale service and communication as a key factor of CSR. Less than 10% of the respondents discussed the economic development of the community. For instance, interviewee 12 suggested the significance of the company invigorating local employment economy through creation of wealth and increased employment.

2. Relationship between CSR and design

When directly questioned about the perception of their roles in delivering CSR, some designers failed to make a direct link between their job role and CSR, but most designers questioned perceived that there was both a direct and indirect relationship between the two. Many interviewees recognised that the design role fulfils responsibility in terms of profitable businesses, quality of life for people, and the environment. This illustrates the interviewee's views on the significance of the economic, environmental and social variables in creating a successful yet responsible development process. Recognising the relationship between the three dimensions and design is important. However, throughout the interviews, it also was found that most design issues related to environmental or social dimensions are closely associated with the firm's economic responsibility. That is, the majority of socially or environmentally conscious design decisions made within a corporation appeared as either unintentional consequences that come from the firm's pursuit of economic gains or the firm's desire to serve socio-economic causes, not solely for charitable purposes. This reflects that economic responsibility is the underpinning of both social and environmental responsibilities, at least in a South Korean context, and thus it is difficult to separate economic responsibility from environment or social ones. This is not only because of the interconnected nature of the economy, society and the environment, but also because of the high possibility of motivation for socially responsible activities being different from the firm's genuine purpose. Therefore, the following sections build upon the discussion of

specific design issues during new product and service development within environmental and societal dimensions, where opportunities to create real economic value reside.

2.1. Environmental Dimension

28 of the 31 interviews discussed the environmental focus within socially-responsible design. The most popular response was to develop eco-friendly products. Throughout the interviews, there appeared to be a strong emphasis on the environmental factor being the most significant part of contribution design can make to support a delivery of CSR. Interviewee 9 suggested that this focus on the environmental aspect was because it was the most visible way in taking action as well as appealing their socially responsible business practice against ever tightening environmental regulation, particularly in the case of the manufacturing industry. The research findings from interviews of designers identified a list of topics in respect of aspects of environmental design. Those topics will be discussed in detail in the next sections.

1) Manufacture stage

Most issues raised by product designers focus on the choice of materials, and manufacturing processes. Almost all industrial designers interviewed primarily considered their roles as mitigating the environmental impact of products in the production stage, more specifically through (i) reducing the number of components, materials, and type of materials, (ii) removing toxic materials contained in products, (iii) use of renewable or recycled materials, (iv) use of process that require less manufacturing energy and materials, and/or (v) minimised use of mock-up. These were supported by the use of examples such as PVC-free materials, reusable/disposable plastic and aluminium, and more environmentally friendly manufacturing methods, such as non-laminated coating method or reducing use of paint.

First, interviewees 5, 11, 13, 16, and 17 suggested that the most common approach to ecological design is to reduce the number of manufacturing processes, especially for post-processing, by eliminating fancy elements in pursuit of simplicity in form, whilst reducing production costs.

Secondly, the issue of removing toxic materials contained in products was discussed by interviewee 10 as a response to the regulatory pressure. Interviewee 12 also suggested that ecological initiatives, especially for hazardous substance management, are actually driven by environmental regulation as external regulatory stakeholders and this, in turn, directs designers or engineers to adopt more environmentally responsible design actions. Therefore, this aspect arguably represents company regulation-led approaches, but unconscious decision-making of designers, because although designers are not fully aware that all environmentally harmful materials need to be excluded during the design processes, company guidelines strictly prohibit them from using materials containing toxic substances which are banned by global regulation, such as Restriction of Hazardous Substances(RoHS), to sell their products in global markets like the EU.

Thirdly, the issue of using renewable or recycled materials in the physical appearance of products was discussed by interviewee 5, with the example of an eco-friendly mobile phone. The solar-powered, eco-friendly phone is made of recycled water bottles and packed in a reusable box made of recycled paper without using bleach, adhesives or coatings in order to be effectively recycled. According to interviewee 5, this was driven by management with the aim of exhibiting and testing its advanced environmental technologies to the market, whilst responding proactively to changes in future environmental regulation. With this company-led approach to environmental responsibility, designers were encouraged to display green thinking, and it required a close collaboration with engineering functions, as much of the tangible improvement in terms of environmental performance comes from the engineering side. This suggests the existence and availability of technology or materials (e.g. use of a recycled plastic from water bottles called PCM) was a critical factor in driving forward environmental sustainability, especially in terms of material concerns.

Fourthly, the issue of module communisation is an example that was motivated strictly by economic imperatives, yet has had a positive impact on the environment as an unintended consequence. Interviewees 10 and 13 discussed module communisation in terms of standardising components so they can be used in many different models, increasing the lifespan of the subsystem even when the software, casing or other components change over time. Interviewee 10 admitted, although this stemmed from a tangible economic benefit by gaining economies of scale, that this would, in turn, lead to a reduction in environmental impact with an optimised manufacturing process and reduced use of resources by designing components to be interchangeably used and replaced within the same product category quickly and cost-effectively. However, interviewee 10's statement *'these are things that the designer does not recognise but they are actually working for the environment'*, seems to suggest that the respondent did not necessarily intend to decrease the environmental impact of the products, but rather, she focused on improving efficiency in the use of natural resources as a definitive responsibility to the company. This suggests that module communisation issues are often regulated by company guidelines due to its economic value, rather than initially motivated by conscious design decision-making toward environmental responsibility as a designer.

Finally, interviewee 13 identified the possibility of reducing prototypes in the design development process with the use of virtual reality technology. He also discussed this ecological initiative during a physical development process as an opportunity for self-reflection to drive change in top management styles. This would cause the business to question the necessity and validity of retaining hundreds of product models and making thousands of prototypes even within the mobile communication sector. A further point raised by interviewee 4 identified the need for improving value within their business, driving down environmental costs and improving efficiency by reducing the consumption of resources with an optimised number of product line-ups, not just in terms of a product itself, but also on an entire business level. This suggests that the firm's environmental impact needs to be considered in terms of business effectiveness; that is, in terms of the ratio

between the natural resources and energy required for the development of new products and services and their economic effects. The impact of work efficiency, especially in the manufacturing industry, is also important when considering long term environmental issues. Enhancing business efficiency by strategic product planning may have unforeseen positive consequences on the implementation of initiatives and the general development of CSR.

2) Distribution stage

The recent progress from heavy to smaller or lighter packaging design was discussed by interviewee 29, who stated that it was unintended and a natural consequence (or requirement) as products became smaller with the evolution of technology and/or changes in consumer needs. Interviewee 28 suggested that since packaging feature design and logistics costs are closely linked, there were also examples of economic value driven by the company to determine the most cost-efficient size for product packaging. In particular, interviewee 16 provided a business case for a washing machine packaging redesign project. The purpose was to replace the packaging that covers the whole surface with paper with an eco-friendly package designed to use paper only for the top and the bottom, to insert the paper container structure that enhances the paper, and to use eco-friendly vinyl material to wrap around the washing machine. According to interviewee S7, this had the effect of planting nearly 200,000 trees yearly. Therefore, it can be recognised as a significant environmental improvement through ecological redesign by eliminating unnecessary parts of packaging and by using recyclable material. In his statement *'[…] the starting point of this ecological approach didn't begin with the intension of protecting the environment in an environmentally friendly manner but began with the intention of reducing the packaging logistics cost, but it has brought these effect. […]'*, it is suggested that businesses are intrinsically concerned with economic return, and the environmentally friendly design approach originated from benefits for the business in a socio-economic sense coupled with the designers' conscious awareness of the need to develop environmentally sustainable products and services.

Nevertheless, there is a dilemma between many aspects of packaging design and environmental responsibility, as discussed by interviewees 28 and 29. Since packaging not only protects the product but also is a tool of exhibition, it is widely acknowledged in retail shops that the package carries a message from the producer to the consumer about the product. The message, apart from being informative, also has an advertising effect, which is crucial in the present market situation. In this context, interviewees 28 suggested that packaging as an advertising medium has (almost) the highest preference both inside (the design, sales and marketing teams) and outside (the local liaisons) of the company. However, interviewee 28 went on to claim that the current role of packaging was misled as the result of excessive competition for achieving a higher market share by catching the eye of consumers with the use of more luxurious and colourful package features, such as the use of full-colour printing or gold foil print. A company's view of using packaging mainly as a tool of seduction management to lure consumers requires more use of post-processing, which, of

course, consumes more electronics, releasing more Co2 and discharging waste water. This is indeed in opposition to the green thinking. It is therefore important to recognise the urgent need for designers to achieve balance of the interdependencies not only between packaging feature design and advertisement, but also between packaging design and its environmental impact, from manufacturing to distribution and to final disposal.

3) Use stage

Generally, the interviewees believed that there is a stronger connection between giving products a physical shape and designers' environmental responsibility; this is because the role of product designers directly relates to using physical resources. Whilst, the general consensus was that user experience(UX) and user Interface(UI) designer chiefly regarded their role as designing interfaces and system with future needs in mind where possible, and creating a user experience that can potentially lead to the users' behavioural change toward a more environmentally sustainable lifestyle.

Interviewee 25 viewed their role in relation to environmental sustainability, as designing platforms that are able to be upgraded. This illustrates the key role of UX and UI designers in extending product life-cycle and maintaining its highest value. This highlights the idea of designers thinking about the whole life cycle of products which are durable goods that provide a service to customers especially in the electronics industry (McDonough and Braungart, 2002). As discussed during many interviews, upgrades are not easy with lots of technological products, even though they are even more appropriate since the evolution of technological change is so rapid. Interviewee 25 goes on to give an example of what is happening in the company and why it is difficult to achieve upgrades; there are two factors affecting this: management's narrow mindset and the focus on short term economic gains. Interviewee S12's statement, '*That is not easy technically and rather than the voice of the designer, the voice of the executives who have the thought of "new products must look new" and the pressure to sell new products is bigger, so these ideas are not well accepted. Version up is not something all people think of throughout the company. However, within the limits of what I can do, I believe the responsibility for the environment is important',* suggested there was no company regulation or willingness on the part of management related to upgradability since the executives did not want to be responsible for the risk of uncertainty, and they thought it to be more economically sustainable to sell as many products as possible, extracting the most profits from them for the short-term, at least during the tenure of the executive, typically a one-year contract.

On the other hand, there were cases driven by company recognition of the need to develop a more advanced level of eco-product by incorporating the ecological concept with the product's UI and UX aspects. For example, interviewee 22 perceived his role as creating an eco-friendly user experience that can potentially lead to users' behavioural change toward a more environmentally friendly way of living. During the interview, the respondent identified that there was a change in the view of 'eco design' from applying it with hardware

issues to internalising it with intangible aspects of design. A more colourful and succinct description was given by interviewee S22, as follows:

"*there was the Eco-walk app designed to tell the user how much CO2 emission he/she saved by walking instead of driving, and depending on which trees in the idle screen design grew, reflecting how they reduced their environmental impact. [..]Another UX design feature used for the eco-phone was the Eco-unlock, which has a refuse bin and can on the unlock screen. Whenever the user drags and drops the can in the refuse bin with recycling icons, then it unlocks the phone, and when the phone unlocks, the screen provides users with information of how much they can contribute to the environment if they recycles a certain number of cans. It gives meaning to the refresh action itself. Through doing this behaviour, the user is able to feel indirectly how much he or she is helping protect the environment. That was something the person didn't know before, but the person will begin to think these actions will be greatly helpful for the environment and will have more interest in this area and think more about this than before."*

In addition, many interviewees discussed the concept of saving energy, although there was distinct uncertainty regarding how designers could contribute to improving energy efficiency. An example of a companywide energy-saving initiative using a GUI design solution was addressed by interviewee 23: '*For example, in the case of ultra-low energy TV, manual features like the power-saving features are approached through the technological part, but the aspect the design part can propose is the screen colour. It was inspired by knowing the fact that energy use is significantly different in black and white. White or bright colours are tones that consume more energy, and black or dark colours consume less energy, in using electricity, there is a big difference between the two. I proposed a concept that it is better in design as well as in energy saving if you make the menu screen darker'*. It is evident that the importance of a company's energy-saving initiatives relates directly to potential benefit not only to the environment but also to the users and the company as well. In other words, those company actions usually originate from market trends reflecting needs of consumers who want to save more money on electricity, yet this would eventually result in reduced CO2 emissions and thus creates a sort of vicious circle.

2. Social dimension

The social dimension relates to people and communities; it focuses on how designers deal, within their daily design practices, with the aspects of human rights, consumers, and social and economic development of the community which are the key constituents of CSR. The elusive notion of CSR, the vagueness around the term and the lack of education about what it means to be socially reasonable were all cited from designers' perspectives as reasons why people focus primarily on just considering the environment when talking about CSR. As such, the social dimension is often the least discussed responsibility, especially at the project level, and this was illustrated in the interviews, as most interviewees had to be prompted to talk about the social aspect of their business. The interviewees discussed two distinct perspectives in relation to the social aspect: (i) social contribution through donating design talent or cause-related marketing, and (ii) developing socially conscious products and services.

1) Social contribution through donating design talent or cause-related marketing

When directly asked about a perceived relationship between CSR and design, many interviewees appeared to fail to link social aspect of CSR with their daily design activities. Apart from the actual design development process, interviewees discussed employee voluntary programs by donating design talent (e.g. design education of the younger generation, voluntary work for mural painting, etc.). Some interviewees suggested a possible connection between CSR and design, referring to marketing campaign-led approaches to CSR. For example, there was a discussion by interviewee 16 about the merits of selling products with a good cause through CSR-informed communication strategy. This approach is known as cause-related marketing and includes marketing initiatives based on the cooperative efforts of business 'for profit' and charitable causes. They believed this had a more direct economic benefit for a deprived local community than any other design involvement. However, in a real practise situation, the interviewee admitted there are many difficulties in adopting those cooperative efforts within the current organisational culture as the company still focuses on short-term profit-making strategies, even if embracing a cause would make good business sense in the long term.

2) Developing socially conscious products and services

When indirectly questioned about the broader role of design in addressing social aspect of CSR, several issues were considered broadly by the interviewees, yet without articulating them as to being ‘socially responsible’ design practices. However, when actually analysing their design approach, it appeared that many interviewees partly make decisions, potentially realising their social responsibility through both tangible and intangible design solutions.

Throughout the interviews, there was a discussion about a broad concept of enhancing the quality of people’s lives. Since understanding and responding to customers has become a key element in expressing social responsibility, relevant design issues have been considered in a user-oriented manner. From industrial designers’ perspectives, the commitment to building a happier and more convenient world to live in was identified as one of the fundamental and inherent responsibilities toward people and the community. For example, interviewees 9 and 12 recognised the fact that the primary role of designers is to create better products that are essential for people’s lives, by which designers are naturally yet unconsciously fulfilling their responsibility both for the company and the society they belong to. Whilst creating products and services based upon designers’ job responsibilities may be beneficial, initially, in gaining imminent economic gains, it is not sufficient to address a holistic dimension of social responsibility. This is because it is basically tied up with serving the economic interests of the firm to run its business in a financially sustainable manner, rather than motivated by an adherence to its human/societal values. In this vein, many product designers viewed designers’ social responsibility not just as creating best-selling products, but more importantly designing for people’s needs and desires. Interviewee S9 considered that creating innovative products based on human aspirations and lifestyle

before people even knew they wanted it could be a process of implementing designers' social responsibility. However, this discussion was, to a certain degree, limited to the aspect of giving products attractive appearances in a traditional view of design. From UI designers' perspectives, interviewee S12 made a more philosophical connection to the role of designers in satisfying the meaning and value needs of people. With the increasing importance of providing a variety of information through intangible service, attempting to design a service system without understanding the context of its use or how the information/content will influence people's quality of life may result in an ineffective and unnecessarily complex design solution, which might not be socially responsible. This is an important point trying to move toward human-centred approach by reflecting the social responsibility of designers, whilst balancing the aim of the business and people's desires and needs.

In terms of product liability, there was strong feeling that protecting consumers' health and safety is central to addressing CSR. As such, interviewees 3, 11, 12, and 13 suggested it is crucial for them to pay attention to product liability and to carefully look at whether there are any parts that could harm customers; yet, it appeared to be one of the primary job responsibilities directed by company regulation to comply with Product Liability (PL) law, ensuring the company has the right to sell its products to the market.

There was a discussion about affordability in terms of allowing people living in poverty to make their social lives a little more abundant with mobile products. Interviewee 1 believed that by designing a mobile phone that only contains essential and fundamental functions and offering it at an affordable price they are indirectly contributing to enhancing people's quality of life in the local community. However, interviewee 27 claimed that they did not create a phone for people in underdeveloped regions with the intention of improving their standard of living; rather, the interviewee suggested that the product with essential features only was developed with the aim of enhancing the company's entry-level market share and cost competiveness. The results can be the same, but the approaching mindsets are different.

On the other hand, a possible connection between design and CSR was made by the discussion about design for accessibility and inclusivity. Interviewees 9, 10, and 21 saw inclusive design features as socially responsible design action. For example, interviewee 10 stated that IT products, such as note-PCs and printers that are designed to be used universally, can guarantee equal opportunities among different social groups, such as people with disabilities. In this sense, interviewee 10 regarded the inclusive design feature as a positive example of implicitly incorporating social responsibility with products whilst serving the firm's economic cause. However, interviewee 5 discussed the difficulties faced by designers in developing a 'design for all'. He thought it was almost impossible to develop a product covering minority groups, such as people with disabilities, due to its limited marketability. This approach lacks a holistic understanding of what inclusivity really means; that is about extending user groups to take into account the needs of older persons

and persons with disabilities, and does not necessarily mean developing products for those people only, to the exclusion of normal users.

The discussion with UI and UX designers about social dimension of responsibility tended to focus mainly on usability issues. For example, GUI (graphic user interface) designers especially recognised the importance of usability of mobile phones for the elderly. According to interviewee 21, she developed a new guideline for the button and font sizes that focuses on enhanced usability, notably for the elderly, reconciling the necessary information on the button and font size with visual appeal and attractiveness for general mobile phone users. Although the interviewee 2 did not think she considered CSR during her design process, she actually internalised the CSR principle regarding caring for vulnerable groups through a user-cantered design approach, creating a new physical interface of the mobile phone for all.

The social aspect seemed to be more implicitly involved with the user-centred design process, and it was often accompanied though non-regulated and unconscious design decision-making processes. As such, many interviewees were making design decisions without articulating it as 'socially responsible' design actions. During the interviews, there was a lot of focus on the effect of design upon people and society, but one significant element did recur throughout the interviews, which was the lack of a definitive definition of what it is to be socially responsible from design perspectives, and the high possibility that motivation for socially responsible activities are different from their genuine purpose. In this sense, interviewee 15, 18, and 21 pointed out that those unconscious decisions toward SRD often originate from the firm's economic cause to satisfy unmet needs of the current and potential customer. As such, the respondents admitted those design decision are not genuinely derived from a sense of social responsibility, but rather from their job responsibility.

Implications

Many interviewees discussed the dominance of the economic perspective that underscores the practice of SRD. However, there was also recognition amongst 70% of the interviewees that there can be a difference in the products and services designed by a designer who is aware of social and environmental issues and a designer who is not, regardless of the existence of a company's regulation in terms of corporate social responsibility. So, ironically, although our interviewees acknowledged the importance of social and environmental dimensions, the prevalence of the economic viewpoint of the corporations means that genuine consideration for community and the environment remains largely elusive.

Throughout the interviews, it was suggested that the company regulation had placed a stronger emphasis on 'outcomes' or 'commercial successes' rather than on the degree to which human and societal consideration and creative attitudes had been thoroughly reflected

in the product development process. Within this company regulation framework, complying with global regulation is regarded as being important by all interviewees as an effective risk-management tool from a narrow view of CSR. In this organisational context, it is argued that many designers are making economically *conscious* decisions within a boundary of law or regulations to generally serve its socio-economic causes. This is represented in a variety of guises, from reputation management, risk management, cost reduction, brand image, to public relations. However, when asked to go beyond company regulation issues, many designers recognised 'eco' as dominate trend or paradigm for design, rather than as an intrinsic value to be applied throughout the product lines. In other words, if the idea of 'being seen to be green' appears to be more important than actually doing something, there could be a huge gap between the publicity and real actions of corporations. Indeed, one interviewee implied that nothing is being done, when viewed from his perceptive of SRD, due to lack of demand and perceived cost barriers. All the interviewees suggested the main conflict in incorporating CSR thinking within the new product development process was in relation to either the additional costs involved or the perceived additional costs involved with 'socially responsible' projects. Interviewees noted that they were working within a restricted budget allocated by the product planning team and had to be careful when using environmentally friendly materials, which are normally more expensive. In the private sector, if a project's business case cannot return the required margin, it will not go ahead; it becomes economically irresponsible for the shareholders. However, the findings from the interviews suggested there were many issues, such as part communisation, that are cost-effective whilst reducing the environmental impact of the manufacturing process. Understanding trade-offs in socially responsible design decision-making is therefore critical and need to be conscious trade-offs, rather than unconscious trade-offs.

In addition, much discussion about the social dimension suggested CSR issues are partly and potentially valid in designers' daily decision-making process, even though the designers may not clearly articulate it. This reflects that there are many designers who are socially aware but do not use the labelling of social responsibility. This arguably express the idea of unconscious decision-making driven by designers' own ethics and value system that has not become regulated or standardised within the organisation. However, CSR and socially responsible design can cause something to become regulated. Once the socially conscious design practices are recognised within an organisation as such, they have something more of regulatory status and become imbedded in the process; and then, socially responsible design will eventually become a part of formal process for hundreds of new product deployment projects going on within the company. It is therefore argued that if they could articulate what they are doing in terms of social responsibility, the impact would be greater on truly and genuine conscious decision-making toward SRD.

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Appendix 1. Index of interviewees

	Title	Division	Skill				
NO.1	Chief Engineer	Mobile Communication	Product Design	NO.16	Chief Designer	Digital appliances	Product Design/ Design Strategy
NO.2	Chief Engineer	Home Entertainment□	Product Design	NO.17	Senior Designer	Digital appliances	Product Design
NO.3	Chief Engineer	Home Entertainment□	Product Design	NO.18	Senior Designer	Mobile Communication	Product Design/ Product Planning
NO.4	Chief Engineer	Mobile Communication	Product Design	NO.19	Designer	Mobile Communication	Product Design/ Design Strategy
NO.5	Senior Engineer	Mobile Communication	Product Design	NO.20	Designer	Mobile Communication	Product Design/ Design Research
NO.6	Senior Engineer	Mobile Communication	Product Design	NO.21	Senior Designer	Mobile Communication	Graphic User Interface
NO.7	Senior Engineer	Mobile Communication	Product Design	NO.22	Senior Designer	Mobile Communication	Graphic User Interface
NO.8	Senior Engineer	Home Entertainment□	Product Design	NO.23	Chief Designer	Visual Display	Graphic User Interface
NO.9	Senior Designer	Computer System	Product Design	NO.24	Designer	Digital Imaging	Graphic User Interface
NO.10	Senior Designer	Computer System	Product Design	NO.25	Senior Designer	Mobile Communication	User Experience
NO.11	Senior Designer	Computer System	Product Design	NO.26	Designer	Mobile Communication	User Experience
NO.12	Senior Designer	Mobile Communication	Product Design	NO.27	Senior Designer	Mobile Communication	User Experience
NO.13	Designer	Digital Appliance	Product Design	NO.28	Designer	Mobile Communication	Package Design
NO.14	Design manager	Mobile Communication	Design Strategy	NO.29	Senior Designer	Digital Appliance	Packaging Design
NO.15	Design manager	Home Entertainment□	Design Strategy	NO.30	Senior Designer	Digital Appliance	In-store Communication
				NO.31	Chief Designer	Digital Appliance	In-store Communication

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Yoori Koo is currently a doctoral researcher in Design Management at the University of Lancaster. Her professional interests involve design/design management and its relationship to corporate social responsibility (CSR). One of her goals is to provide effective design management framework with which organizations can successfully incorporate human societal value into every aspect of a business, whilst achieving long-term financial gains. This includes effective CSR decision-making processes that affect the development and implementation of socially responsible design. She studies the potential of design management as a valuable tool with which to address problems and issues faced by both organizations and society

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Evaluation of an Operational Methodology for Sharing Innovative Manufacturing Knowledge

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Keywords: Knowledge sharing, innovative manufacturing, preliminary design.

This study evaluates the requirements of an operational methodology developed for the preliminary design stage of complex mechanical components. The methodology uses a combined tacit and explicit knowledge sharing approach to effectively identify, acquire and share innovative manufacturing knowledge. This enables an assessment of manufacturing feasibility to take place earlier in the design process and reduce risks associated with innovative manufacturing processes. The methodology was trialled using three separate real-life design situations and the outcomes evaluated using surveys and observations. The results largely supported the methodology requirements but key areas requiring further work were identified, primarily in defining the knowledge at an appropriate level and in meeting user requirements.

1. Introduction

Complex mechanical components (defined here by the authors) are found in complex engineering products which have a combination of mechanical, electrical and software sub-systems for high technology applications. These components must satisfy multiple design requirements from a range of engineering disciplines (such as thermodynamics, stress, performance etc.). Often, they are complex in geometry. The engineering design process for these components needs careful and systematic management to achieve the optimal resolution of the multiple requirements. The approach adopted typically follows the stages of the systematic design process as discussed by Pahl and Beitz – concept, preliminary and detail design (1988). During the concept design stage, the performance specification for the product is generated. This specification becomes an initial physical representation during the

preliminary stage, with an overall product general arrangement, overall sizings, assemblies and component interfaces. Final component design then takes place during the detail stage, where the engineering features are fully defined in the component, geometry, dimensions and tolerances added and all necessary additional information added to enable the component to be produced and supported in service.

At the preliminary design stage the geometry has not yet been fully defined, hence the selection of the manufacturing process will have a major influence on the subsequent outcome of the size and shape of the component. If the manufacturing process is in development, that is, 'innovative', this can offer significant opportunities to change the resulting size and shape of the potential design. This can result in improvements to other design requirements such as performance.

An example of a complex mechanical component is shown in figure 1. The blisk is a component from a gas turbine engine which can be used instead of a conventional blade / disk assembly in some circumstances. A single component removes the need to have features added to facilitate assembly in the conventional assembly. This reduces the weight of the component and hence increases the potential performance. Developments in manufacturing processes enable this new component size and shape to be successfully produced.

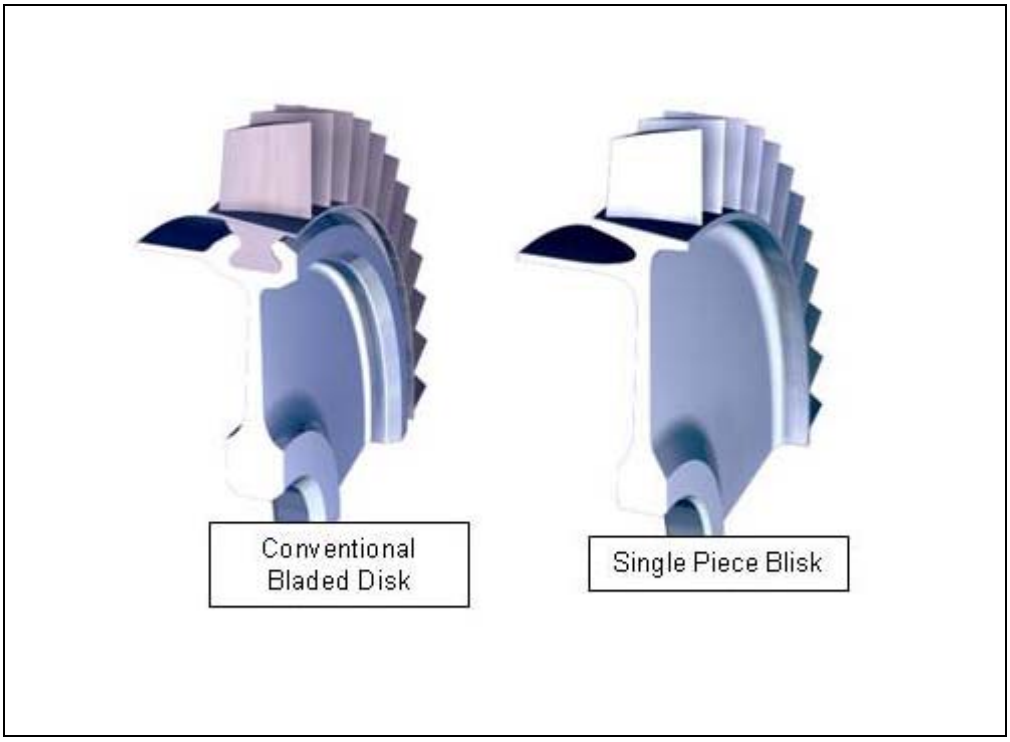

Figure 1: Example of conventional blade / disk assembly and blisk (reproduced with permission from Rolls-Royce plc)

However, such innovative knowledge may initially be difficult to identify and codify, presenting a risk in assessing manufacturing feasibility. Acquiring and sharing this innovative manufacturing knowledge effectively can therefore be treated as a knowledge management problem. This study considers the innovative manufacturing engineering knowledge requirements for the preliminary design stage of complex mechanical components found in gas turbine engines for aviation applications. It took place as an in-depth study in a single UK organisation.

An operational methodology to address this problem is outlined and evaluated in this paper. The evaluation is discussed from two perspectives: the evaluation of the previous manufacturing knowledge requirements generated; and how effective the methodology is in use in generating these requirements.

2. Background

The engineering design process can be considered a knowledge management process (Hicks et al, 2002). McMahon et al proposed that engineering knowledge has both explicit and tacit elements, following the definition proposed by Nonaka, following Polanyi (McMahon et al, 2004; Nonaka, 1994; Polanyi, 1966). Explicit (or codified) knowledge can be easily articulated, therefore codified and transferred. Tacit (or personalised) knowledge, on the other hand, is borne of one's own experiences and perceptions and is difficult to codify and transfer in the same way. Nonaka asserts that both can be necessary requirements in order to build organisational knowledge. This has led to two approaches in knowledge management in general: the commodity approach and the community approach. The commodity approach follows the definition of explicit knowledge and assumes that knowledge can be codified, isolated from its source and be transferable. Such an approach has influenced the development of information systems. The community approach assumes that knowledge cannot be isolated from its source (the individual), therefore it cannot be transferred in the same way and must be shared through social networks. Both approaches can be seen in the development of systems to support engineering design, for example in knowledge-based engineering and CAD systems (commodity) and integrated product teams (IPTs – community).

Manufacturing knowledge (a subset of engineering knowledge) has been defined as knowledge about the method of manufacture, its capability and its cost (Nowack, 1997; Chen, 1999; Balogun et al, 2004). The granularity of this knowledge varies according to the stage of the engineering design process, with its relevance being primarily to the detail design stage. The level of manufacturing knowledge for earlier stages of the design process has been defined as being 'more abstract' but the extent of this has not really been defined (Boothroyd et al, 2002). Research in this area is concerned with integrating manufacturing knowledge into the design process and also follows the commodity and community approaches.

The commodity approach to managing manufacturing knowledge considers the interoperability aspect of sharing design and manufacturing knowledge between different information systems. Typical examples of this approach are features and information models (Sharma and Gao, 2002; Borg and Giannini, 2003; Canciglieri and Young, 2003). Although this approach has been highly useful in producing optimised solutions, the main benefits have been at the detail design stage as they are reliant on a certain maturity of geometry. Even with research aimed at the earlier stages of design, it could be argued that much of the geometry is known before the manufacturing assessment takes place. There is also an assumption that the manufacturing process is known and capable.

Examples of the community approach have also been applied to the engineering design process, most notably through the use of multi-disciplinary teams (IPTs). The best examples of these tend to be co-located although this is not always feasible on large global projects (Pawar and Sharifi, 1997; Deitz, 1995). A criticism of the community approach is that without a systematic process they may not be seen to be enabling effective knowledge management.

With our particular case, the use of an innovative manufacturing process may enable the other requirements to be better achieved. However, the consideration of a manufacturing process which is in development is a risk. The extent of its capability is not fully known. Therefore, the definition of manufacturing knowledge can be extended to include knowledge of the maturity of the process (Mountney and Gao, 2006). If there was a mechanism to effectively identify, acquire and share this knowledge, this would reduce the risk in the design process.

It is therefore necessary to consider the maturity of innovative knowledge and how this relates to the definition of explicit and tacit knowledge. Bohn considers that knowledge moves on a continuum from tacit to explicit as it matures (Bohn, 2004). Therefore tacit knowledge and the community approach are necessary in the management of innovative knowledge. Furthermore, other researchers have highlighted how innovative knowledge is generated by sharing knowledge across disciplines, another mechanism which requires the community approach (Dougherty, 1992; Saviotti, 1998).

A suitable knowledge management technique to effectively acquire and share innovative manufacturing knowledge therefore requires a combined approach. There is a need to create an environment where innovative knowledge management can be shared effectively, yet also be systematically recorded in its explicit form. Such characteristics suggest the use of an operational methodology. Examples of this can be seen in Hall and Adriani's operational methodology to assess explicit and tacit knowledge requirements in new product development (1998), but has not been developed for the specific case considered here.

This therefore presented an interesting research challenge. Two in-depth investigations took place in the selected organisation which resulted in an initial hypothesis of manufacturing engineering knowledge requirements for preliminary design (see section 4.1). An operational

methodology was then developed from these requirements (see section 4.2). The evaluation of this methodology is the main concern of this paper.

3. Aim and Approach

There were two objectives in evaluating the methodology. The first was to confirm the hypothesis of manufacturing knowledge requirements developed from the earlier work, confirming that the method developed was effective in identifying, acquiring and sharing innovative manufacturing knowledge requirements. Secondly, as the methodology was developed for operational use, it was also important to evaluate it from the users' point of view and to examine whether it would be useful in an organisational setting.

The purpose of the evaluation was to determine the suitability of the methodology developed in meeting the requirements and to highlight areas where further improvements could be made. A formative approach was therefore adopted which would require the analysis of qualitative data (Patton, 1987). This suited the flexible and phenomenological approach adopted with the two earlier investigations and was complementary to Nonaka's view of organisational knowledge as the collection of knowledge from individuals. Data sampling was purposeful in order to highlight cases of specific interest - in this case, those with an innovative method of manufacturing in development.

4. The Methodology

This section briefly discusses the research carried out prior to this paper in developing the methodology. Section 4.1 summarises the hypothesis of manufacturing knowledge requirements derived from two in-depth investigations. Section 4.2 summarises the development of a methodology which embodies these requirements.

4.1 Manufacturing Engineering Requirements

The first investigation within the organisation was concerned with the nature of manufacturing engineering knowledge for the preliminary design stage. A series of semi-structured interviews took place with preliminary designers and others involved in the preliminary design stage. These interviews were analysed using Grounded Theory technique (Strauss and Corbin, 1998). The following requirements were derived:-

1. The manufacturing knowledge generated from using the methodology should show the constraints (or opportunities) of the process on the overall size and shape of the component at a content and level sufficient for common understanding between the design and manufacturing specialist domains and to assess manufacturing feasibility.

2. The manufacturing knowledge requirements need to show an indication of the maturity of the manufacturing process.

3. A range of knowledge types which cover the range of tacit and explicit knowledge elements needs to be used to identify, acquire and therefore share innovative manufacturing knowledge at a level appropriate to the preliminary design approach.

The investigation and these requirements are discussed further in Mountney et al (2007).

The second investigation explored how these requirements could be seen in a component design situation. A series of informal discussions took place around a specific component which fulfilled the criteria of being a complex mechanical component and having an innovative manufacturing process. The results of these discussions established the knowledge required, but also highlighted how this knowledge set varied between the different specialist domains of design and manufacturing. The knowledge requirements would need to be finalised and a consensus established from the collective knowledge from these particular specialist domains. A set of guiding questions were then derived from the discussion results to determine this knowledge. This is discussed further in Mountney et al (2011).

4.2 Methodology components

The methodology was developed as a consequence of the investigatory work summarised in the previous section (Mountney, 2009). It has the following three components:-

1. A systematic series of questions aimed at deriving the manufacturing knowledge at a level appropriate for preliminary design, by identifying pertinent material, process and geometric characteristics. This series of questions are designed to be used in an operational setting. This was derived from the findings of the second investigation and fulfils the first requirement.

2. A process maturity audit which determines whether a component has an innovative manufacturing process, developed to indicate the process maturity and fulfil the second requirement.

3. The use of the process maturity audit and the systematic series of questions in a series of workshop settings, to facilitate the sharing of tacit knowledge elements and the codification and recording of the relevant explicit knowledge elements in text and numerical form.

The methodology was created around four processes:-

Select: considers the components relevant for manufacturing knowledge collection and assesses (quickly and intuitively) whether the process is innovative, using a process maturity audit.

Create: the manufacturing knowledge relevant for the selected component and process is firstly identified and then acquired using a systematic set of questions to define the geometry, material and process characteristics of the component. Knowledge which is codified can be recorded.

Use: This knowledge is then fed back to the preliminary design team at the most appropriate level for use in the design process.

Reuse: the knowledge recorded is reviewed and updated as it matures.

5. Evaluation Design

5.1. Design of the evaluation sessions

The evaluation sessions were designed to reflect real-life design situations as far as possible. Three real-life cases were selected: an assembly, a component and a component feature. Each case examined two methods of manufacture, of which one was a ‘mature’ method currently used in production and the other an ‘innovative’ method in development. Each case had two evaluation sessions planned: a manufacturing evaluation and a designers' evaluation.

The purpose of the manufacturing evaluation was to identify and record (where possible) the knowledge required to assess manufacturing feasibility at the preliminary design stage. For each session, a small group of engineers were identified and invited to take part. This group constituted the component design engineers and manufacturing engineers and technologists for both methods of manufacture being considered. They were considered to be knowledge experts and were therefore representatives of the specialist domains of design and manufacturing. The group worked through the ‘select’ and ‘create’ processes of the methodology, with the workshop facilitator (the author) identifying and recording the knowledge in a series of pre-designed MS Excel forms. The facilitator also recorded observations of the group during the session.

The results of each workshop – the output from the forms - were then presented back to representatives of the preliminary design team for their evaluation, during the designers' evaluation.

In total seventeen engineers took part in the evaluation sessions, of which 8 were design specialists (preliminary and component) and 9 were manufacturing specialists. A summary of the session participants is shown in table 1.

Session	Subject	Participants
Manufacturing evaluation 1	A component feature	1 specialist component designer 4 manufacturing specialists
Manufacturing evaluation 2	An assembly	1 specialist component designer 3 manufacturing specialists
Manufacturing evaluation 3	A component	2 manufacturing specialists
Designers evaluation 1	Output from manufacturing evaluations 1 and 2	4 members of the preliminary design team
Designers evaluation 2	Output from manufacturing evaluation 3	2 members of the preliminary design team

Table 1: Participants in evaluation sessions

5.2 Survey design

The purpose of the survey was to record the qualitative opinions of the workshop participants which could then be used to evaluate the methodology and its use. These opinions were recorded using a combination of attitude scale and open-ended questions. The average 'score' of the attitude scale questions was taken as an indication of opinion; the open ended questions were thematically analysed. The questions were aimed at evaluating the three topic areas which correspond to the methodology requirements. In most cases the questions used for the manufacturing and designer evaluations were different; however a core set of five questions were common to both evaluations. These questions, and the evaluation sessions to which they are relevant, are shown in table 2. In addition to these questions, five open-ended questions were included in both surveys for formative evaluation.

The scale used in the attitude scale questions was 1 – 6 where 1 = strongly disagree and 6 = strongly agree. (For some questions the scale was different, either 1 = not at all useful and 6 = very useful; or 1 = too time consuming and 6 = an effective use of time, but the conventions of the score followed the same pattern). They were analysed by finding the average of the responses for each question. This was treated as an indication of opinion. With the scale being 1 – 6, a neutral response would be indicated by an average score of 3.5. Each survey represented a unit of analysis, with a comparison drawn between the results for the different specialist domains. The same units of analysis were used for the open-ended questions.

6. Results

Table 2 shows the breakdown of average attitude scores for each question, overall and by specialist domain. The responses to each of the main topics will be summarised in turn.

6.1 Questions about assessing the maturity of the process

Two questions (1 and 2) were asked in the manufacturing evaluation survey, primarily concerned with the user's point of view. Responses were mainly on the affirmative side of neutral. A weakness with the survey design was that no questions were included to enquire about the usefulness of assessing the process maturity. The only way to assess this was from the responses to the open-ended questions.

6.2 Questions evaluating the knowledge content and level

Questions 3-8 were used in the manufacturing evaluation surveys and were designed to evaluate the process of identifying and defining the knowledge from the user's perspective. Answers again were on the affirmative side of neutral.

Questions 9-12 were asked in both the manufacturing and designers' evaluations and were designed to evaluate the methodology requirements. In terms of the content and level of knowledge, replies ranged on the scale from neutral – slight disagreement (from the designers at 3.00). The reason for this may be suggested by the responses to question 11. The knowledge recorded is at a more detailed level than usual for the designers and slightly less

Evaluation survey questions	Where asked		Score	Average by domain	
	M/f evaln	Design evaln	Overall average	Design	M/f
Questions evaluating the Process Maturity Audit					
1. I understood the statements in the audit.	Yes		4.25	4.00	4.33
2. The process maturity was assessed quickly.	Yes		4.13	3.50	4.33
Questions evaluating the knowledge content and level					
3. I was able to identify the manufacturing characteristics.	Yes		3.86	3.50	3.86
4. Identifying the characteristics was easy to work through.	Yes		4.00	4.00	4.00
5. Identifying the characteristics was quick to work through.	Yes		3.56	3.50	3.57
6. It was useful to distinguish between differentiating and influencing characteristics.	Yes		4.44	4.50	4.43
7. Following the template was more effective than group discussions.	Yes		4.00	4.00	4.00
8. I could identify the knowledge required.	Yes		4.11	4.00	4.14
9. The content of the manufacturing knowledge specified is sufficient to allow an initial process feasibility assessment to be carried out during stage 1 preliminary design.	Yes	Yes	3.24	3.00	3.56
10. The level of detail of the manufacturing knowledge specified is sufficient to allow an initial process feasibility assessment to be carried out during stage 1 preliminary design.	Yes	Yes	3.29	3.17	3.44
11. Compared to the manufacturing knowledge I would use in my job role, the recorded knowledge is (less detailed / more detailed).	Yes	Yes	4.10	4.67	3.25
12. It is useful to distinguish between knowledge which constrains manufacturing process selection and knowledge which is background for a business case.	Yes	Yes	5.05	5.42	4.56
Questions evaluating the use of different knowledge types					
13a. Recording the manufacturing knowledge as numerical information was (not useful / useful)	Yes		3.22	3.50	3.14
13b. Recording the manufacturing knowledge as numerical information was (too time consuming / an effective use of time).	Yes		2.78	3.00	2.71
14a. Recording knowledge as additional comments was (not useful / useful).	Yes		4.67	4.00	4.86
14b. Recording knowledge as additional comments was (too time consuming / an effective use of time).	Yes		4.33	4.00	4.43
15a. Being able to discuss the manufacturing knowledge requirements in a workshop setting was (not useful /useful).	Yes		5.11	5.00	5.14
15b. Being able to discuss the manufacturing knowledge requirements in a workshop setting was (too time consuming/ an effective use of time).	Yes		4.11	4.50	4.00
16. It was useful to be able to combine recording knowledge (as text and numerics) and workshop discussions.	Yes	Yes	5.05	5.42	4.56

Table 2: Summary of attitude scale questions and responses

for the manufacturing engineers, therefore recording it at the appropriate level has not been wholly successful. However, all respondents found distinguishing between manufacturing process knowledge which physically constrains the design and that which supports a business case useful, particularly the designers.

6.3 Use of different knowledge types.

As the knowledge expression became more tacit, from numerical to text to speech, it was rated more highly by the participants in terms of its usefulness, particularly the workshop discussions.

6.4 Open ended questions

Both the manufacturing and designer evaluation surveys contained five additional open-ended questions. The answers were thematically analysed. The questions and the themes which emerged from them are shown in table 3.

The responses indicated that some of the features of the methodology were favourable. Some of these features corresponded with some aspects of the original design requirements for the methodology: process maturity (although this was discounted by one respondent), the systematic aspect of the methodology, use of the methodology specifically for specialised components and knowledge sharing. These responses are highlighted in grey in the table.

However, the responses also highlighted some aspects which needed further consideration. As the methodology was tested in isolation of other knowledge systems used within the organisation, there were some concerns that it duplicated aspects of these systems. There were also concerns about the scope of the methodology, particularly from the designers. On the whole they found the information about the process maturity useful, however they were interested in a different approach, more concerned with sharing knowledge about new processes and investigating the design possibilities about these processes. There were also concerns about the content of the knowledge recorded, reinforcing the survey replies.

6.5 Evaluation session observations

In addition to the survey responses, observations of each workshop session were recorded by the facilitator to check that the survey responses tallied with the running of the sessions as a way of checking respondent and reactive bias. In the first evaluation, two survey responses did not match the obvious workshop experience of the participants. It appeared that the respondents had recorded what they thought the facilitator wanted to hear rather than their own experience. These surveys were therefore withdrawn from the analysis.

Question	Manufacturing Evaluation responses	Designers' Evaluation Responses
17. What was the most useful part of the workshop for you? Why?	Knowledge sharing: 5 Knowledge content: 1 Manufacturing impact: 1 Process maturity: 1 Not answered: 1	Knowledge content: 3 Process maturity: 2 Manufacturing impact: 2 'Useability': 1 Additional contact links: 1
18. What was the least useful part of the workshop for you? Why?	Numerical knowledge: 3 Process maturity: 1 Time to run the workshop: 1 Methodology scope: 1 Nothing specific: 1 Not answered: 2	Content not appropriate to preliminary design: 1 Keeping database updated with knowledge: 1 Duplication of knowledge in existing systems: 1 No perceived advantage for preliminary design: 1 Standard process information: 1 Accuracy of knowledge: 1 Not answered: 2
19. What changes would you recommend to the methodology? Why?	Terminology: 3 Methodology design: 2 Methodology content: 1 Useability: 1 Not answered: 2	Business readiness: 1 Methodology scope: 5
20. Would you be interested in using any aspect of this methodology in your job role? Yes / No / Don't know. Why?	Yes: 5; No: 2; Don't know: 1; Not answered: 1 'Yes' replies:- Systematic method: 3 Design – manufacturing interface: 1 Business case: 1 'No' replies:- Already have tools: 1 No reason given: 1 'Don't know' reply:- Would want another trial.	Yes: 3; No: 0; Don't know: 3 'Yes' replies:- For specialised components which directly influence engine architecture: 1 As a prompt for discussions with a specialist:1 For general knowledge about new processes: 1 'Don't know' replies:- Not sure it's what I need: 2 Don't see how it relates to conversation with an expert.
21. Any further comments?	No responses.	Keeping the recorded knowledge updated: 2

Table 3: Summary of responses to open-ended questions

7. Discussion and scope for further work

The results of the evaluation sessions do seem to largely confirm the original hypothesis of manufacturing requirements which was generated from the earlier work. A discussion of the process maturity does appear to have some benefits in mitigating risk during the preliminary design stage. The requirement for the use of different knowledge types does seem to be the most successful part of the methodology, with points about the ability to share knowledge, discuss knowledge across the design and manufacturing domains, and to use ways of expressing knowledge all mentioned as being useful. It was interesting that the identification and quantification of explicit knowledge was seen as being one of the least useful aspects of the methodology; this may again confirm the immature aspect of some of the innovative manufacturing knowledge being discussed and its relevance to the particular types of components for which the methodology was designed.

It is considered that the requirement for the content and level of knowledge was only partially satisfied. The results did indeed demonstrate that there was a difference in the level of knowledge required for the design domains and manufacturing domains, further confirming this requirement. However, the methodology was not successful in being able to convey this at the level most appropriate for preliminary design. However, from the workshops the engineers themselves had difficulties pinpointing the most appropriate level of granularity required. The methodology can be seen as an attempt to achieve this, but one which clearly requires further investigation.

In terms of the methodology as a practical tool to be used operationally, again it is clear that some aspects require further development. This is perhaps unsurprising as it was the first time that it was trialled within the organisation. It is clear that further work is required to identify the knowledge at the most appropriate level of granularity, however there are some more fundamental issues to address. Although a method for systematically sharing knowledge about innovative manufacturing processes seemed to be received with interest by representatives of both specialist domains, there were suggestions for a different scope, particularly from the preliminary designers.

There are some limitations with this work. The trial results are confined to three different components and a small group of respondents in a single organisational setting, although this purposeful sample provided a rich data source to investigate the methodology in use. A significant limitation was that the preliminary designers themselves were unable to take part in the evaluation sessions, even though these were originally designed with them in mind. It would have been interesting to see if this addressed any of the content and level or scope issues which were raised in the evaluation.

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Digital Service Offering Modularity: An Empirical Analysis of Traditional Publishing Industry

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Based on extant service design and innovation literature, we propose a framework for digital service modularity. The framework can be used to describe how firms develop digital service offerings. In the empirical part of this study a case study of 15 companies from traditional publishing industry was conducted to analyse ways firms embed modularity to their service architecture and service design when transforming to digital service business. The empirical findings suggest that modular service design for digital landscape is largely moderated by the offline traditional service offering.

INTRODUCTION

Rapid digitization, the conversion of traditional printed words into electronic formats, is having fundamental influence on how information is found, consumed and shared (Fetschering and Knolmayer, 2004; Stahl, Schäfer and Mass, 2004; Tian, Martin and Deng, 2008). As a result, many traditional publishing companies have developed and launched various digital media services that can be consumed through different mobile and tablet devices (Huhtala, Sihvonen and Leminen, forthcoming 2011). In order to succeed in emerging digital media service markets, both organizational innovativeness and effective service design are essential (Slater and Mohr, 2006; Yoo, Henfridsson and Lyytinen, 2010). Moreover, understanding service architecture and modularity are needed to enhance firm's capability to innovate and design (Voss and Hsuan, 2009).

As service architecture and modularity have received only scant interest in the extant service design literature, this study aims to examine modularity in traditional publishing industry service offering designs and evaluate its alternative options in the digital landscape. Deriving from this notion, our research problem can be stated as:

> How firms embed modularity to their service architecture and service design when transforming from traditional product/service business to digital service business?

Additionally, our aim is to uncover how the service offerings and their modularity differ between distinctive three publishing industries; namely newspaper, magazine and books.

In order to address the research problem, an in-depth multiple case study was conducted (e.g. Yin 1898; Stake 1995). Overall 15 cases were studied by interviewing managers, directors and other key decision makers from different news, magazine and book publishing companies between May 2010 and May 2011. Essentially, this covers a period when digital media service markets for tablet devices (such as Apple's iPad) started to emerge.

THEORETICAL BACKGROUND

During the last decades, service design related research has been gaining increasing popularity (e.g. Donnelly et al., 1985; Voss et al., 1992; Goldstein et al., 2002; Holopainen, 2010). Goldstein et al. (2002) proposed a classification for research related to service design and development. This classification includes among others, the process of service design and new service development or NSD (e.g. Donnelly et al., 1985; Scheuing & Johnson, 1989; Bowers, 1989; Johnson et al., 2000), dynamics (Johnson et al., 2000) and innovation process (Sundbo, 1998; Edvardsson et al., 2000), and service design and innovations' impact on performance (Voss et al., 1992).

Service design and innovations

Service design has multiple linkages with innovations (e.g. Voss et al., 1992; Sundbo, 1998; Edvardsson et al., 2000). For example, Voss et al. (1992) examined the relation between innovation, service design and business performance and found that innovation in services is crucial for maintaining competitive advantage.

Traditionally innovations have been classified as incremental or radical (Garcia and Calantone, 2002). Furthermore, Henderson and Clark (1990) add two further types of innovations, namely architectural and modular innovations to this classification. Modular innovations are innovations that change the design concepts meaning that knowledge of the service component design change. Architectural innovations change the knowledge of the relationships between the components. As a firm confronts an architectural innovation, much of what the firm knows is useful and can be applied in the new situation, but some of its knowledge is not only inappropriate but actually handicaps the firm. Thus, the firm has to recognize what is useful of its existing knowledge and what is not, and it has to acquire and apply new knowledge when necessary. In incremental innovations the service component

design and of the relationships between the components remain mainly unchanged. Finally, radical innovations are the most challenging type of innovations because they change knowledge of both the component design and the architecture, i.e. relationships between the components. (Henderson and Clark, 1990).

Service architecture and component design modularity

Voss and Hsuan (2009) claim that an understanding of service architecture and component design modularity is crucial to service design and innovation. They argue that service architecture is an important enabler of agility and that the architecture must be designed with agility in mind. A carefully designed modular architecture makes agility possible. They analyze a service system architecture with four levels, that is industry, service company/supply chain, service bundle, and service package/component levels. In this paper, we focus on service bundle and service component levels, i.e. the service architecture and component design levels of service offering, but we also draw some conclusions on the service industry and company and supply chain level.

Service modularity is a rather new research theme, but it has been greatly influenced by the earlier discussion on product-related modularity (Bask et al., 2010; Pekkarinen and Ulkuniemi, 2008). Voss and Hsuan (2009) point out that the concept of "modularity" or "architecture" has rarely been used in the design of services. Service offerings can be seen as sets of services, products, and processes. There are non-modular (integral) service architectures, where offerings cannot be easily divided into components, and modular service architectures where offerings consist of service packages or modules (Voss and Hsuan, 2009; Bask et al., 2010). As an example from the publishing industry context, offerings can be integral (a book, a magazine issue, a printed newspaper etc.), or they can consist of modules. Schilling (2000) mentions an example of the use of modularity principles in the publishing industry, namely textbooks, as many publishers enable teachers put together their own textbooks consisting of book chapters, articles, cases, or even the teacher's own materials.

A service module can be seen as one or more service elements offering one service characteristic (Pekkarinen and Ulkuniemi, 2008). Key characteristics of modular products and services mentioned in the literature are that they are built of standardized and loosely-coupled components, so that they can easily be decomposed into modules, and they can be recombined and reconfigured to create variety. The interface constitutes the critical element of the unit standardization, and the basic idea in modularization is that a module can be substituted without affecting the thoroughly defined and standardized interfaces (Bask et al., 2010; Campagnolo and Camuffo, 2010; Jacobs et al 2007; Salvador, 2007; Mikkola, 2006; Sanchez and Mahoney, 1996).

Digital service design modularity

In this research we examine service offerings and especially the service architecture and component design in the publishing industry, the current state of design of digital publishing

services and alternative service offering design options for publishers in the digital landscape. According to Yoo, Henfridsson and Lyytinen (2010), however, in the digital environment modularity is distinctively different compared to traditional product architecture: the architecture becomes “layered modular” meaning that the component designs building the system are not derived from a single design hierarchy of a given product, and that is why the components become product agnostic and they can be bundled with heterogeneous devices. Besides, in the digital environment the designers of components cannot fully know how the components will be used, and that a layered modular architecture offers generativity, that is the technology has an overall capacity to produce unprompted change and innovations (Yoo, Henfridsson and Lyytinen, 2010).

Theoretical framework

In Figure 1 we summarize the discussion presented in the earlier literature into a framework for analysing digital service modularity. Our framework is modified from the framework presented by Henderson and Clark (1990), and it is based on the notion that transformation from traditional product/service business to digital service business unfolds through changes of either service architecture or service component design, or both. The framework is useful because with it we can capture the possible routes the firms use when they develop modular service offerings for digital landscape. An underlying presumption is that modularity in service architecture and component design helps companies to become more innovative and agile.

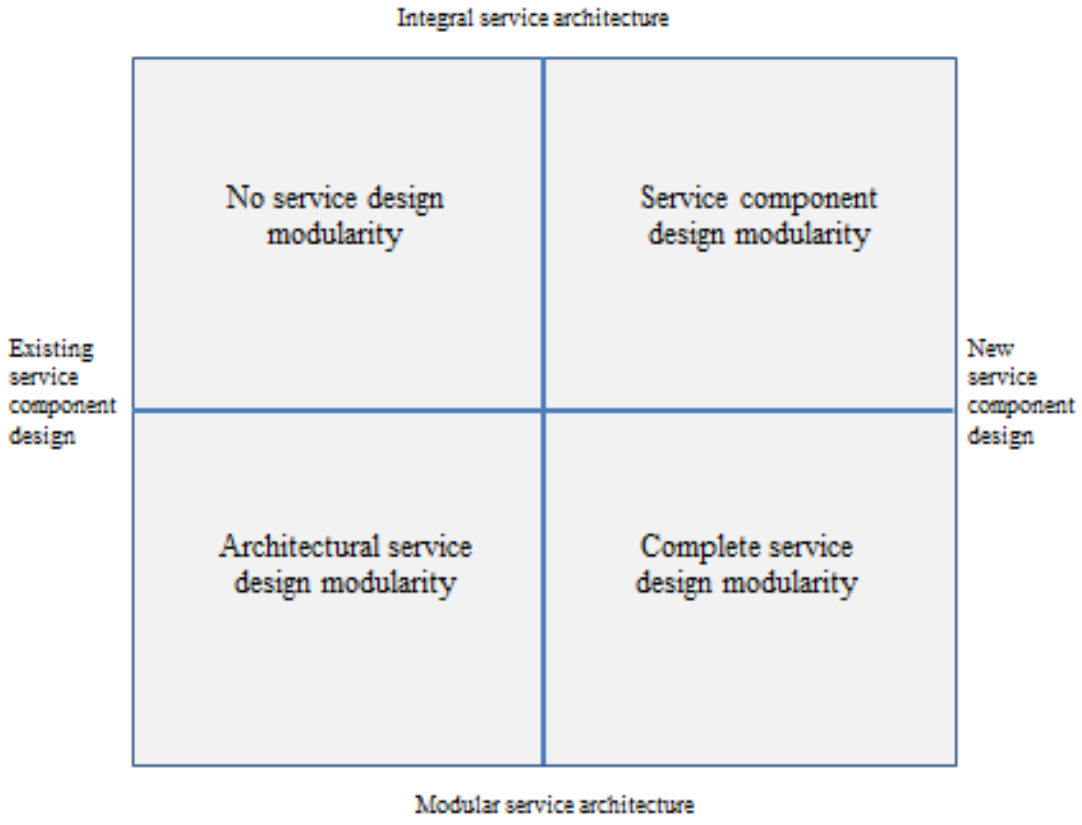

Figure 1: Framework for defining digital service modularity.

When a company entering digital landscape has not developed any new service components or reconfigured its integral service architecture, it is in the upper left corner of the matrix where its service design expresses *no service design modularity*. In this case no or only minor innovations are required. If a company replaces its integral architecture with modular architecture but continues using the existing service component design, it applies *architectural service design modularity*. When a firm develops a new modular service component design for digital landscape but relies on the integral service architecture, it applies *service component design modularity*. Architectural changes or new service component design require new knowledge of these issues and consequently some level of innovativeness. Architectural changes require reconfigurations in how the components are linked together, and changes in component design require development of new digital components. Finally, changing both the architecture and component design resulting in *complete service design modularity* is the most radical change. It requires profound new knowledge and innovations, and that is why this transformation can be supposed to be the most challenging one.

METHODOLOGY

In order to gain in-depth understanding of a currently unfolding phenomena, case study approach was chosen (Stake, 1995; Yin, 1989). The research framework, data collection and the analysis evolved simultaneously and was subjected to systematic combining (Dubois & Gadde, 2002).

In a case study, definition and selection of the case(s) are essential (Ragin, 1992; Romano, 1989). The case companies for this research were selected based on theoretical sampling, in which the cases are selected so that they represent the problem of the study (Yin, 1989). However, the decisions as to how many and which particular cases to select were left to the research group (Romano, 1989).

In order to address the research problem, we gathered data by interviewing overall 15 managers, directors and other key decision makers from different news, magazine and book publishing companies. These consisted of 4 magazine publishers, 7 newspaper publishers and 4 book publishers.

Each of the 15 case companies is currently developing digital content services in different forms. Each company forms a unique case study entity. As Table 2 shows, the main data source through which digital services were captured and described consists of 15 semi-structured key informant interviews within the case companies (Kumar, Stern & Anderson, 1993; Arksey & Knight, 1999). The interviewees were chosen based on their involvement with the digital service development, essentially following theoretical sampling (Strauss and Corbin, 1998, p. 201).

Companies	Interviewees
Case 1 (books)	Manager, development
Case 2 (newspapers)	Director, online media
Case 3 (newspapers)	Manager, development
Case 4 (magazines)	CEO
Case 5 (newspapers)	Researcher
Case 6 (newspapers)	VP, online media
Case 7 (newspapers)	Director
Case 8 (newspapers)	CEO
Case 9 (books)	Manager, purchasing
Case 10 (newspapers)	Manager, development
Case 11 (books)	Director, ICT
Case 12 (books)	Director, online media
Case 13 (magazines)	Director, business development
Case 14 (magazines)	CEO
Case 15 (magazines)	Director, online

Table 2: Interviewee data

The main focus areas in our interviews were service design and service architecture. For this purpose, we used literature on service design and service architecture to plan for the questions in our semi-structured interviews. Overall, the semi-structured interviews consisted of 11 parts covering topics such as digital content characteristics, distribution channels for digital content and business relations in the digital landscape.

The interviewees were accordingly asked to specify the key aspects of their current and potential service offering designs. The choice of informants was based on the principle that information is best elicited from people who have knowledge of the phenomenon (e.g. Arksey & Knight, 1999) and therefore all informants have been involved in developing digital content publishing for tablet devices.

Having interviewed 15 key informants and industry experts, saturation (repetition and similar incidents) was observable in the data and so the collection of empirical material was ended. All interviews were taped with the interviewee's permission, transcribed and analyzed accordingly. Qualitative data analysis was employed in order to thematize and analyze the material (Miles & Huberman, 1984).

FINDINGS

Most of the actors interviewed pointed out that new component design will be the first step from print to digital for companies in Finnish publishing industry. This step has been already taken by majority of case companies from newspaper industry, but so far they haven't been able to commercialize their services. Even though the offering based on new component design has not been succeeding in newspaper industry, book publishers are planning to take the same approach when providing services for tablet devices. Also many case companies from newspaper industry seem to believe that tablet devices will increase consumers' willingness to pay for digitally published content, and thereby will open a second chance for the industry to commercialize digital publishing services.

However, some interviewees seem to aim to apply modular service architecture for their digital business. As the managers from magazine and newspaper industry said, in order to succeed in the future, the service modules should be developed so that customer can choose and combine the digital content from various sources and participate in service design process. For these companies modular service architecture means providing the original traditional content in smaller digital modules, which can be offered and consumed separately or in bundles. One example is personalization of newspaper homepages according to interests, emphasising for example sports and politics news. Another example mentioned in the interviews was place-connected services:

> "*it can be connected to a place so the closer you are to something, so you can follow it." (Director 2)*

Figure 2 classifies case companies based on whether they apply existing service component design or new service component design and whether they have integral service architecture

or modular service architecture. For example, case company 10 of newspaper industry applies integral service architecture and new component design. The company has a webpage and a mobile application. Case company 13 of magazine industry applies modular service architecture and existing component design, and the interviewed director sees that digital content business for tablet devices increases the potential to earn. Making the activity economically profitable is not considered to be easy though, because there have been discussions of personified magazines for a long time, but nothing concrete has happened. Also, the payback for digital content services may not be immediate. As one interviewee said:

> *"we are also doing service development and projects that are not profitable from day one" (Manager 10).*

Some of the case companies from newspaper industry may move from integral service architecture to modular service architecture after the arrival of micro and nano payments, because this opens earning models for low price service offerings.

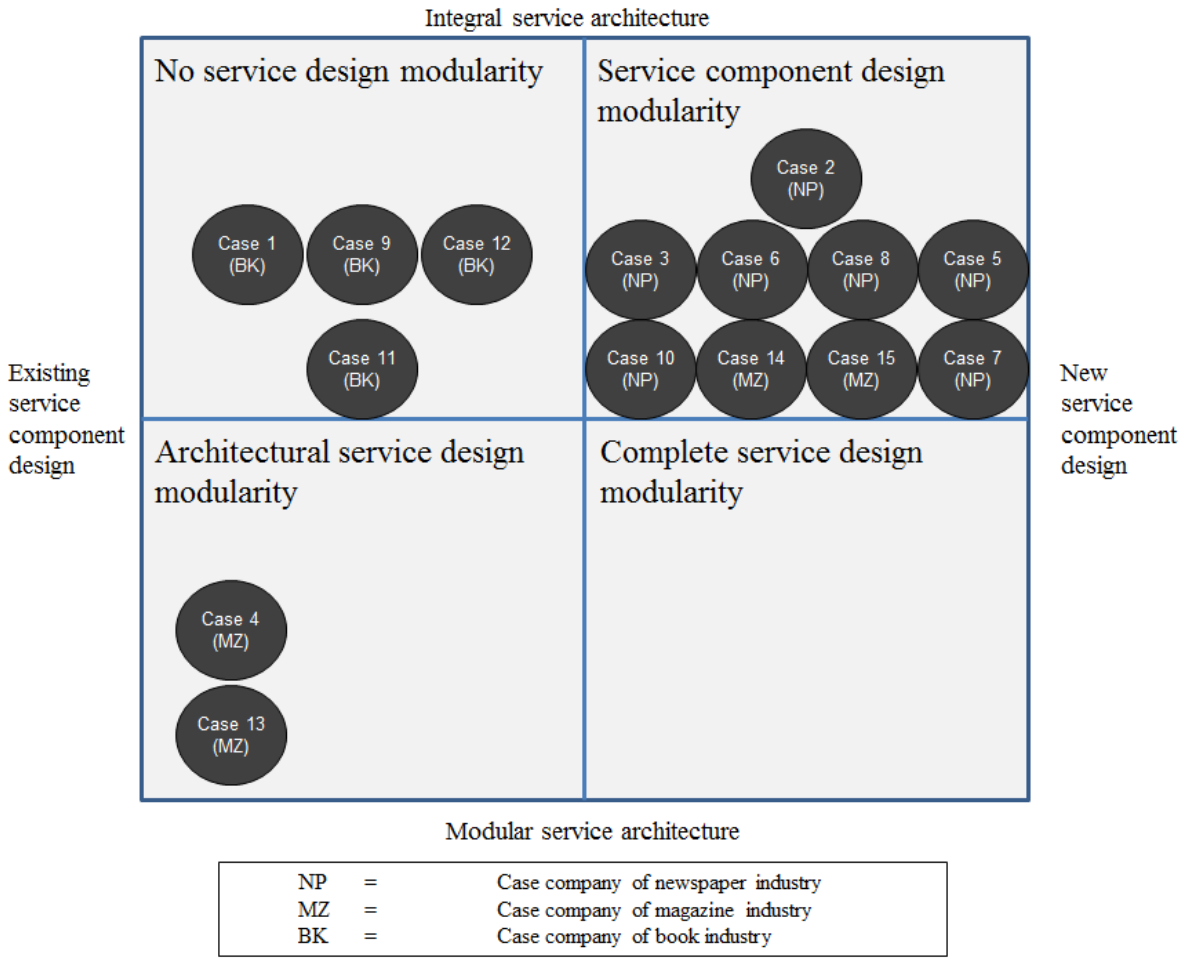

Figure 2: Digital service modularity for publishing industry.

As an outcome of no service design modularity, companies are able to produce only digital replica versions of traditional products, e.g. PDF-version of traditional media. Moreover, as an outcome of service component design modularity, companies produce multiple digital replica variations, such as PDF, webpage and mobile application. In contrast to no service design modularity and service component design modularity, companies which apply architectural service design modularity produce sub-modules as outcomes of service design process, including stand-alone articles for instance. Among the case companies of this study, there are no companies that apply complete service design modularity. An outcome of complete service design modularity would be real service offering modularity, e.g. personalized bundle of stand-alone articles from multiple services.

CONCLUSIONS

Based on extant service design and innovation literature, we have proposed a two-dimensional framework presenting a typology of possible levels of digital service modularity. In this framework, one axis represents the modularity of service architecture and the other the service component design. Therefore, four different combinations of service architecture and service component design were aggregated. These are no service design modularity, service component design modularity, architectural service design modularity and complete service design modularity. The framework can be used when describing the different routes that firms use when they develop modular service offerings for digital landscape.

In the empirical part of this study the framework was used to analyse changes in service offerings of traditional publishing firms. Firms embed modularity in different ways to their service architecture and service component design when transforming from traditional product/service business to digital service business. Empirical part of this study reveals that three of the above mentioned designs have been applied when transformed from traditional product/service business to digital service business. These are no service design modularity, service component design modularity, and architectural service design modularity.

As an outcome of no service design modularity, companies were able to produce only digital replica versions of traditional products. Moreover, as an outcome of service component design modularity, companies produced multiple digital replica variations. In contrast to no service design modularity and service component design modularity, companies which applied architectural service design modularity produced sub-modules as outcomes of service design process. Among the case companies of this study, there were no companies that apply the fourth design option, complete service design modularity. This was not a complete surprise as this kind of change would have required both architectural and component design innovations. Thus our case study confirms our theoretical assumption that this transformation is the most challenging.

In all publishing industries, the choice of digital service offering was largely moderated by the offline traditional service offering. In the first stage of digitalization process all case

companies from book industry are replicating their traditional offering in the digital landscape. In contrast, newspaper companies are providing their traditional service offering in multiple digital service forms, such as webpage mobile application content and digital (PDF) replica. Since there is a general trend toward shallower, more fragmented and less concentrated reading (Levy, 1997), sub-module service offerings in digital markets are justified. However, only two companies from magazine industry are planning to provide offering in smaller sub-modules for the customers

The empirical findings of our study suggest that even though some managers in publishing industry are able to recognize benefits of modular service design, the prevailing industry recipes tend to block the creation of real modular offerings when traditional service offering is transformed to digital form (Spender, 1989).

In the digital environment service providers are able to operate diverse delivery channels in line with their business strategy and offer many new services more economically with greater geographic reach and product variety. (Sung-Eui, 2005). However, the results of Stuart's (1998) study indicate that existing service culture can have a significant impact on modifying the new service design proposal making implementation success and high customer satisfaction levels more difficult to achieve. Companies that have operated in newspaper, magazine and book industries for a long period of time probably have developed themselves existing service culture. Furthermore, in emerging industries such as digital services, customers often do not know what they want or need, and this limits the company's ability to design services solutions (Verma et al., 2002).

From a management point-of-view, this research provides a basis for analysing a company's service offering and contrasting it to other actors in the industry, as well as, for steering the service offering design to a chosen direction.

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Managing the Transition from Product to Service

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Keywords: Product, Service, System, PSS

With an increasingly competitive global market, cost, quality and technology leadership are no longer sufficient for businesses to secure critical advantage. Instead, differentiations are being provided through the supply of innovative services, which can rapidly develop into the unique selling propositions of each firm. Services now account for a greater share of profits then manufacturing operations in many 'manufacturing' firms (Neely, 2007). Instead of mass produced goods, customers now demand services and integrated solutions, i.e. goods and services integrated into customer-specific packages (Davies, 2003 as quoted by Braxx, 2005). Companies seeking to meet customer expectations and requirements with personalised, flexible and increasingly comprehensive solutions must convert their product strategies into product and service strategies or Product Service Systems (PSS). This paper discusses two research developed PSS models and two PSS models developed through industrial application and feedback. Common areas of emphasis in relation to the management of product to service transition will be reviewed. By comparing different approaches to the management of PSS and reviewing common areas of emphasis, this paper aims to highlight elements of PSS which require additional attention in order to effectively manage the transition from product to service.

Product Service Definition

PSS is a relatively new and broad topic. Due to the combination of product and service within PSS, studies draw best practice from a multitude of disciplines (product development, service development, project management, engineering etc). To facilitate discussion it is useful to examine the definition of PSS. The defining lines between product and service are becoming increasingly blurred (Correa *at al*., 2007; Graves and Ward, 2007). The importance of services is increasing within manufacturing companies and trends are moving towards a more

product service approach to business, where both are combined together to provide high customer value. Figure 1 illustrates the servitisation of manufacturing. However, due to the inherent differences between goods and services many companies struggle to integrate and manage the two effectively and do not successfully exploit the financial potential of an extended service business model [Friedli, et a. 2005].

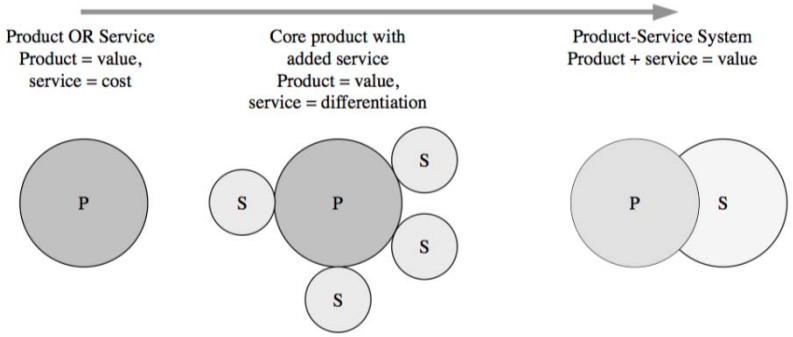

Figure 1: The servitisation of manufacturing (Beltagui *et al*., 2009).

PSS has been described as 'an innovation strategy, shifting the business focus from designing (and selling) physical products only, to designing (and selling) a system of products and services which are jointly capable of fulfilling specific client demands' [Manzini E. and Vezzoli, 2003]. PSS enables companies to move progressively towards a new way of interacting with its clients. What the company or an alliance of companies conceive, produce, and deliver, is not simply material products, but a more integrated solution to a customer demand, producing a satisfactory utilitarian result. For the purpose of this study, and keeping aligned to the overall context of the research, a Product Service System is: *A system which combines a tangible product with an intangible service, integrated to provide additional value to the customer which would not be provided by the supply of the product or service individually.*

Approach

This paper discusses four PSS approaches, two of which developed by academia and two developed through industry application, which can facilitate the transition from product to product service focus. The first academically developed method is by E. Schweitzer and J.C. Aurich. Schweitzer and Aurich have developed a continuous improvement process, which takes into account the specific requirements of PSS. They look at the demands placed on a systematic performance measurement of PSS and the necessary information exchange between the involved parties. The second academically proposed method is by Moore *et al.* Moore has developed a methodology for realising product-orientated PSS and use-orientated PSS for consumer goods, which utilises product lifecycle data to determine and enable services. Both models were chosen as they represent progressive multi-disciplinary approaches to PSS, which have been validated through application.

The two industry based approaches have been documented through primary research carried out by the author. Due to commercial sensitivity they cannot be presented in their entirety. However, relevant elements will be discussed in detail. Both companies have high levels of expertise in service design and have worked in a broad range of industries. Company 1 (C1) specializes in PSS with relatively high levels of technology based services, for example the telecommunications industry. Company 2 (C2) specializes in PSS with relatively high levels of customer co-creation, for example banking. Both companies were intensively interviewed, their approaches discussed and their processes mapped down. Recordings of the interviews were used to add additional detail to the process maps and interviewees were asked to verify that the maps correctly represented their process operations. Both companies represent progressive and established PSS development companies.

Key Findings

The following section discusses the main common areas of emphasis within the PSS approaches studied. All models aim to maximise the value created through the PSS process. The concept of value is abstract and its interpretation varies according to the context (Sanchez et al., 2006). Value in the context of this report is the customer perception of the benefits gained through the purchase of and interaction with products and services. It is important to emphasise that value includes both monetary and non-monetary aspects.

Systematic approach

Systematic approach in this context means a clear, coherent and stepped approach to PSS. All four approaches to PSS are based around a central linear structure, with a standardised series of processes as a foundation. Additional variable processes are then branched off this foundation. Roles and tasks are clear. This structure provides a clear path of progression for staff unfamiliar with PSS. Moore *et al.* pays particular attention to the flow and capture of information. Product life cycle information has the potential to add value for the manufacturer, customer and stakeholders. Moore has clearly defined lines of information flow which aim to minimise information loss. Staff have specific roles with clearly defined duties and tailored access to gathered information.

Aurich and Schweitzer also have a structured approach to PSS, consisting of systems and subsystems (see figure 2). Subsystems group actions into product related, service related and product/ service combinations. These subgroups are elements of the main linear system. Variable elements within the subsystems are integrated into the main linear structure to allow a level of flexibility for unforeseen problems. Information provided by both staff and customers is collected and made readily available. Subsystems can adjust to allow for new approaches to problem solving, which are then captured and added to the process. This is then available should the problem arise again. This approach allows a level of flexibility within the process, while continuously improving its solutions data base.

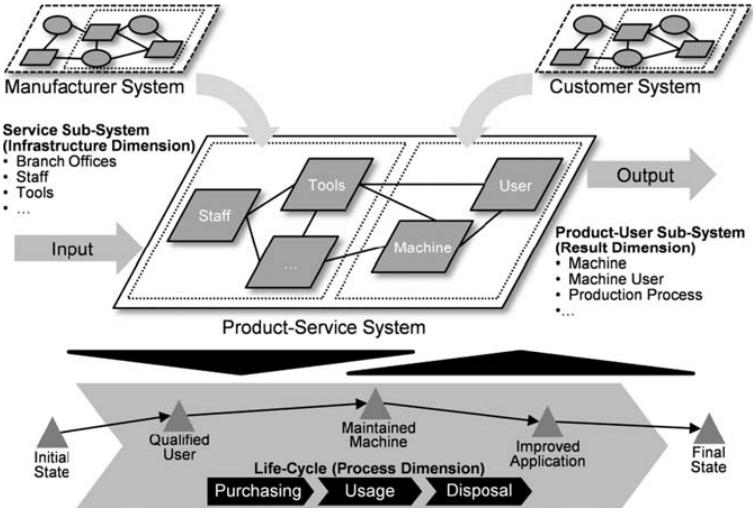

Figure 2: Industrial product-service systems and sub-systems (Aurich & Schweitzer, 2010)

C1 links the stages of PSS to companies' current product development processes to create a level of familiarity. Similar to product development, C1 uses service stage gates to provide a list of requirements which must be met in order to progress to the next stage of the process. This gives a clear picture of what is required of each staff member and prevents any ambiguity. C1 also uses this approach to plan future service expansion and development, as it provides an indication of staff and resource requirements at each stage. The level of flexibility within the process can vary, depending on the PSS being developed. Technology driven PSS can have a low level of flexibility, as rigid standards and requirements must be met. Alternatively, customer driven PSS has higher levels of flexibility to meet a range of customer requirements, and effectively manage the variety of customer inputs.

Due to the high level of customer co-creation within participating companies, C2 allows for a higher level of variability within their PSS process. Rather than a specific line of progress, a central ladder structure is used as a guideline and the PSS process is broken down into large flexible steps. The project begins on the bottom rung, and progresses up the ladder as the project advances. As development continues, these steps become progressively more definite. When a PSS is ready for launch, the company has developed a linear process with integrated variable elements, for example different product/ service combinations. This provides a series of steps for predictable product and service problems, and a degree of freedom to solve new arising issues.

Although the stages differed, all methods studied used a stepped approach, breaking the process into smaller, manageable stages. This provides a clear list of tasks for participants and a path of progression for the project as a whole. Product based inputs are simpler to predict. In contrast, customer based inputs can be difficult to predict. Therefore, flexibility within the process must increase in relation to the level of the level of customer input to allow for a range of scenarios.

Communication

Communication in this context is the flow of information between different elements (customers, service providers, manufacturers etc) within the product service process. This includes static information (for example material requirements for production); dynamic information (for example preventive maintenance, individual customer issues etc); and communication between people (service providers, customers, sub-contractors etc). The role of communication is critical in the implementation and management of PSS across all four approaches studied.

Moore *et al*. emphasise the importance of accurate collection, availability, analysis and application of information. Information actively gathered during the use of the product life-cycle, is used to determine patterns and profiles. Based on these profiles, corresponding service requirements are established. In order for information to flow smoothly within Moore's system, communication must be apparent, exact and current. To achieve this, communication lines between PSS participants are clear and readily accessible. Information is collated into a common source which is easily accessed and regularly updated.

Similarly, Schweitzer and Aurich emphasise the importance of standardised process descriptions for all partners within the PSS network to ensure clear communication of the necessary design, production and service processes. Standard product usage information is made available through a software platform. Additionally, tacit and explicit knowledge of the PSS operators is collected and made available on the network as solutions were provided to emerging problems. This provides a level of flexibility to overcome unforeseen problems. To facilitate such an open forum, Schweitzer and Aurich pay particular attention to the design of information exchange processes. Participant roles and lines of communication are clear, and the system aims to create a clear and continuous flow of information amongst partners.

Both C1 and C2 highlight the critical role of communication in PSS from the perspective of the customer and the provider. Due to the multifaceted nature of PSS, both companies believe communication amongst providers is essential to ensure a smooth flowing process which meets customer requirements. Companies need a comprehensive understanding of the changes required within the company and benefits to be gained from PSS. Emphasising the benefits ensures commitment of staff to the necessary changes. Additionally, C1 places particular emphasis on internal communication as a form of reassurance. Clearly communicating their role in the process provides reassurance of customer's and provider's path of progression. This is found to increase the willingness of staff to adopt changes. C1 involves staff as much as possible in the process. This creates a feeling of ownership and ensures a deep level of understanding.

It can be seen from the above that clear communication within PSS is essential as it prevents any ambiguity of process or provider/ customer role. Although it is important that information is gathered, more importantly information must be properly distributed and understood by both staff and customers. This allows roles within the PSS to be

communicated clearly. Clarity provides reassurance for any necessary changes and clear line of progression and helps prevent any stumbling blocks within the process.

Customer co-creation

Customer input in this context is the active participation of customers within PSS, which is necessary for or improves process operation. Customers offer a new potential source of competence for companies. This competence is a function of the knowledge and skills they possess, their willingness to learn and experiment, and their ability to engage in an active dialogue (Prahalad and Ramaswamy, 2000). Unlike products which can be manufactured independently from customers, a level of customer co-creation is required for the production of services. Therefore, increased emphasis on customer co-creation is necessary when managing the transition from product to PSS.

As mentioned previously, Aurich and Schweitzer propose a PSS process with a series of interrelating systems and subsystems. Subsystems with information exchange between the customer and PSS are designed to allow for variance between individual customer cases. Certain customer key figures are defined at the beginning of the process, for example expected usage patterns, and particular attention is paid to data gathering at the relevant subsystems to gather new key figures and verify established key figures. This data is fed back into the process to avoid the problem reoccurring. Similar problems highlighted by customers are grouped into patterns, and the system is used to generate standardised solutions. This aims to utilise customer co-creation and feedback to create a continuously evolving and improving PSS process.

Moore *et al*. take a different approach to customer co-creation. Moore gathers information during the use of the product. This is then used to create a profile of the customer and determine the necessary service elements. Customers can access the information concerning their product usage patterns (for example energy consumption) and their service usage patterns. Moore *et al*. uses this to create customer awareness of their role and participation within the PSS. This provides an opportunity for the company to work with the customer to reduce their consumption levels and gather customer feedback. This has a mutual benefit for both the customer (for example reduced energy costs) and for the company (lower levels of use will result in lower maintenance requirements).

Similarly, C1 emphasises the need for customer co-creation and accurate gathering of information. C1 encourages open lines of communication between the company and the customer. This relationship allows a free flow of information and feedback which is used to generate new PSS concepts and improve existing PSS processes. Additionally, involvement of the customer in the PSS development process, clarifies of their role and familiarises them with the process. C1 highlights the further benefit of customer co-creation relationships as a means to create customer loyalty. In order to achieve this, PSS processes must ensure that methods of customer co-creation are clear and fully utilised.

Of the three approaches reviewed, C2 has the highest level of customer input and therefore, places the highest importance on customer co-creation. Although C2 acknowledges that it is not always possible, it encourages customer involvement in every stage of the development process. Customers must be the central concern for the company. Rather than viewing the PSS process as a provider of functions, C2 views it as an experience. As this is difficult to quantify, in order to determine the desired experience and its effectiveness, C2 believes the customer must be directly involved in the development process. Using tools, the customer and company carefully map down the customer's journey. This can then be used to highlight any stumbling blocks within the process, and maximise the benefit offered to the customer. As with C2, C1 believes the active participation of customers in the development of the PSS, greatly improves adoption and satisfaction levels. It welcomes customer input into the concept generation stage to determine the value sought. Information gathered is developed and the customer is invited back for trial runs of the proposed PSS.

As can be seen from the above, as the importance of services increases within the PSS process, the importance of customer co-creation also increases. In order to utilise customer input, lines of co-creation must be clear, adaptable and properly managed. Information must be accurately gathered and applied. This provides invaluable knowledge on the requirements to be met, suitable processes of provision, the effectiveness of the PSS provided and potential future PSS systems.

Quantifiable factors

In this context quantifying factors are elements which can be measured with a degree of accuracy. Product manufacture provides definite quantifiable elements, (for example parts produced per hour) which can be tightly controlled through a quality system. Due to the intangible nature of service, it can be difficult to quantify factors and ensure a level of quality. Therefore, in the transition from product to PSS, coping with ambiguous elements can be challenging. In the four approaches to PSS studied, all aim to provide some degree of measurable data.

Aurich and Schweitzer use key figures, which are determined through collaboration between customer and service provider. Key figures are result orientated (benefit provided to customer and provider); process orientated (process necessary for realising the benefits); infrastructure orientated (resources needed); and information orientated (information exchange related to the customer and provider). Target values are set for each key figure. These values are then used to assess the performance of the PSS for the individual customer, and facilitate improvements where appropriate. Improvements measured are evaluated by the previously established key figures. Again, these quantifiable elements, determined through customer co-creation, provide a clear path of progression and quantifiable performance.

Moore *et al*. groups data into static and dynamic data. Static data remains unchanged throughout the process and has a level of predictability (for example service schedules). This allows the cost and financial return of necessary resources to be determined. Dynamic data

occurs during distribution, usage and end-of-life. These are more difficult to predict (such as preventative maintenance) but can provide valuable information for future PSS. Although more difficult to quantify, Moore emphasises the collection and analysis of dynamic data as a means to provide valuable customer insight. Dynamic information can be used to determine explicit and implicit knowledge and unexpected patterns and relationships within the PSS. This can then be fed back into the PSS to provide additional value for both customer and provider.

Both C1 and C2 link PSS developments to measurable financial return. This is assessed through increased product and service ranges, increased customer value and cost reduction. Both companies acknowledge that, due to the nature of services, significant benefits provided by PSS can be difficult to quantify. Product based companies are familiar with tangible, quantifiable product processes. By placing a measurable element to the PSS, it acts as a reassurance of its effectiveness. In parallel, both C1 and C2 track difficult to measure elements (such as customer experience). These are then related back to the financial return, such as product sales and repeat purchases. Correlation between direct and indirect benefit soon becomes apparent. This justified time and finance spent of elements which initially seem to provide no financial gain.

As a result of the intangible nature of service, their value and benefit can be difficult to quantify. This makes the transition from product to PSS difficult. To facilitate this transition, all models studied generate a level of quantifiable data. This creates a level of comfort with the unfamiliar PSS process. As aspects of service can be difficult to attribute to financial return, relating measurable elements to abstract elements can justify costs.

Conclusion

This paper discusses four PSS models; two developed through industry interaction and two developed through research. By comparing common areas of emphasis, several critical elements of PSS which require additional attention to effectively manage the transition from product to service are revealed.

It is important for PSS to be approached systematically. As the PSS process is a relatively new development which can be complex and multifaceted, a logical approach gives a clear route of progression. Additionally, it allows the process to be broken down into small, manageable steps which facilitate its application. Due to the co-creative element of some services, it is important that the approach allows some flexibility. A rigid PSS cannot accommodate the changing requirements of customers and variable forms of customer input. It is the flexibility of PSS which holds the main value for both customer and provider, as it allows changes and improvements to be made which increase customer benefits.

Communication and management of knowledge between all parties involved in the creation, supply, receiving and review of the service is critical. PSS requires input from numerous parties. In order for the product/service supply to flow smoothly, information exchange

among parties must fast and direct. Any delay or confusion in information will negatively affect the PSS process and reduce the benefits to customer and supplier. In addition, communication amongst all parties is a source of information for improving current operations and the generation of new PSS process as it highlights any problems or unmet needs. Similarly, usage patterns and post-market reviews are important sources of information on supply and demand, existing and potential revenue streams, and PSS improvement and creation.

As the importance of services increase within the PSS, higher importance must also be placed on customer co-creation. User input is the active participation of customers within PSS which offers a new potential source of competence for companies. Again, communication and flow of information is critical to maximise the benefits of customer co-creation within PSS. Processes to gather information must be readily available, accurately gathered and applied. This provides invaluable insight into customer requirements.

In contrast to products, the value of services can be difficult to quantify. In the shift from product to PSS, coping with ambiguous factors can be difficult. Establishing a quantifiable element within the PSS process facilitates this shift as it can justify time and financial investment. It clearly communicates the value provided through the provision of PSS. Additionally, relating definable aspects to ambiguous elements of service creates a level of comfort and familiarity within the providing staff.

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User Experience in Complex Systems: Crafting a Conceptual Framework

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The aim of this paper is to explore the expectations and demands set by companies operating in business-to-business metals and engineering (MEI) industries for a conceptual user experience (UX) framework. The UX framework is targeted at guiding management and design processes, co-creation of UX capabilities and user interaction solutions – and thus at enabling companies to challenge and surpass their present level of performance in designing UX. In this paper we summarise the expectations and demands set by the current design and development processes as well as the decision-making practices within companies.

INTRODUCTION

The concept of user experience (UX) originates from human-centred design research that already has a long tradition in ensuring that users' needs and demands are taken into account in all phases of design (ISO 1998, Nielsen 1993, Beyer & Holtzblatt 1998). User experience partly replaced usability in human-centred design in the early 2000s (e.g. Hassenzahl & Tractinsky 2006). User experience means that in addition to pragmatic needs products and services must also support users' hedonic needs, such as stimulation and self-expression. Furthermore, users' interactions with every contact point in the life cycle of system usage should be satisfying (Väänänen-Vainio-Mattila et al. 2008). Designing for UX aims at broader views of users' emotional, contextual and dynamically evolving needs, and the impact of users' previous experiences on new experiences. The goal is to create something that attracts and creates new meanings for the user. New design methodologies are currently under development world-wide to capture UX. At the leading edge are, for example,

experience-centred design (Blythe et. al. 2006), worth-centred design (Cockton 2008) and ethnography-informed design (Dourish 2006).

In general, UX development has been driven by B-to-C markets. We hypothesised that business-to-business markets could similarly benefit from UX thinking. The potential of design for UX is widely recognised within the UX and design community at least, but increasingly within the whole innovation system. Turning this potential into competitiveness, however, necessitates a significant leap in both research knowledge and company practice.

A central challenge within Finnish MEI is that competitors have similar basic products with similar functions. Market success requires standing out from the competition with a more comprehensive approach to customer value creation (e.g. Woodruff, 1997; Mikkonen, 2011) also referred to as a transition from products to services (e.g. Oliva & Kallenberg 2003, Gebauer et al. 2005, Grönroos 2008). This transition emphasises the importance of UX in complex systems of integrated technologies, products and services that could involve many users and customers.

The central research challenges are to create a comprehensive understanding of user and customer experience in complex systems and how to realise user and customer experience orientation in the companies' design and collaboration practices in innovation networks. The aim of this paper is to explore the expectations and demands set by companies operating in business-to-business metals and engineering (MEI) industries for a conceptual user experience framework. The UX framework is targeted at guiding management and design processes, co-creation of UX capabilities and user interaction solutions – and thus at enabling companies to challenge and surpass their present level of performance in designing UX.

APPROACH

Achieving a comprehensive understanding of user and customer experience in complex systems requires the interpretation and integration of existing, often quite fragmented, information from many streams of research as well as new empirical studies in the MEI context.

In order to understand how to consider user demands and to enlarge user participation in the design we should take a look at what we have learned in **complex systems design**. There is a growing body of knowledge on complex socio-technical systems from the point of view of human behaviour and work analysis methods (Woods 1998, Vicente 1999, Miller 2000, Norros 2004, Savioja & Norros 2008, Norros & Salo 2009). In complex system design, the focus of human-centred design expands beyond the original focus of a singular user's situation to considering entire systems or work processes.

A more comprehensive focus is also relevant to understanding the design of services, for example in MEI contexts. User-driven service development is still one of the key research issues in **service science** and business (Vähä 2009). Stimulating service innovation, enhancing service design and enhancing the service experience through co-creation were

among the research priorities identified recently in the Journal of Service Research (Ostrom et al. 2010). The challenges of service development particularly in manufacturing and the B-to-B context has recently gained a lot of attention (Kalliokoski et al. 2003, Oliva & Kallenberg 2003, Auguste et al. 2006, Brax 2005, Gebauer et al. 2005, 2006, Grönroos et al. 2007, Hyötyläinen & Nuutinen 2010). While usability and HCD research applications for B-to-C markets have somehow dominated, this stream of research can bring added value in understanding the characteristics of user and customer-driven innovation to B-to-B markets.

Contemporary management discussion on the creation of **customer value** implicitly assumes value creation to occur in the context of one product or service as a single occasion. Discussion on the topic in the context of broader offerings, or complex systems, or between system components is scant. To build up an integrated offering in complex systems, one needs to know, in addition to the potential demand, the structure of the demand and the preferred method of purchase. Bundling or integrating services does not necessarily decrease the freedom of choice from the customer's perspective; it may improve customer satisfaction because of the frustration a customer can feel due to excessive choice or variety. Identification of the driving forces behind customer value for a complex systems offering provides the basic understanding of how to begin.

There are several suggestions for theory frameworks for customer value (Holbrook, 1999; Woodall, 2003; Khalifa, 2004) and different approaches discussing the customer value of a single product or service (e.g. Woodruff, 1997) from the perspective of achieving competitive advantage through customer value creation; Oliver (1999) discussing customer value through the concept of achieving excellence; Lapierre (2000) discussing customer perceived value in an industrial context. However, theoretical discussion on customer value creation concerning offering entities, bundles or integrated offerings is rare, but has begun on customer solutions. The main weakness that characterises the literature of customer value is the lack of agreement among scholars and, as a consequence, the lack of a clear-cut definition of value (Sanchez-Fernandez and Iniesta-Bonillo, 2006). In addition, there is some evidence to indicate that literature generally proposes either purposefully convergent, or individually distinct, notions of value for the customer (Woodall, 2003).

Finally, the key question of how to create competitive advantage for a company from the value perceived by the customer of complex systems and their user experience remains to be solved. Recent management literature (e.g. Christensen, 2010; Dedrick et al. 2010; Chan et al., 2010) has pointed out that much research and most company activities are focused on the creation of value, not its capture. In other words, companies are struggling in their efforts to create a sustainable competitive advantage since they are not able to capture the value that is being created by even a superior user experience (Chatain, 2011; D'Aveni et al. 2010; Powell, 2001). The value-based approach provides a holistic treatment of how the blending of competition and capability heterogeneity generates performance differentials (Chatain, 2011).

The design process itself needs to be reflected when targeting improved design outcomes. Hence, **design research** and **innovation research** have become relevant for improving

industrial production and the competitiveness of products. (Chesbrough 2003, Chesbrough et al. 2006, von Hippel 1998, 2005, von Hippel et al. 1999, van de Vrande et al. 2009). “Open innovation” has become a frequently used key word in academia, practice and funding agencies (Jawecki &Bartl 2010). There is a need to develop methods and practices for open innovation that better take into account the characteristics of MEI and are compatible with R&D processes, as we already noted. From the companies’ perspective, one of the main questions in general is how open the company wants to be depending on the phase of the innovation process, the product and IP considerations, among other factors (Jawecki &Bartl 2010, Paasi et al, 2010,). Related research areas are also networking, co-creation and visual contracting, which is a new and emerging field, closely connected to the ease of doing business and the management of intangible assets, including IPR. The success of open innovation depends not only on methodological expertise to search and acquire users’ collaborative input but also on organisational routines to digest and assimilate this external input (Jawecki &Bartl 2010), that is, **organisational culture and capabilities** (e.g. Schein 2004/1985, Teece et al. 1997, Schreyögg & Kliesch 2007)). A recent study of 36 companies from different industries in Finland and the Netherlands showed that almost every company had innovation relationships with their customers and suppliers, but the forms these relationships took, and the kind of practices they involved, varied greatly (Paasi et al. 2010). The management of intellectual property and knowledge is very challenging when other actors are involved in parts of the innovation development process (Luoma et al. 2010).

According to Ergonomics of human-system interaction. Part 210: *Human-centred design for interactive systems 2.15 user experience is: “a person's perceptions and responses resulting from the use and/or anticipated use of a product, system or service*

> *•NOTE 1 User experience includes all of the users' emotions, beliefs, preferences, perceptions, physical and psychological responses, behaviours and accomplishments that occur before, during and after use.*
>
> *•NOTE 2 User experience is a consequence of brand image, presentation, functionality, system performance, interactive behaviour and assistive capabilities of the interactive system, the user's internal and physical state resulting from prior experiences, attitudes, skills and personality, and the context of use.*
>
> *•NOTE 3 Usability, when interpreted from the perspective of the users' personal goals, can include the kind of perceptual and emotional aspects typically associated with user experience. Usability criteria can be used to assess aspects of user experience. " (ISO 9241-210:2010)*

From this definition there is still a long way to **practical guidelines and tools** for taking UX into account in design and strategic processes in a particular industry. Kaikkonen (2009) has recently emphasised that proper definition of UX is needed to help define the goals for user experience at the start of product development.

Several general models of UX exist, but no good comprehensive **operationalisation of the concept** in the research literature for our purpose. Most of the models agree that UX is affected by three main factors: the user's internal state (predispositions, expectations, needs, motivation, mood, etc.), the characteristics of the designed system (e.g. complexity, purpose, usability, functionality, etc.) and the context or the environment (e.g. organisational/social setting, the meaningfulness of the activity, the voluntariness of use, etc.). (e.g. Hassenzahl and Tractinsky 2006). Experience does not exist in a vacuum, but in dynamic relationships with other people, places and objects (Buchenau and Fulton Suri 2000). Elizabeth Sanders says (2001): "There is no such thing as experience design. You can't design experience because experiencing is in people. You can design for experiencing, however. You can design the scaffolding or infrastructure that people can use to create their own experiences".

We claim that although positive UX can be regarded as a design ideal, the concept is too broad to be operationalised and utilised in "a traditional way" since the concept is far too broad and complex for research or product development to describe the focus of the work. (see also Kaikkonen 2009). *What is needed is a framework that enables companies to challenge and surpass their present level of performance in creating positive UX (based on focused interventions) as well as to manage UX in a way that ensures avoiding most damaging risks of bad UX (general understanding of UX and its relationships).* The development of such a framework requires multi-disciplinary empirical research and utilising of results and methods originating from the aforementioned different branches of research and practices in a spirit of design thinking (e.g. Rowe, 1987; Brown, 2008; Lockwood, 2009).

METHODS

We explore the expectations and requirements posed for the UX framework by business-to-business companies that would enhance company practices by taking a more holistic view of their complex product development, delivery, end-user usage and life cycle maintenance operations. With this exploration, we attempt to establish business-critical aspects of the UX framework that would at least partially answer the business needs of corporations when considering the competitive edge derived from UX.

Exploration of the UX framework requirements took place in two workshops (with 51 and 39 participants, of which half were from companies) and several smaller meetings (with participants from 4 to 6 different companies). Based on this data, we synthesised our view on current development and then considered on-going themes of studies.

RESULTS

In this chapter, we present the summary of the expectations and demands set by the companies for the UX framework and conclude with trends that increase the complexity and challenge of user experience, usability and design in MEI which were identified in our study.

Expectations and demands for the UX framework

We identified three levels of demands to be taken into account by the UX framework: UX as a strategic business factor, UX as a renewal driver of R&D, and UX as a human-technology interaction concept determinant.

At the level of UX as a strategic factor, the expectations and concerns related to for example, the role of design in strategic management and decision-making, the impacts of UX in competitiveness, corporate brand creation and the renewal of industry.

In general, one of the cornerstones of MEI business and R&D thinking seemed to be measurable performance criteria, productivity of the systems and cost efficiency in manufacturing. UX developers and other advocates of human driven design typically see product perception and quality in a more holistic, subjective and less easily measurable way. Consequently, UX approaches seldom have quantitative proof of impact or show a success record within MEI. This can be one of the reasons why the approaches are not more broadly utilised within MEI. For cost-effective utilisation of the UX approaches it is important to have knowledge of where and when they have most impact. This requires research that shows the effects of the UX factors on business and is the most important requirement of the framework; and will mean, for example, defining the logics of the relationship between UX and competitive advantage, the differences between user and customer experience and the principles for managing UX development. Companies in particular are interested in the value capturing perspective, as typically benefits from UX improvements tend to spill over to customers and incur only R&D and other costs for the company. Thus, one of the key targets set for this project has been to create a framework which can depict the logic of UX improvements from the perspective of product/service producers. UX as a business factor is closely related to the creation of competitive advantage over a company's rivals; and therefore the relationships between UX activities and business logic should be clarified in future research.

Renewal of R&D processes was one of the key challenges recognised. The expectation for the framework related, for example, to the fact that many potentially good UX ideas fail to reach products and services (and become real innovations) because of strict R&D processes and established practices. Also there are difficulties in finding good and efficient ways to involve end-users and customers in product and service development. Furthermore, a significant change in national research funding which emphasises the role of companies in planning and leading future oriented research programmes creates new demands for innovation processes.

As already mentioned, one of the important characteristics of MEI is that products are often aimed at B-to-B and sometimes also B-to-C markets. The impact of user experience on customer satisfaction in industry is already recognised, however, companies lack the means to study user experience, to design good user experience and to set measurable targets for it. Especially in B-to-B business, it is crucial to build up the capability of understanding not only the customer's, but also the user's point of view. Users and customers have different

perspectives on products and services, thus complicating processes to incorporate UX into the design. Open innovation is a new method which helps to understand and involve customers and users in product and service design. However, there is a need to develop UX methods and practices both for companies' R&D and open innovation that better take into account the characteristics of MEI and are compatible with R&D processes. From the framework perspective that means recognition of the key characteristics of present and targeted innovation practices and culture.

At the third level, *UX as a human-technology interaction concept determinant,* the concerns related to the capability of creating UX-driven concepts that can guide technology development and the utilisation of available technologies. From a practical design perspective, there is a need for tools to define a targeted company or product/service specific UX, and then evaluate or test if it is reached during the design process. Furthermore, present and future technologies offer new possibilities to enhance UX and manage complex systems. A further need is to evaluate their potential in an MEI context. Enhanced experiences, technologically augmented reality, interactive user guidance and virtual environments are among possible future trends.

In summary, the expectations and demands for the framework were various and related not only to the framework itself, but also to the process of achieving the overall target, the research and change process. The scope of the required research programme can be summarised as a need for a holistic user experience model (Figure 1).

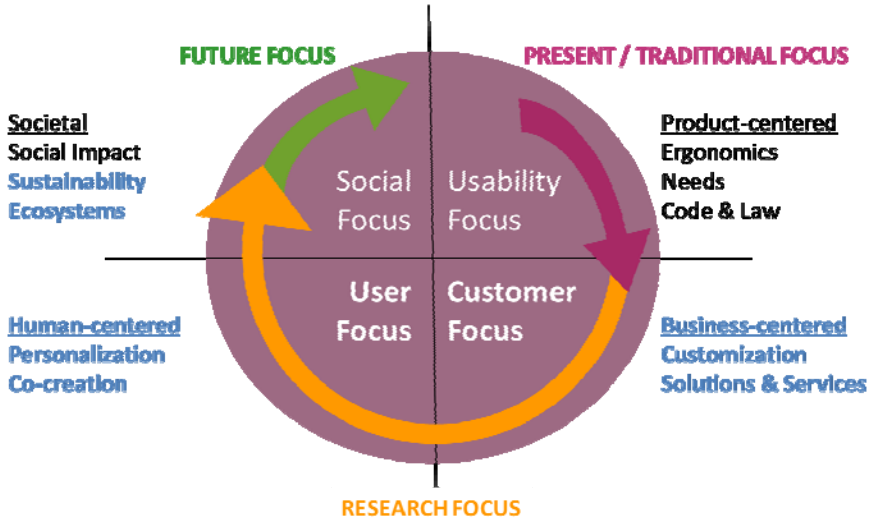

Figure 1. Research focus: Holistic user experience – UX 360 degrees (adopted from Stenros et al., 2010).

Trends that increase complexity

Furthermore, we identified several trends that increase the complexity and challenge of user experience, usability and design in MEI:

- Future focus on comprehensive solutions, not only technologies or end-products

- From customised to highly personalised products and solutions
- Towards sustainable, full life-cycle solutions (zero emission)
- Decentralisation of knowledge monopolies: innovation competence is based on the access to knowledge networks rather than the ownership of knowledge
- Technology, products and services are seen as enablers or platforms rather than interfaces
- Changes in the role of the user; the user as a content creator, increasingly also a co-creator
- Blurring of boundaries: multi-professionalism, interdisciplinary approach
- The new technology dilemma: the need to present complexities in a user-friendly, simple way

DISCUSSION AND CONCLUSIONS

To summarise the main results: We identified three levels of demands to be taken into account by the UX framework. These were: UX as a strategic business factor, UX as a renewal driver of R&D, and UX as a human-technology interaction concept determinant. The expectations and demands for the framework not only related to the framework itself, but also to the process of achieving the overall target, the research and change process. In addition, we identified several trends that increase the complexity and challenge of user experience, usability and design in MEI:

Our study has implications both for theory and practice. The results may contribute to three fields: UX potentials for B-to-B and MEI competitiveness, development of the new business-oriented UX framework, and UX's theoretical roots. Practically, the results can reveal the key development issues in reaping the business potential of UX.

There are many examples of well-designed consumer products based on deeper UX understanding and related success stories of international companies. There are also some good examples of successfully utilising design in enhancing UX in the Finnish MEI context regarding products (e.g. forklifts and lifts). In addition, there are already some examples of international companies that have managed to utilise design or 'design thinking ,' systemically and in a holistic way, in enhancing their business (e.g. Apple) and this 'movement' has also gained ground in leading Finnish companies. However, usually the new method of approach is only adopted by individuals or particular groups within the companies, while the majority still hold to the traditional, more product- and technology-oriented way. Also within one company, views on UX can range from a single interaction with a product creating a "wow" factor to an all-encompassing consumer experience as demonstrated in the Gegner et al (2011) study on a multinational company. There is also some evidence of the link between the use of design and financial performance. A study by the Design Council, Design in Britain 2004–05, based on an annual business survey of 1,500 companies of all sizes and sectors, shows that companies using design to innovate and stand out are growing

faster than their competitors. According to the in-depth research, a third of the UK's fastest growing companies see design as integral to their business, while only 11 per cent of businesses with a decreasing turnover have this view. Furthermore, design has great potential for strategic innovation (Utterback et al., 2007). The most beneficial seemed to be where corporate strategy and design are aligned (in design companies). To conclude, adopting holistic, systematic 'design thinking' throughout a company's way of doing business has many potential benefits. However, this requires an understanding of UX in a complex system and in a B-to-B context, corresponding new tools and methods for design, and realising user experience orientation in the company's practices. Hindsight comparisons between successful and non-successful companies provide only limited guidance in developing the necessary capabilities and practices in a different business context. Furthermore, building understanding of UX in complex systems is far more complicated than designing singular products.

The main limitation of this study is that we have only "scratched the surface" of understanding UX in this context and are continuing our work by carrying out focused interviews and case studies. As noted in the introduction, the central research challenges are to create extensive understanding of user and customer experience in complex systems and to discover how to realise user and customer experience orientation in companies' design and collaboration practices in innovation networks. Although we now have general-level understanding of the demands and expectations set by companies for the framework, this understanding needs to be converted into collaboration research and development practice between academics and companies which will produce the targeted results.

The framework development and shared efforts to fulfil the needs of MEI continue in the FIMECC Research Programme, User Experience & Usability in Complex Systems (UXUS). The programme is particularly aimed at increasing the competitiveness of Finnish MEI by UX-driven new design and collaboration methods that produce personalised user/customer experiences – and challenge the present 'mindset'. It supports future knowledge creation and creates new interaction concepts and innovative practices in developing user and customer experience excellence. Five Finnish global companies and five research institutes are currently participating in the programme.

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Extending Management Control over Post-NPD Design Efforts — An Interventionist Case Study

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Post-NPD control has received scant attention. Our case study provides an example of how post-NPD control was improved in the R&D department of a company. The use of accounting tools, such as control mechanisms, facilitated accountability, controllability and visibility, as well as decision making. Our way-paving contribution is twofold: (1) we discuss post-NPD control that has been underemphasised in the extant literature (e.g., its potential benefits and pitfalls) and (2) we use a uniquely point-blank-range case illustration of design management inside research and development (R&D).

INTRODUCTION

Product improvements after new product development (NPD) are a design activity that is undoubtedly a condition for profit-oriented R&D, but it is often underemphasised. These improvements occur after the initial release of a product. After the launch, several correctional or supplementary designs may be necessary to improve the product. We call this stage 'post-NPD design'. We divide the R&D continuum into three phases: pre-NPD, NPD and post-NPD (Clark & Fujimoto 1991; Jokioinen & Suomala 2006). Basic and applied research takes place during the pre-NPD phase. New products are developed, by definition in NPD, and then further developed in post-NPD design as needed[1]. These three phases require R&D management, as not every requirement set for the outcome (e.g., a new product or a functionality) can be met during a single phase of the continuum. Customer demands are

[1] According to Suomala (2004, p. 19), some authors claim that product development is the part of R&D that is outside basic research (Clark & Fujimoto, 1991, p. 169), while others say that R&D is a functional department and NPD an activity (Hertenstein & Platt 2000).

often pluralistic and evolve over time, as do the demands of top management to leverage R&D to effectively develop a profitable product portfolio.

Pre-NPD, NPD and post-NPD differ management-wise in certain dimensions, for example, the degree of relative newness and the uncertainty over the consequences of actions vary between stages of the R&D continuum. On one hand, R&D needs to be managed by taking into account the varying uncertainty and varying needs for innovative decisions within the R&D continuum. This variability is a suitable topic for scholars. On the other hand, this viewpoint, post-NPD design in particular, has not attracted much attention in academia, which has mainly focused on managing NPD. Some notable post-NPD conceptualisations are Clark and Fujimoto (1991, pp. 121-122), Meyer et al. (1997) and Janz et al. (2005), but the literature has largely disregarded post-NPD controllership (Chamberlain, 2007).

An inadequate emphasis on management in the context of life-cycle extending product improvements and post-NPD design exists, because the extant literature largely focuses on controlling NPD (e.g., Nixon 1998, Kerssens-van Drongelen & Bilderbeek 1999, Rabino 2001, Bonner et al. 2002, Suomala 2004, Jørgensen & Messner 2010). A literary bias might exist since NPD largely determines product costs (e.g., Raffish 1991, Ax & Ask 1995, Asiedu & Gu 1998, Uusi-Rauva & Paranko 1998, Suomala 2004) and is linked to novel innovations (Song & Montoya-Weiss 1998). The remaining product life cycle might be considered a time of valueless 'fire extinguishing' with few innovations (Ribbens 2000).

The two questions that arise are: How can post-NPD design benefit from management control? What are the pitfalls of such control? To resolve these questions, we offer empirical evidence of what management accounting (within management control) can do for R&D management, particularly during the post-NPD phase of the R&D continuum. However, in addition to giving normative guidelines on how to control post-NPD design, we position our contributions as paving the way for further research, particularly concerning the ways a specific phase of the R&D continuum, i.e., post-NPD, benefits from management control with regard to the bigger picture of a firm's management. In this way, our findings offer a starting point for further work.

To create an understanding of control in the post-NPD design environment, we assessed R&D and product support functions inside a global original equipment manufacturer (OEM; henceforth referred to as 'Milestone'). In 2010–2011, our research group started developing more systematic controls for post-NPD management inside the OEM as change-agent-type interventionist researchers (for more on interventionist research, see Jönsson & Lukka 2005; Suomala & Lyly-Yrjänäinen 2010). In practice, we investigated the existing product improvement process model and analysed improvements in that model based on the needs of the different stakeholders, and we eventually developed suitable accounting tools for managers.

One key originality of this paper is our effort to provide an in-depth view of management accounting in an R&D context (as called for by e.g., Jørgensen & Messner 2010), and more

specifically in the rarely addressed post-NPD phase. Milestone has cooperated with our research group for over 10 years, and this cooperation has given us a unique and trusting relationship with the company. In the past, this cooperation has taken place in supply chain management, service orientation and R&D. In this paper, we provide academia with a narrative about how post-NPD design activities took place inside Milestone. Our data consists, for the most part, of notes from participant observation that was made possible by the company representatives, and we wish to acknowledge their contributions.

In the following section, we briefly look at the extant literature of control-creativity-interface and management accounting in the post-NPD phase. Then, Milestone's case is used to illustrate our theoretical groundwork. Finally, our case-based findings are discussed and conclusions are presented in the last section.

LITERATURE REVIEW

Relevance of the old versus the new control paradigm

Following the recent work by Davila et al. (2009), it seems that the literature on the control of creative activities can be divided into two streams. The first stream, the old or traditional control paradigm, dissociates innovation from formal control and comprehends control as limiting creativity, whereas the so-called new control paradigm sees control not as hindrance but as a way to support innovation (Adler & Borys 1996, Davila et al. 2009, Adler & Chen 2011). Adler and Chen (2011) introduced a motivational approach to controlling innovative work. However, as these authors combined coordination and creativity demands, they disregarded the fact that even the most mundane piece of work can be done with innovation. For extreme low-creativity and low-coordination demand, Adler and Chen gave the example of the "toll-booth operator". At the other extreme, they gave the example of large-scale collaborative creativity, the "bridge designer", whose work requires high levels of coordination and creativity. Nevertheless, even such a demanding task may contain many ordinary aspects (low in innovativeness and creativity), e.g. in terms of organisation and coordination. Designing can turn from artistic creativity into engineer-like problem-solving that requires logical coordination more than the motivation of designers' creativity. None of the design (or R&D) activities within the R&D continuum can be clearly labelled as high or low creativity. Rather, creativity is a relative concept affected by management control.

Taking control versus innovation and the relativity of creativity into consideration, the questions is whether it is relevant to discuss control as either hindering or enabling bureaucracy (cf., Adler & Borys 1996). Every task—demanding creativity or not—requires, simultaneously or in turns, banal procedures (that can be supported by control) and creativity (that requires also certain amount of freedom). Both enablement and coerciveness potentially take turns. R&D serves as a good example of a context that simultaneously requires certain amount of free-of-rules creativity to produce something new, but has to be controlled to produce its outcome in a rational rule-abiding way.

More specifically, the context of post-NPD design can be problematised within the framework of the "old vs. new control paradigm" and the relativity of creativity. Davila et al. (2009) understandably divide innovation into the incremental (i.e., current business model) and radical (i.e., new business model), and the source of innovation into top management and rest of the organisation. Post-NPD innovation is often truly incremental, low in artistic creativity and mostly correctional or improvement-type in design, but from what level of the organisation does innovation originate in this case? Is it top management that gives directions to improve the product and then their subordinates follow? Is it the engineers who push the incremental innovations from the bottom up? We ask these questions because Davila et al. (2009) proposed different kinds of levers of control for each possibility, such as Simons' (1994) "diagnostic systems", e.g., budgets and project monitoring for top-down incremental innovation, and "boundary systems", e.g., formal rules and codes of conduct for bottom-up innovation. The situation dictates the control mechanism to be selected, as accounting has a contingent nature (cf., Chapman 1997).

In sum, given that a design task requires creativity and innovation, these requirements can be supported by control mechanisms. However, all design work has to be considered as containing multiple shades of creativity: some tasks require more creativity than others and some require more control. Finally, post-NPD design is a problematical context because it is often innovation in an incremental form, but *ipso facto* post-NPD design opens an advantageous opportunity to discuss the many sides of R&D management.

Management accounting considerations on post-NPD design

All pre-NPD, NPD and post-NPD efforts strive to improve the product portfolio of a company as the marketplace develops (Otto & Wood 1998, Chamberlain 2007). Ergo, if NPD and further development aim at the same goal, should the controllership over NPD be extended to cover the post-NPD design phases? Indeed, a more systematic approach to the management of the post-NPD design phase is necessary (Coulter & Bras 1997; Chamberlain 2007). In practice, a product improvement manager needs to decide, for example, how to value, select and prioritise redesign tasks and how to allocate time and human resources. A manager whose area includes product improvements faces tasks similar to those for any other manager outside of R&D. These decisions lack justification without the rationale of how to make judgements, such as the suggested pallet of an NPD project controller (e.g., in Rabino 2001). Moreover, during the tag-end phases of the R&D continuum, namely, the ones post-NPD, design-related issues can be witnessed firsthand and uncertainties in decision-making become fewer. These fewer uncertainties make accounting an even more credible tool set as decisions can actually be calculated; or accounting can even be used as a "machine" that gives answers to financial questions in order to facilitate decision making, e.g. in R&D (Thompson & Tuden 1959, Burchell et al. 1980, Hopwood 1980, Chapman 1997). But which control mechanisms to consider and which questions to ask from that "answer machine"? Ashley (1994) provided an example of the reasons why a product needed to be redesigned and the product's costs were an important trigger. Chamberlain (2007) proposed, quite

mathematically, certain redesign difficulty and commonality indices in order to maximize profit gained from redesign efforts. Clark and Fujimoto (1991) introduced risk and cost as post-NPD control mechanisms and decision aids, but stated that bureaucratic processes hindered flexible engineering changes. Echoing Clark's and Fujimoto's view on risk an costs, Suomala (2004) emphasised the cumulative financial impact of product development decisions and introduced a life-cycle-extending view on product profitability (i.e., cost and risk accompanied by positive cash flows) that could be used to control post- NPD design:

> "If the cumulative financial impact [...] of a new product is not fully and carefully assessed, the financial possibilities and risks of the product remain ambiguous. [...] [T]his interpretation of product life cycle can be addressed by applying investment calculations such as NPD or ROI [...]. However, it is worth remembering that both the profitability of the product and the profitability of the after sales business associated with the product affect the financial success and constitute *the total profitability of the product*. [...] *Development investments besides the initial NPD effort should also be included in the calculations*." (Suomala 2004, p. 147, emphasis added)

The purpose of this paper is not to explain how such calculations are built and used. Instead, we wish to claim that in order to reduce the ambiguity concerning the total life cycle of a product, the post-NPD design should be taken into account. Moreover, this "accountability" for post-NPD design management can be fertilised using, for instance, the abovementioned ideas of cost and profitability consequences. This requires visibility of the activities performed and products designed—visibility that could potentially be manifested by accounting numbers. Indeed, according to Avery (1953, pp. 84–85) accounting is a language that carries out measuring "in value-terms" and "in dollar-cents-expressions". Horgren et al. (2006), however, stated that managers should avoid overemphasising controllability[2] and focus more on gaining information and knowledge. Hence, it is noteworthy that the outcome of measurements should be more important than the control itself. Indeed, in this brief literature review, research goes beyond the purely technical aspects of accounting into the more social significance of accounting-induced visibility.

> "Rather than accepting its [accounting's] technical rationality, such research is beginning to probe into the wider organisational and social origins of accounting as we now know it. [...] And with accounting [...] as [an endeavour] that creates a very particular visibility and pattern of organisational significance, more explicit attention is being given to its consequences for both organisational and social action." (Hopwood 1987)

[2] "Controllability is the degree of influence that a specific manager has over costs, revenues, or related items for which he is responsible." (Horngren et al. 2006, p. 199)

MILESTONE'S CASE OF CONTROLLING POST-NPD DESIGN ACTIVITIES

To give some background to our study, two researchers (the first two authors) acted as interventionist members inside Milestone and considered how to improve the control mechanisms of the R&D functions of one division. These researchers' task was to make cost calculations and diffuse cost consciousness among the parties involved (e.g., designers, production, purchasing and after-sales personnel) in an NPD project to design a new generation of a piece of machinery. For this project, a lot of emphasis was put on estimating the potential profitability of the new product and studying the use of informal control mechanisms (e.g., the use of more informal informing, rather than reports) as a means to implement a customer-orientated strategy.

However, an intriguing question seemed to be in the R&D managers' minds, a question that crossed the researchers' minds as well. A development activity more straightforward than NPD had recently been highlighted by Milestone's divisional top R&D management. This activity incorporated the design and engineering efforts needed to support Milestone's existing product portfolio, and its tasks were triggered by the needs of external customers and in-house stakeholders (e.g., manufacturability, cost issues and functionalities). As the researchers interpreted it, top management seemed to have become more interested in developing post-NPD design in a more value-oriented direction and creating visibility for those activities to enable control of the R&D continuum as a whole. Without revealing the mechanisms of post-NPD value creation, these activities could easily be interpreted as being peripheral with an emphasis on cost control.

Due to the recession in 2008–2009, top management needed to respond to cost-reduction pressures and find places for potential improvement in the effectiveness of R&D. More uniform control mechanisms were needed and top management was interested in refining the output of post-NPD design work and identifying the value of individual tasks. However, the initiative to develop management control of R&D was not only due to the recession, but also to management needing to respond to a variety of market demands. Milestone's products had to serve multiple customers' evolving demands, and hence the need to improve the products after the NPD phase can be interpreted as being crucial in light of the company's customer-orientation strategy. Collectively, top management was accountable for the product development activities, which meant increased requirements for controllability that required more transparency and visibility. In order to gain this visibility, top managers seemed to be concerned with the overall profitability consequences of the post-NPD activities and of the variety of the single design tasks within these activities.

The overall need to gain more systematic control over post-NPD activities made divisional R&D managers and their subordinates, the design team leaders, interested in gaining a more transparent view on the value of the design work of their department. The R&D managers required thorough analyses of what things or tasks were done in the department. In particular,

R&D needed to show the value-added created by the post-NPD design tasks. Apparently, the value of post-NPD design work was not visible to the top managers, whereas its expenses could be easily verified by looking at a staff report, for example. The R&D managers at Milestone's division were obligated to improve their reporting procedures in order to meet top managers' requirements for increased visibility of post-NPD designs.

More specifically, the R&D managers called for easier decision making and redesign task valuation, improved task organising and more systematic monitoring and reporting. Previously, post-NPD design tasks had been prioritised somewhat intuitively. On one hand, some design tasks were extremely critical (e.g., a response to a new regulation) and had to be carried out and made way for. However, the managers did not have sophisticated tools to do design task prioritising with consideration on the bigger picture of the company-level profitability consequences caused by the made or planned product improvements. This would provide the task-valuing aspect called for by top management. In order to make R&D more efficient, the top managers needed to ask the R&D management to carry out tasks that were profitable overall for Milestone. The R&D managers were interested in such a general view, claiming that otherwise their in-house design meetings would focus too much on cutting costs and too little on improving the products. These practitioners had already rethought the purpose of further, often correctional, post-NPD design as not merely as an easily viewed "fire extinguisher", but also as a value-creating activity, such as NPD.

The R&D managers identified the need to drill through the valuating aspect to reveal the variety within, and the characteristics of, the post-NPD tasks. These tasks could be minute design and engineering tasks, including only changing few design parameters in a mechanical drawing, or large-scale mobilisation of the department to comply with tightened environmental regulations that concern the whole product portfolio. These two examples would totally differ in scale and size in terms of design expense and value-added.

To provide the top management with a general view of post-NPD task profitability consequences, the R&D managers called for more systemised and commensurable design task valuation from the researchers. Each task was to be valued beforehand and prioritised accordingly, leading to a situation in which the R&D organisation would have a dynamically refreshing list of design tasks. Then, R&D management would plan the to-do activities, organise their designers and engineers and report to their superiors what had lately been done. All this organising—excluding the newly introduced task-valuing aspect—had previously been carried out using a handful of spreadsheet tools that seemed incapable of serving as management devices now that the concept of task value had been introduced. The two interventionist researchers were asked to attend a meeting in which R&D management told them the situation: a new control tool needed to be developed and implemented, but in-house

resources were too busy with their core business and hence an opportunity opened for the researchers to step in and intervene in post-NPD design management[3].

In general, one can easily claim that products should initially be so good that no correctional post-NPD design is needed, and hence their upkeep would not erode R&D resources. In Milestone as well, R&D managers seemed to think that post-NPD design is at its best once nobody notices its existence. This means that required design actions are carried out efficiently and even proactively before problems occur. In this way, post-NPD design is similar to the housekeepers in a hotel, for example. These housekeepers maintain a certain standard of tidiness, but their good or bad performance is usually determined by the outcome of their activities, namely, are the rooms clean or not? It does not matter how this cleaning is done, apart from being cost-effective and not disturbing the hotel's clientele. One can thus claim that housekeepers are at their best if their work is invisible, i.e., it appears the hotel had never become unclean. This example of hotel housekeepers reveals an important *raison d'etre* for post-NPD design as well. Not all products are optimally manufacturable nor can they fill evolving customers' expectations at the moment of the initial product launch—but they should appear to be such and do so.

Indeed, three central issues in controlling post-NPD design efforts at Milestone emerged: (1) giving value to single design tasks, (2) prioritising these tasks and (3) organising the prioritised design tasks in terms of profitability to reveal the value-creation mechanisms within the post-NPD activities according to top management's information needs. The to-be-introduced control mechanisms, in the form of new accounting tools, should incorporate these issues, but at the same time, not forget that post-NPD design should support Milestone's total profitability as well.

Nevertheless, task valuing, which is one of the cornerstones of achieving more controllable post-NPD activities, was not a straightforward routine piece of work as expected. As a hypothetical example, consider the designing of a safety disclaimer sticker for a machine. This sticker enables the machine to be sold on a more tightly regulated continent where potential sales profits could reach £100 million. Could the value of a few minutes work spent adding the safety sticker to the mechanical drawings be worth £100 million? In general, it would seem absurd to value such minute task so highly. If all of £100 million profit is due to a newly added sticker, is the initial development of that machine therefore worthless (or worth only the sales on other continents)? This is an absurd claim, though theoretical, but once one begins to question a task's valuation, it becomes never endingly ambiguous. If such ambiguity exists, what happens to the management control system build upon these tasks' value? There are even such tasks, like safety issues, that will stop a business if they are

[3] There is little scientific value here in the fact that Milestone could use the researchers as part of its labour force—other than possibly a methodological one—but academia can learn from Milestone's issues as pointed out now from a "point-blank" range. For this reason, there is no intellectual contribution in presenting the actual reports or control tools that were implemented; the story itself is more beneficial for contributing to the understanding of the many-sidedness of R&D management.

disregarded. Furthermore, as the consequences of development actions become less uncertain, as when moving from basic research to post-NPD design, one may face uncertainty over the included accounting objects: Which objects should be included in a calculation in order to value a task: e.g. additional after-sales potential, working capital consequences or increased employee satisfaction due to fewer items in a product's structure? In sum, being accountable for conducting post-NPD design at Milestone seemed to be relatively certain with regard to the outcome of the tasks in real life, but relatively uncertain in terms of putting a monetary value on individual tasks. This ambiguity, however, was more due to drilling into the post-NPD process than being unable to sort out how to organise such activities.

Although theoretical ambiguities existed in the task valuation, the R&D managers seemed to be well informed about developing their post-NPD processes and reporting. The visibility of post-NPD design was interpreted as being sought after. A transformation towards in-detail reporting had emerged. This information could now be used in everyday managerial tasks and in reporting. To be frank, this also meant that practitioners needed to invest their time in developing their new accounting tools and their reporting activities. The collective time that reporting took could, nevertheless, be divided within the organisation more efficiently because new reporting tools required individual engineers to input data about how they had spent their working time and revealed the long-term positive consequences of the post-NPD value creation mechanisms.

From autumn 2010 to the summer of 2011, the researchers and R&D managers developed suitable control methods and processes to collect and report post-NPD task data. During the summer, global organising software was introduced inside Milestone and R&D managers were asked to assist with the implementation of the new system. Indeed, during that time, also other departments within Milestone had begun to develop their previously inadequate control and management tools for post-NPD design work and they started a process to develop this global information system for this purpose. Altogether, the interventionist research effort presented in this paper helped also other departments, as they started to fine-tune their information needs and reporting practices in connection with their post-NPD activities. In sum, Milestone's case offers a way to ponder how the better visibility of the value-added provided by carrying out post-NPD design and engineering tasks can be leveraged in R&D management. This visibility can be a vital part of being able to understand an activity, control it, and become accountable for it in a manageable way.

DISCUSSION AND CONCLUSIONS

Potential benefits and pitfalls of post-NPD management control

Our account of Milestone's management control development project serves as an in-depth example to illustrate the potential benefits and pitfalls of management accounting in post-NPD design. As depicted in Milestone's case, extended control can increase the accountability, controllability and visibility of post-NPD design efforts (cf., Horngren et al.

2006). Managers and designers can use control mechanisms in order to create new and improved transparency of the activities within the R&D department.

The case also illustrates that not all design work is creative in the artistic sense; naturally there is a place for engineering as well. Large-scale coordination of rational decisions in post-NPD design has the potential to support the total profitability of a company. Moreover, the concept of profitability brings this discussion to the fountain of accounting. As depicted by Avery (1953), accounting can make measurement more uniform as accounting objects are handled and compared against each other in monetary terms. Such monetisation of design efforts and tasks with ambiguous characteristics might open a possibility for even single designers to question their earlier (possibly intuition-based) decisions and to use accounting as an answer machine—as soon as correct questions are formed about what to measure (cf., Thompson & Tuden 1959, Burchell et al. 1980, Hopwood 1980, Chapman 1997). Life-cycle considerations (Suomala 2004) on how to value a post-NPD design effort, such as the hypothetical safety sticker design, may potentially help make design tasks more commensurable regardless of their ambiguous character. This could facilitate comparisons between single design tasks and the selection of the tasks with the most favourable overall profitability consequences, in particular when design resources are limited.

Indeed, although Chamberlain (2007, p. 354) reminds of designers' bounded rationality in determining factors relevant for decision making, accounting measures help designers reason the consequences of their design efforts, which reduces the risk of intuition leaving out important decision-making factors. Single designers and design managers may become more analytical about their work, which then enables drilling into the design process and analysing weaknesses and improvement potential. This can become a positive social consequence of control inside an organisation (cf., Hopwood 1987), as valuation, measurement and control procedures become more uniform. This transformation can even facilitate decision making regarding innovative design decisions, similar to the way suggested by the new control paradigm (e.g., Adler & Borys 1996, Davila et al. 2009, Adler & Chen 2011). Unveiling the value creation mechanisms within post-NPD and visualising the importance of thought-to-be-banal and only cost-inducing post-NPD design work could shift product development management's focus from NPD measurements to considering the whole R&D continuum.

Post-NPD design control, however, potentially incorporates pitfalls. It is problematic to verify which parts of value-added are due to any single design task (cf., the safety sticker problem). What kind of value should or could even be verifiable? Costs are relatively easy to sort out in detail, which can make costs too convenient a measure. As potentially inadequate measure, costs ignore future income potential induced by product improvements, for instance. This means that product profitability may be left unclear. As Horgren et al. (2006) put it, the focus should be on gaining and using information, not on controllability per se. Another problem is the accounting objects that should be selected. Are the ones that have once been selected to illustrate the performance of post-NPD design truly illustrative? Those controls that have been selected can easily become ambiguous. For instance, what outcome could be

dealt with as a consequence or value of a single design task, design project, design portfolio, life-cycle design plan or even a strategy or a vision? These questions all are completely on different levels of analysis and cannot be answered by using data from only one level. Thus, further research could focus on the implications of measuring the value of design-related decisions made nearer the practice of design as well as on a more strategic level. Both theoretical and empirical work is welcome. Luckily, Chamberlain (2007) has already touched strategic redesign.

More on the practical side of post-NPD control, it is in particular noteworthy to ponder where too-tight control could lead an organisation. Designers' time is allocated in administrative rather than value-adding tasks and too small issues can be brought under scrutiny (cf., once again the safety sticker problem), causing the bureaucracy to be more coercive rather than enabling (cf., Adler & Borys 1996), or too boundary-like (cf., Simons 1994). Management might also interfere in activities in which they are not competent. Altogether, the pitfalls of control in post-NPD design could lead to focussing on short-term objectives, rather than looking at the larger-scale profitability of an organisation. This pitfall was not evident in Milestone's case but is a natural extension of the analysis. Purposeless extension of control could have negative social and organisational consequences (cf., Hopwood 1987). These abovementioned items, benefits and pitfalls of control, have implications on R&D management practice and its measurement and control but more work is still needed to provide normative guidelines of how to control post-NPD design in general.

Conclusions

Our findings open fruitful ground for discussing the notions of innovation and management control in the latter stages of a product's life cycle at the extreme D-end of R&D. We found evidence of management control methods being used as tools that unveiled the value-creating side of the otherwise potentially thought-to-be banal and merely correctional post-NPD design and engineering tasks. Our findings have a way-paving character: We argue that there is more to R&D management than merely NPD control. The later and earlier parts of the R&D continuum can potentially benefit from management control. Our study serves as an outline of the kinds of themes that can or could be faced when the R&D continuum as a whole is considered worthy of financial analysis. This also serves as an indication of further research directions that require attention. These directions are suggested towards advancing post-NPD management control to serve a coherent conceptual assemblage of total R&D continuum management that combines the R- and D-ends. This still requires both theoretical and empirical work in terms of identifying possible guidelines of controlling post-NPD design, other than merely the difficulty of the redesign efforts and the commonality consequences these efforts have (cf., Chamberlain 2007). The consequences extend beyond axiomatic costs.

To conclude with, it would not be unexpected to postulate that post-NPD design control might differ from control of other phases of the R&D continuum. Instead, based on our

findings, we generally argue that there is company and R&D profitability potential in developing controls for post-NPD design. Indeed, the theoretical and managerial contribution of our paper is firstly in contemplating management control in a post-NPD context, and secondly building our potential benefits and pitfalls of post-NPD control upon a uniquely point-blank range interventionist case study. This underlines the practical relevance of our work and positions our twofold, way-paving contribution to the literature and managerial practices of R&D.

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Applied Design Management in Healthcare And Medical Industries

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Keywords: ***Design Management, Services Design, Process Design, Product Design, Brand Design, Healthcare and Medical Industries, Pharmaceutical Industry, Applied design management in healthcare medical industries, Exploratory research.***

This paper reviews the existing literature of design management with key focus on healthcare and medical industries. In the UK healthcare system the Department of Health(DOH) is actively involved in the governance of pharmaceutical and supporting industries. The healthcare system in an economy requires active support from medical industries to ensure the availability of effective medicines, vaccines, surgicals, diagnostic technologies and clinical consumables to deliver good quality healthcare facilities to all the patients. The *Services design* of the healthcare system combines all the elements of the healthcare system (Infrastructure, Staff, Clinical inventories etc.) to deliver services to all the communities in the society. The Pharmaceutical industry further involves the surgical and clinical supplies that have an active element of *product design* to fulfil the clinical requirements of the physicians and other clinical staff. The *Process design* is applied in the operations of the medicines, this further includes licensing the patents and other intellectual property rights possesses by the corporate pharmaceutical brand. For the pharmaceutical companies building a corporate brand identity is an essential pre requisite to convert the clinical success into a commercial success. This paper attempts to combines services design, process design, product design and brand design in an applied context of healthcare and medical industries.

Introduction

The implications of Design Management in the commercial success of the enterprise vary from industry to industry. In Healthcare and Medical industries, the concept of design management is applicable in number of interacting themes. For the healthcare system (e.g. NHS-National Health Services) the design management is applicable through services design. There is direct impact of medical industries infrastructure within the country on the effectiveness and efficiency of healthcare system of the country. For medical industries the manufacturing of pharmaceuticals and medicine is with the inclusion of process design that integrates R&D with marketing, finance and intellectual property experts. The design management is of significant importance in the product design process for surgical equipment and clinical consumables. Brand design is every aspect of the product/service that provides an identity in the market place. Brand design is the identity of the medicine but the market performance of the medicine and result effectiveness is based on the research & development (R & D) quality. The aim of this paper is to explore the implications of design management within the Healthcare and Medical Industries. This involves *service design* for a healthcare system, *process design* for the manufacturing and production of medicines, *product design* for the design of surgical utilities and *brand design* for the identification and legal protection of development with in the market place. In the pharmaceutical industry role of design management is as a disciplines integrator that brings R&D, finance, marketing/branding, operations/production and legal affairs department in one line.

The adopted research philosophy for this paper is based on social constructivism, for developing conceptual details to interconnect product design, process design, services design and brand design in healthcare and medical industries. The devised research methodology is considerate to the tenacity, authoritativeness, and authenticity of knowledge in regard of the research conducted within the domain of design management. The anticipated outcome of this research will build up a clear understanding about the implications of design management within Healthcare and Medical industries.

Literature Review

The applications of any academic field are subject to the environmental and situational circumstances. Design Management is a developing body of theory that has its roots in marketing, sociology, psychology and engineering literature (Vazquez & Bruce, 2002). The product on its own is a result of an operational process; this process is designed, developed and maintained to ensure the availability of the product. According to Vazquez & Bruce (2002) the initial focus of design management was product development based with a string of sequential process orientation. In the healthcare and medical industries sector the product is a medicine, surgical or any clinical consumables. The process refers to the business operations that result in the production of the product. The healthcare system is a broad system responsible for providing the healthcare facilities to the society or communities living in the society. In healthcare sector services design deals with designing, maintaining and improving a healthcare system, which integrates all the required elements to deliver the healthcare facilities and look after the general wellbeing of the society.

According to Gomez et al (2004) the concepts of design management is understood in different ways, by highlighting different aspects or activities and involve diverse typologies and connotations. The applications of design management in the healthcare and medical industries are different than any other sector for instance automobiles or consumer goods. The healthcare service is not only a commercial process for generating revenues. In almost all the healthcare systems the inclusion of public sector is for the concept of welfare. While the private sector can put the maximization of the revenue as a prime objective but the public sector is more focused for the wellbeing of the society. The medical industries, which include the pharmaceutical industry and surgical instrument manufacturing, the design management provide an element of commercial success along with fulfilling the requirements of the regulatory authorities (MHRA, NICE, ABPI, etc.)

Services design in healthcare

According to Stefan Moritz (2005) “service design helps to innovate (create new) or improve (existing) services to make them more useful, useable, desirable for clients and efficient as well as effective for organizations. It is a new holistic, multi-disciplinary, integrative field”. Health care service design refers to creating and sustaining a health care system that delivers the effective and efficient treatment to the patients by the health care system. The fundamental base of the healthcare and medical industries is on ensuring the wellbeing of the

society or the economy. The macro part of the social wellbeing deals with the healthcare system. It is a responsibility of the national healthcare system to deliver equalling healthcare facilities to the individuals and all the ethnic groups within a society.

The services design of healthcare system refers to the arrangement of healthcare facilities in such a format that the infrastructure is fairly available to all the communities with in the society. The healthcare requirements of the communities vary interms of their demographic and geographic altitudes. The services design of the healthcare system must ensure the fair distribution of resources in all the communities with the economy regardless of the economic status of the patients. It is indeed important to understand that patients are not the consumers. So the quality of the treatment must not depend on the financial status or the paying capability of the patient.

According to Eiriz & Figueiredo (2005) health care quality can be studied at two different levels. At one level it can be assessed as a performance issue related to the entire health care system. At the organizational level at the other hand, actors such as patients and doctors involved in service delivery can assess heath care quality. The second point discussed by Eiriz & Figueiredo (2005) focus on the delivery of the healthcare services by the organization.

According to Cutler David (2008) United States spends the most money per capita on healthcare and has the most technologically advanced medical system in the world, yet not the healthiest society of the earth. This indicates that the healthcare services design is more critical than the healthcare infrastructure and overall financial liquidity. Murray (2010) briefs the similar concern by discussing that in 2006 the United States was number 1 in terms of heath care spending per capita but ranked 39th for infant mortality, 43rd for adult female mortality 42nd for adult male mortality and 36th for life expectancy. The services design in healthcare is also of significant contribution, along with the health care infrastructure, in delivering the healthcare facilities to the communities or the economy.

National Healthcare Services (NHS-The public funded healthcare system in the UK)) came into operation in 1948, following the provision of NHS act of 1946.According to the research paper by Boyle Sean (2008) The National Health Services accounts for 86% of total health expenditure. It is mainly funded by general taxation (76%) but also through a National Insurance contribution (19%) and user charges (5%) (Department of health, 2006).

In the official budget publication for 2011, the UK government allocated £ 126 billion on the provision of Health care. Compared with £ 89 billion on education, 40 billion on defence and 23 billion on transport, it is clear that heath care is the key priority of the UK government.

Duncan & Breslin (2009) presented an added element in the healthcare services. According to the review of Duncan & Breslin work by the Journal of strategic direction the healthcare services have traditionally concentrated on the diagnosis of diseases and its treatment. The emotional needs of patients undergoing hospital treatment have been very much an afterthought. The SPARC programme (see/plan/act/refine/communicate) model adopted by Mayo Institute (a non-profit organization located in Minnesota) is an attempt to untangle a number of complicated relationship that exist in the chaotic hospital environment and to provide solution as to how they could be improved.

SPARC Programme in healthcare services design

Following are the four steps of SPARC programme (Duncan & Breslin, , 2010 ,Achieving patients wellbeing through creative design , Journal of Strategic Directions, Vol 26 , page, 37-39)

Topic Framing: Exploring a general topic (disease) to gain an understanding of the issues and different relationship; brings all stakeholders (patients, Physicians organizations and refereeing physicians) together to enables an agreed direction to be worked out for everyone affected by the project.

Research: Collecting data through a variety of field observations which are fed back by storytelling that reveals the key issues to be resolved.

Design: Design and development includes developing compels innovative ideas about people ,processes, space, technology and material artefact and the testing of these ideas with patients and physicians in a clinical setting ; allowing evaluation and providing an opportunity for feedback before changes are implemented

Implementation: Vital to the whole project and how healthcare is delivered and experienced.

At each stage the element of understanding human behaviour was used to challenge and inform the work and to innovate where possible.

Learning from the SPARC provides the point that making design an integral part of the organization can improve insight about services delivery and allow designers to develop across project themes, connect different projects and understand project outcomes in ways that improves the value in the outcomes.

The healthcare industry is generally defined as a key focus upon the treatment and nursing of patients who are injured, sick, disabled or infirm and is facilitated by professional health workers and technology. The healthcare technology industry can thus be broadly segmented into two areas

Pharmaceutical and drug development

Medical technologies

Pharmaceutical industry deals with the development of medicines and therapeutic options to cure the disease or to ensure the general wellbeing. The effectiveness of the healthcare system also depends upon the availability of effective medicines (an output of the pharmaceutical industry). National Health services (NHS) is the healthcare system of the UK and the UK pharmaceutical industry constitutes all the entities that directly or indirectly contribute in the research, development and distribution of medicine in a healthcare system acceptable format. The process design with in the pharmaceutical sector is quite different to other production oriented sectors. Pharmaceutical industry is a research led industry, where by pharmaceutical companies invest bulk financial resources and long term commitments in discovering new chemical entities (NCE) for further developing medicines.

The medical technologies segment constitutes of the business that are involved in the design and development of the surgical instruments within the clinical processes. This also includes the laboratory setups and diagnostic technologies. As far as the product design is concerned for this segment, the clinical capabilities and the quality compliance is the guiding factor rather than any aesthetical element.

Brand Design

Brand refers to the identification for the company or the products/services offered in a market to the consumers. According to Bavelo & Brand (2003) brand design will evolve beyond its traditional focus. Brands are co-owned by all the stakeholders, everyone to the shareholders to the public at large. The product design refers to the features and technical aspects of the product. It includes the details for aesthetics and the issues of product engineering. The brand design constitute of those elements that differentiate the product from the competitors offers. According to Roscam & Gessel (2008) “the role of branding for the organization and their stakeholders has changed considerably throughout its history. From its origin as a sign of ownership through the recognition of its status as a mental representation of consumer benefits, the brand has now arrived at a point where it represents the vision and strategic

positioning of the organization to its environment. There is a possibility that product design doesn't find the brand design of the organization". In the pharmaceutical industry criticality of branding may be a reason for mergers and acquisitions (M&A), whereby when a company discover any new chemical entity or a therapeutic medicine they consider selling the patents rights, if brand support is not available, to commercialise the clinical success in to a market success. It further extends the argument that excellence of product design and excellence of brand design are two different aspects. The brand design is the reputation of the corporation or the product in the minds of the consumers and marketing intermediaries.

Product Design

The product is a final output of the business, offered to the consumer, in the market for consumption. According to Ulrich et al (2008) "product development is an interdisciplinary activity requiring contribution from nearly all the functions of the firm; however three functions are almost always central to a product development project, marketing, design and manufacturing". Manufacturing on its own can be neatly placed in the process design.

In case of the surgical equipment the design is indeed important from the functional point of view rather than looks or aesthetics. According to Ulrich et al (2004) "the design function plays the lead role in defining the physical form of the product to best meet customer needs". In this context the design function includes engineering design and industrial design.

In case of the medicine/drug that is used by the patient for any therapeutic purpose or general wellbeing the design is not as much applicable in the discussions as it is in case if the surgical and clinical consumables. According to Gomez et al (2004) "efficient design management means better product definition which enables differentiation and this leads to greater product success". In terms of surgical and clinical consumables the successful design means that physicians will have good results by using the specific design. This further stress the inclusion of physicians ion the product design process or using the physicians/doctors in analysing the predict performance. Svendsen et al (2011) discuss the linkage between new product developments and inter firm relationship. This inter firm relationship can be seen as involving users in the process of design. The users of the surgical instruments and the clinical consumables are doctors, physicians and nursing staff. The participation of the users ensures that the products are designed by incorporating the user centric approach.

Veryzer & Mozota (2005) has discussed the integrative nature of product design "over a course of product development process, there are number of disciplines that participate in

designing of a product. These include R&D, engineering, industrial design, marketing research, manufacturing and so on."

Process Design

Process design covers the arrangement of operational activities in such a way that the anticipated product is engineered and manufactured as per the expected requirements. Process design relates to the manufacturing element of the product. According to Ulrich et al (2004) the manufacturing function is primarily responsible for designing, operating and/or coordinating the production system in order to produce the product. In the pharmaceutical industry the process design is much critical. The process design includes the Research & Development pipeline, for discovering the new chemical entities (NCE); applying NCE in to clinical research and then manufacturing the medicine that full fills the requirements of good clinical practices, to ensure that the medicines are safe for the clinical applications. The Process design also includes the management of the patents and medicine licensing. Pharmaceutical industry is one of the most regulated industries in terms of patent protection. The pharmaceutical organizations do collaborate and even in some cases merge or acquire other companies/ brands for synergising the process design.

Organizations are concerned with branding and design excellence as a result of market orientation. The existence of alternatives in the market requires that business product/services are of distinguishable aspects. The market orientation literature (Kohli & Jawarski, 1990; Narvar & Slater, 1990; Folay & Fahay, 2009) has been highly significant in operationalizing the marketing concept. The modern businesses allocate resources and long term commitments for design and branding as a result of increasing market orientation. In the Pharmaceutical industry design or the shape of any medicine is dependent on the clinical requirements rather than looks or aesthetics. But the brand name is critical for influencing the prescription intermediaries including doctors and healthcare system. The process design is applicable in the pharmaceutical industry in the production process. This can also include the patents licensing to improve the return on research & development (R&D).

The role of the corporate brand in the success of the medicine is of significant contribution

Approach

The research approach for this paper is on the track of "EXPLORATORY" studies. According to Saunders et al (2004) "exploratory studies are the valuable means of finding out 'what is happening; to seek new insights; to ask question and to assess phenomena in a new

light' (Robson 2002)". The Design management on its domain is yet a developing field of study. This paper aims to explore the different components of healthcare and medicine industries to propose a model that depict the application of design management within healthcare and medicine industries.

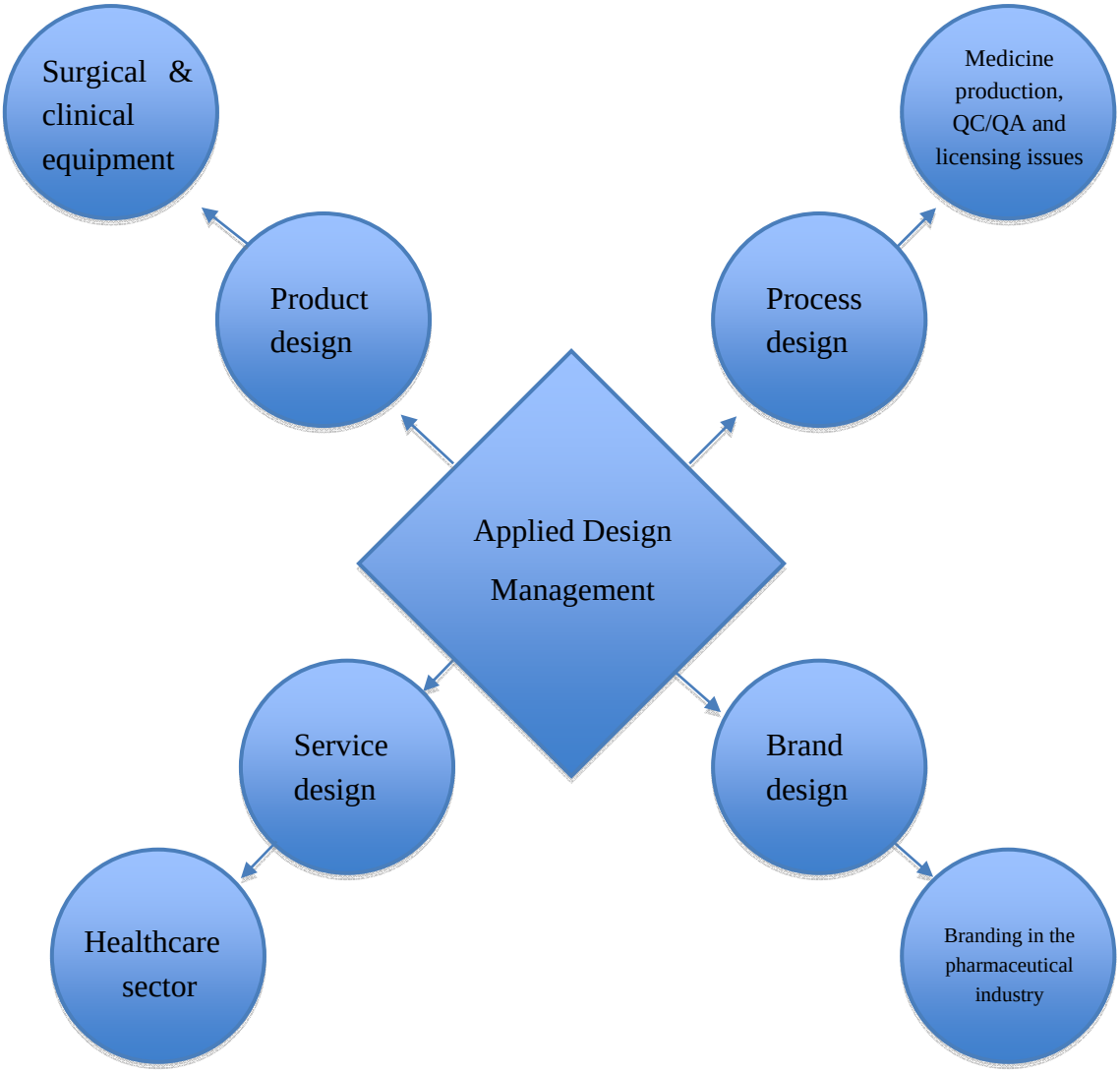
The exploratory research can be linked with positivism or Interpretivism approach. But more often in the field of business and management realism is the mixture of positivist and Interpretivist approach, perhaps reflecting the stance of realism (Saunders et al, 2004).

The proposed framework of this research paper "Applied design management" will be further used in devising the separate individual research projects based on *services design* matter in the healthcare system. For which the research will be based on descriptive details of the UK healthcare system.

Product design in the surgicals and clinical instrument is in further need of study to develop the role of design in the process of developing equipment for the clinical purposes. Process design is more applied in production and licensing of the medicines, while brand design in the pharmaceutical industry will analyse the role of corporate brand in the minds of prescription intermediaries including doctors, physicians and prescription intermediaries.

The exploratory research is a bit broad in nature as compared with descriptive or explanatory research. According to Adams & Schvaneveldt (1991)" the flexibility inherent in exploratory research does not mean absence of direction to the enquiry. What it does mean is that the focus in initially broad and become progressively narrowed as the research progress (Saunders et al 2004)". The adoption of exploratory research for this research paper is significantly justified due to the fact that the initial proposed framework will work as a guide in directing the more focused future research projected for uncovering services design for healthcare sector, product design for surgicals and clinical equipment, process design for the manufacturing and licensing of medicines and brand design for studying the role of corporate brand in the field of pharmaceuticals.

Implications for Theory and Practice



Applied Design management in Healthcare and Medicine Industries (Proposed Framework)

In the UK specific scenario the national health services (NHS) and the department of health (DOH) plays an active role in the provision of medicine industries. NHS is the public funded healthcare system that is the major consumer for the products and services offered by the pharmaceutical industry and other supportive medicine industries. The arrangements of the healthcare resources such as doctors, clinical staff, equipment, infrastructure, system, structure by the NHS determine the effectiveness and the efficiency of the healthcare system. The role of the medicine for any healthcare system is significant. Though the UK economy is an example of capitalistic system yet the healthcare system in the country is an example of socialistic system. This means providing healthcare facilities regardless of the patient financial status and affordability issues. The issues of product design for surgicals and clinical equipment, process design for the manufacturing of the medicines, and brand design for the promotion of the medicines all these areas are controlled by DOH through MHRA

(Medical and Healthcare regulatory Authority) and NICE (National Institute of Clinical Excellence).

This paper aligns all the dimensions of the design management (Services Design , Product Design , Process Design and Brand Design) with an aim to extend the future individual research projects for converting this basic exploratory study into further descriptive and explanatory research dimensions, to uncover the role that design management can play for ensuring the valuable healthcare facilities in the society.

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Design Management in Services: A Case Study of the Design Management Competences Used in a Museum Exhibition that Focused on Increasing Social Inclusion

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This paper evaluates the design management competences used in the case of the *Knitted Lives,* an art project and museum exhibition created to improve the lives of older women. We discuss how design management contributed to the effectiveness of the project and, generally, the way that design could be managed in cultural organisations, specifically museums and art galleries that offer services to society. These services include: a) in the case of museums the research, collection, exhibition and preservation of art works, cultural heritage objects and other types of material and/or intellectual human achievements and b) in the case of art charities the involvement of isolated social groups in creative activities to improve well being and combat social exclusion. Both these kinds of organisations contribute to cultural and personal growth, education, entertainment, knowledge dissemination and appreciation of the individuals towards the arts, as well as, their own lives and capabilities. Consequently, they are agents of social change. We believe that design and design management, have a key role to play in any social innovation process and, in this particular paper, we explain how.

Why *Knitted Lives*?

Nowadays, museums are increasingly seen as service organisations; “Today, rather than museums existing for the purpose of preserving and studying collections... are... existing more and more for the purpose of serving the public. This changing emphasis... has profound implications for the social organisation of museums and for the conditions of work within them” (Ames, M.M. in McLean, F. 1996, pp: 23). In addition museums can contribute to social inclusion; “A growing body of research into the social role and impact of museums

suggests that engagement with the concepts of social inclusion and exclusion will require museums to radically rethink their purposes and goals and to renegotiate their relationship to, and role within, society" (Sandel, 2003).

In our opinion museums, and cultural organisations generally, should also rethink the role design plays in the development of their projects. In the present, many cultural organisations limit the use of design to the creation of displays, websites, leaflets and other information means. In addition, the creation of these means often comes later than the conceptualisation or even the creation of the exhibition. This reality basically signifies two things: a) unfortunately, in current museums' practice design is not seen as an integral part of the cultural product. And b) design is not undertaken holistically, in other words as a set of different design disciplines that must be coordinated and must ensure consistency at all stages of the project. For example, it is common to curate an exhibition and then contact a graphic designer to create some promotional materials. Ignoring that, there are more design disciplines indirectly contributing to it, such as architectural design (the building) or interior design (the spaces and how they guide the visitor to a particular path). Ultimately, these design disciplines, in conjunction with the artefacts, guide the visitor in a particular experience. The conceptualisation of an exhibition as an experience, and not just a set of artefacts placed in a rational way, could lead to significant innovations in the museums sector, and furthermore would place experience and service design in the realm of the museums activities. There are many overlaps in what experience and service design would be in the museum context. In essence we are talking about design processes where the intangible, experiential factors that surround the tangible outcomes –the artefacts, the displays or the leaflets- were paramount and therefore are in a way predetermined by the curatorial team.

In the case of the *Knitted Lives* project, 31 women (50 to 90 years old) created and exhibited knitted artworks and design objects. These ranged from bicycles and standard lamps to lipsticks and powder compacts -all made out of yarn and cotton. But the most important elements of the exhibition were intangible, and they had to do with the fact that each one of these objects was inspired by events in the creators' lives. In other words the women were invited to reflect upon their life and valuate it. We strongly believe that *Knitted Lives* wasn't just an exhibition of knitted artefacts, but an exhibition that generated an unforgettable experience, by celebrating the lives of older people and fostering reflection on everyone's future lives as we get older. And it was even more than that, as it formed a platform for social inclusion (please see below).

Going back to the importance of a new way of thinking and design practice in the museum space, we would like to recall the findings of a previous paper, where Irini Pitsaki suggested that, in the case of cultural products, such as exhibitions and events:

a) "Design must have focus and must offer a conceptual framework for the development of any cultural product.

b) Design must consider the use of space, objects and communications (mix of design disciplines). In other words, it must be the result of a combination of different design disciplines such as architecture, interior design, interaction design, web design, graphic communication and others.

c) Design must consider and reflect the flow of movement and, in addition, guide the visitor or user to attain an appropriate, pre-established in a way, cultural experience.

d) Design must be a total process that starts from seeing the world through the eyes of the user, suggesting experiences and make them possible.

e) Design must be an integral element of any cultural product development process, because it offers an appropriate mindset and a body of knowledge which is ideal for the integration of creative approaches, as well as, management and marketing perspectives". (Pitsaki I, 2010)

We've chosen to work on the *Knitted Lives* project because many of these elements were in place. Even if the organizers of the exhibition wouldn't verbalize them this way, it was proved through the interviews that we conducted with them, that in the case of *Knitted Lives*, design was an important element; it gave focus to the project and, therefore, offered a conceptual framework within which an exhibition was created and a valuable experience was offered to a group of older, frail women. As it was acknowledged by the curators of the exhibition, design was perceived as a "concept of quality". "We didn't want this exhibition to be one more initiative for two dimensional knitted works, but a high quality three dimensional knitted objects exhibition that can be introduced in art galleries and contemporary museums" (Alice Thwaite).

In *Knitted Lives*, design was also the combination of different related disciplines, and guaranteed consistency of scope and objectives during the project process. More specifically, consistency was made possible through the collaboration of two textile artists, a writer and a photographer with the project manager. In addition, design was in the *Knitted Lives* project a total process that started from seeing through the eyes of these women, but also through the eyes of their families and local communities, as audience of this exhibition and as potential participants to a greater, social inclusion goal. This exhibition was more that an event, it was an opportunity to establish a dialogue between these women and the society. It was an opportunity to tell a valuable story for the benefit of both knitters and the audience, as the exhibition acted as a tool to help them become self-fulfilled. We will now discuss what the project involved and how design was managed to contribute to social value.

Introduction of the *Knitted Lives* project and the way design was managed

The *Knitted Lives* project was a social inclusion project made possible through combining an exhibition with a socio-cultural initiative. It was an initiative of the Equal Arts agency in Gateshead, which is a non-profit organization that aims to improve the quality of life in the North East by enabling older or frail people to access and participate in art projects. The exhibition was presented between February 13th and March 14th 2010 at the Shipley Art Gallery, which is the North East's leading museum of design and contemporary crafts. The social inclusion objective was achieved through older women getting together to share a common interest and to demonstrate their continuing abilities to the rest of the world. These women met once a week for a year to produce in total 125 high quality three dimensional knitted artefacts that connected to a personal story.

Some examples are (Knitted Lives, 2009):

	A *Communist Bag*, in memory of the difficult between the two world wars years, when the knitter Nan Haughey decided to became a Communist to fight against poverty. Nan explains: "In 1937-38 things weren't good in this country at all. I always used to feel for these chaps, going day after day. The unemployed would stand on the pavement with their heels on the kerb and their toes in the gutter. They seemed always to standing that way. There really was poverty. I became a signed up Communist, needless to say".
	A *Garbage Bin* knitted by Dot Tweddle. Dot says about her life: "I was born in 1951 in Scotswood, put into care and tossed from pillar to post. When I was 14, I left the children's home and went to find work in London. I was on the streets but eventually got a bedsit. I needed a job and this guy said "get up at 4, put on an old pair of jeans". He said to his pals "She'll not last two minutes, she'll not be able to lift the steel bins". But I just coped, straight onto my shoulder and into the wagon. My life felt rubbish and I just thought that empting rubbish was appropriate for what I was feeling".
	A *Community Centre Bag* made by Elsie Marshall who said: "I've looked after children and old people from the age of eight. On the estate there were so many people who were housebound or wouldn't come out. This hall was only used

	for bingo twice a week and a coffee morning once a fortnight. A beautiful hall standing empty – so I thought if we can just get things organised and get people to come. Since I took over we've been redecorated and applied for new furniture. We've got 65 members now and getting more and more all the time. It's the happy spirit I like. It's good to see people smiling".
	A *Pink Shopping Trolley* and a walking stick made by Dot O'Shea knitted. "I treated myself on my 60th birthday. I wanted a trolley but not a boring one, I've never been boring. There was only one left and it was shocking pink. It seems to have become famous and I really love it. I've gone outrageous again. I like being different, sometimes it works, sometimes it doesn't", she said about her now knitted pink trolley.

The aim

The project was planned to involve older people that are often excluded from arts and an active social role. The aim of the project was described as "an opportunity for these women to celebrate their lives and their skills", and also involved frail people who could not easily leave their homes, giving them a quality creative experience and the opportunity to make their creativity visible to the local communities. The women engaged in a group activity on a weekly basis, getting all the benefits that derive from having an occupation, working collaboratively and developing friendships. These benefits contributed to their personal growth and well being and mainly relate to being creative and socializing. "Meeting and working together appeared to have a therapeutic effect on the participants; raising spirits and giving rise to great deal of laughter" (Abbott, R. 2009, p.6).

Similar benefits we can find deriving from many community projects and, most particularly, we can find similar knitting initiatives across the UK. What made this project so special and how that was expressed through its aim? This particular initiative was not a usual knitting and older women entertaining activity, for several reasons:

- It had focus: the exhibition's target and theme were established at the early stages of the project. The women knew that this initiative would culminate in an exhibition with the thematic focus of narrating a personal story.
- It pursued high quality results: the artistic quality of the artefacts was a pre-requirement of the project. All the women participants had knitting skills, some more expert than others. However, their previous work was based on patterns and small two dimensional creations. A significant step forward was needed for them to understand what artistic quality means and what is the difference between craft work and work that can really be presented in a contemporary museum. Improvements in their skills also involved work on large scale three dimensional objects, using many different materials and textiles that they were experiencing for the very first time. In relation to

the social group of older women participating in the project, the aim was to show that "age is not a barrier to make an effective and powerful contribution" (Abbott, R. 2009, p.8).

- It pursued consistency in the way the aim underpinned the process. In addition to high quality of outcomes that put these women's' lives in the centre of attention of the audience, the organizers of the exhibition wanted the creative process to reflect these principles too. A challenge faced during the process was to give these women the ownership of it. In other words improve their well being by making them feel that they are not directed but they direct their work, offering them finally a very distinctive experience.
- Quality of the experience of the participants. The overall experience was meant to be very satisfactory and we believe that the organisers achieved this. There was an experience centred approach to the exhibition and what surrounded it before and after. Before the exhibition is the process of creation of the artefacts and after is the interaction with the local communities, as well as the value perceived by these women, that will always nourish their lives.

In our opinion these alternative approaches in the way the aim of the project was specified and materialized, led to a significant difference in the results achieved, in comparison to other similar cases in the UK. We consider that search of **focus**, **quality**, **consistency** and **holistic** approach to the resulting **experience** were key for success. In the case of *Knitted Lives*, these factors were underpinning the way the scope of the project was communicated and put into practice, constituting an important differentiation factor. This, as it will be discussed in the conclusions of the paper, was the result of design and design management principles applied in the project (please see conclusions).

The service

The project was part of the Quality of Life Partnership initiatives materialised and managed by Equal Arts. The Quality of Life Partnership (QLP) operates out of Age Concern's (now AgeUK) structure and is supported by Newcastle City Council, with the aim to respond to the challenges of an ageing population by bringing older people and agencies together to find ways of meeting the needs and aspirations of older people. Age UK has a vision of a world in which older people flourish by being equal citizens with equal rights or by having opportunities to participate and contribute to society as volunteers, active citizens, good neighbours, family members, and workers.

We consider that the service offered to the knitters, derived from a strategic synergy of these organisations and aimed to combine harmonically their respective aims. In that sense the service was the connector of different agendas of agents in North East England. It is, in other words, a service designed and managed by Equal Arts, but a one that combined requirements

broader than the particular's organisation. In that sense all these organisations shaped indirectly the design of the service.

The service was developed by Equal Arts, and was offered to three women groups. This service included bringing them together to engage in collaborative and creative work, providing them with a space for socialisation, helping them improve their knitting skills, reflecting on their own lives and making visible their abilities to a broad part of the population, as well as establishing an open conversation with their families, friends, neighbours and other citizens. These people can also be considered as indirect receivers of the service provided, as they benefited from the exhibition in various ways. As examples we can mention the audience's opportunity to appreciate high quality knitted artefacts, be entertained and stimulated to reflect upon these women's lives and, therefore, their own future lives. Through an exhibition like that the visitors, became more sensitive in social issues with particular interest in aging, creativity and well being.

The team

The project was inspired and managed by Alice Thwaite, Director of Development at Equal Arts. Three groups of women, in total 31 during 2008 met weekly at St Silas Age Concern day centre in Byker, the Bishops Court Anchor housing scheme and the Knit & Natter at Benwell Hall Drive. The leading role during the workshops was held by the textile artist Fiona Rutherford, with support from Jenny Burns, another textile artist. The writer Carol McGuigan, as experienced in oral history documentation, collected their stories, while photographer Sally Ann Norman captured their work and designed the exhibition catalogue. All of them had experience in working with older people.

Alice, as project manager, "maintained a high level of contact and communication with the artists, she was visiting the groups on a regular basis" (Abbott, R. 2009, p.8) and she contributed to the curation of the exhibition. Fiona and Jenny worked closely with the knitters to help them understand the exhibition concept and to develop their ideas The textile artists, apart from contribute to the development of high skills, they were also the motivators of the team; by understanding the developing dynamics of each group, they managed to keep the spirits up and work with enthusiasm. From a design management perspective we could say that these constitute important leadership abilities.

The process

The idea for the project came from Alice Thwaite who then approached Age Concern Newcastle and talked to some of the women to make sure that they were interested. After securing funding for the initiative, she approached one already established group of knitters and formed another two. The workshops began in January 2008 and soon the team started shaping the exhibition concept. Initially it was expressed as creating bags, with their contents and the associated stories. Over the weeks the participants developed confidence, enthusiasm and many valuable ideas, to end up to a pre-event called "In the Bag" on July 11, 2008 in Bishops Court, West Denton (they also had a final get together event on October 13th 2008 when the 40 per group workshops ended). The July event was the first gathering of the three groups and was really important in terms of realisation of the quality of work on progress and the impact that may have. It helped the "participants to make sense of what they were doing and enabled them to see the work objectively and appreciate the quality of what was being produced" (Abbott, R. 2009, p.5).

In addition, in April and July visits to the Shipley Art Gallery took place with the aim of putting the project into the context of an art exhibition. "Jenny commented that the trips to Shipley Art Gallery had been important in showing the participants the value of objects which have no practical use. They enjoyed the gallery and found it inspiring, which was evidenced in a *leap forward* in their understanding of the aim of the project" (Abbott, R. 2009 p.4)

We consider that organising these events and visits was an important management decision that contributed to a sense of collective identity among the three groups, and shaped the final exhibition by getting the big picture of the progress of work and the results aimed. This is something to bear in mind in terms of how this project was designed and managed and how it became successful (please see conclusions).

During this event the photographer had a chance to work on the women and, that again, was a significant boost of energy and confidence for them, as it reflected a community project underpinned by professionalism. Finally, the involvement of the writer also became a vital part of the project "because conversation and anecdotes in the groups was an intrinsic part of the project that supported the development of the theme for the work and ideas for the peices" (Abbott R, 2009, p.5).

The exhibition

The artefacts were exhibited at the Shipley Art Gallery and other venues, such as the Alnwick Garden (10 April – 9 May 2009), Newcastle City Library (June 2009), Saltwell Tower (August 2009) and the Harrogate Knitting and Stitching Show 2009 and the window of John Lewis shop in Newcastle's Eldon Square. The theme of the exhibition was the creation of works that illustrated the personal stories of the knitters. In that sense, the exhibition was well defined and no size or type limitation was established for the objects.

In the way we approach the exhibition, it connects to the entire process and the **holistic experience** intentioned to be offered to the women during the project. And most importantly, we see this exhibition as a **platform** where social inclusion was made possible, was materialised and was expressed in a very explicit way. The exhibition was the connector with the society, the glue that put together all the different aims and intentions of the different people and organisations involved directly or indirectly. The agencies that organised and found the project, the artists, the women, the museum, the audience and absolutely everybody that links to the project in one way or the other. The exhibition was a platform that brought together "unexpected and momentary conjunctions" of everybody involved "in such a way that they could see themselves and their activities reflected within the broadly defined" scope of the project (Rogoff, I 2008, p. 6). The role of design, in this case, was to ensure a suitable platform formation, as discussed above.

The design

"Equal Arts, has demonstrated its knowledge, experience and project management expertise in bringing about imaginative, creative and constructive experiences for older people that has given opportunities for them to work together, rediscover talents and skills and surprise themselves with new ones. This quality arts activity has provided significant added value to social interaction for people who live independently and are at risk of isolation. It has brought about new friendships, consolidated existing ones, produced high levels of creative activity both during the outside workshops, and provided a weekly event to look forward to" (Abbott, R. 2009, p14). We used the case study of the *Knitted Lives* project to investigate what made the project effective, through design and design management, at different stages. We are also interested in how these can be used to maximise the effects of a museum's services in order to bring about cultural and social value. For that reason, we examined many aspects of both design and the management of design in the *Knitted Lives*. In the interests of clarity we focus

in this paper on three interrelated aspects: the museum *service*, the design of the *exhibition*, and the design of *artefacts* (Figure 1)

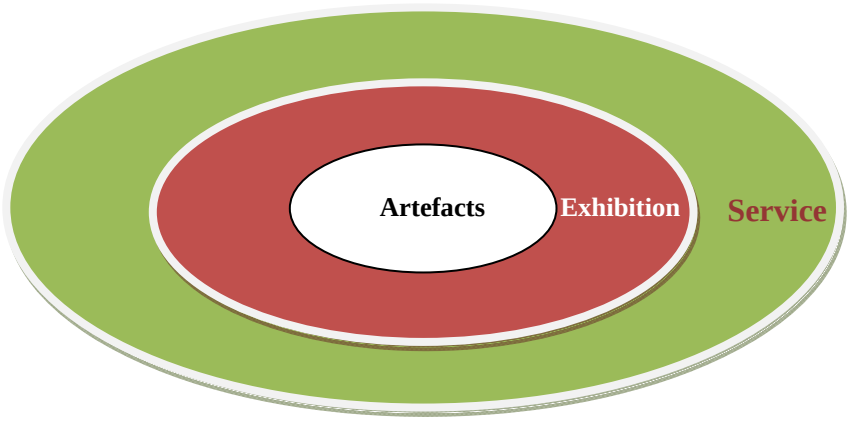

Figure 1: The three levels of design in the *Knitted Lives* Project

The **services component** involved the design of processes and the predetermination of intangible aspects that added value to the project and relate to its general strategic aims. For example, the service offered to those older women is: to bring them together and provide an attractive context in which to be creative, socialise, practice their hobbies and connect with the broader local community. The service design is team-based, comprising Equal Arts, Shipley Art Gallery and other agencies, experts in the factors that lead to social inclusion (see also conclusions).

The **design of the exhibition** involved the creation of a platform, in the sense of intangible elements, but also the physical spaces where the exhibition took place, the flow of movement in these spaces, the placement of art works / designed objects and the narrative derived from all of these. In addition, the exhibition design involved the design of communication means, such as leaflets and catalogue, the design of information and, ultimately, the design of the total experience that the event aims for, taking in consideration the emotional needs of the women and the audience (see also conclusions).

The **design of artefacts** involved each one of the works created for the exhibition, which combined aesthetic value with functionality and symbolism. Some of the pieces represent industrial product designs (e.g. a shopping trolley, a bicycle, a table tennis bat), while others are fashion accessories (e.g. a bag, a pair of shoes, some underwear). These artefacts were made by the women who, in this context and level of the project, acted as designers (see also conclusions).

Based on this explanatory model, our paper arrives at general conclusions regarding the management of design in the cultural fields with the aim of social inclusion.

Design management competences

At this point of the paper we would like to summarise our perception of how design was managed in the *Knitted Lives* project. The key factors that made it a successful and design oriented project are the following:

a) *Design in the outcome*: Design was seen as vision, as a high quality standard to be achieved. In the words of the project manager, design indicated the "search of quality" of the artefacts, while the leading textile artist described the same idea as "the value that allowed the objects to sit in the gallery".

b) *Design in the process*: Design was seen as the focus that underpinned the project. A focus that came from choosing a theme for the exhibition, at the early stages of the process. Design "was the thought behind what's being made" (Fiona Rutherford) and was finally reflected on the quality of works and the valuable experience of the women. In other words, design was seen as an integral element of the process, in a way that allowed consistency; it prevented from deviations and ensured that the initial aim will be achieved.

Another interesting idea around what design was in this context, is that "it ensured simplicity and introduced the works to their best value" during the exhibition (Fiona Rutherford). To conclude with, design was about taking the skills of the women one step forward and, finally, presenting them to the world under a different light.

Patrik Hetzel in his PhD thesis on "Design Management, constitution de l'offre" (1993) discusses three ways in which design influences an organisation: 1. "It influences the product offered by the firm by giving "sense" to them. 2. It influences human resourses management by mobilizing, motivating, facilitating the circulation of information, and by bringing together the various actors working in different services around the project. 3. It influences the firm by facilitating the formulation of the project and by encouraging the strategic nucleus in the company to generate vision". During our study we considered that the agencies and actors involved in the project were an organisation, and we identified that Hetzel's factors could describe nicely the way design contributed to the success of the *Knitted Lives* project:

1. Design gave "sense" to the project. Its "sense" derives from the fact that design, as it was previously discussed, was perceived as a "concept of quality" and offered focus to the project.

2. Design brought together the various actors of the project, through an exhibition – the platform on which social inclusion and the rest of aims of the project were made possible.

3. Design encouraged the strategic nucleus of the different agencies involved in the project, to generate vision; the vision of an artistic level knitting exhibition suitable for contemporary museums.

A different way to illustrate how *Knitted Lives* success could be described in terms of design and design management competencies, results if we re-think the classification of the twenty one characteristic variables of design management that Brigitte Borja de Mozota lists in her article "Design and Competitive Edge: a Model for Design Management Excellence in European SMEs" (2003, p. 95), at least ten out of the twenty one variables apply in the case of this social inclusion project. These are:

1. "Design creates a competitive advantage" (variable 1). *Knitted Lives* exhibition was very different and much better than other similar initiatives.
2. "Design is a core competency" (variable 2). These women developed and relied on artistic skills different from those they had before.
3. "Design contributes significantly to benefits perceived by the consumer" (variable 3). According to visitor feedback records, the exhibition was hugely appreciated by the audience.
4. "Design changes the spirit of the firm, which becomes more innovative" (variable 4). The three groups worked in an innovative way and produced innovative objects.
5. "Design improves coordination between marketing and R&D functions" (variable 8). The high quality of work made possible a greater advertising of the exhibition.
6. "Design is a knowhow that transforms the activity processes" (variable 9). The intervention of the artists and the existence of a clear vision had a direct impact in the way these women worked.
7. "Design gives access to a wide variety of markets" (variable 12). Apart from people interested in community work, the produced exhibition is suitable to general museum and gallery public.
8. "Design improves coordination between production and marketing" (variable 14). Design ensured high level of consistency between the exhibition and the catalogue produced.
9. "Design develops project management of innovation" (variable 15). The project was managed in an innovative way.
10. "Design creates a new market" (variable 16). Design as artistic quality of the artefacts, opened the way for similar exhibitions in other museums and galleries.

If we finally, draw some conclusions based on the three levels design model (artefacts, exhibition and service) that we described before, we could say the following:

Design of the service: The service is the broader level of design of the project that includes and underpins the other two (the exhibition and the creation of artefacts). At this level, the management required the coordination of a number of different agencies with different socio-cultural agendas. Each had to achieve its own objectives whilst these were subsumed within the overall policy, strategy and mission of the project. It required gathering and sharing of

information and communication among the various stakeholders. The success of the service was achieved by setting strategic goals and making management decisions to enable their achievement. One of these strategic decisions was creating a differentiation factor that will impact the experience of the women and the audience. As it was mentioned in "the aim" section, this derives from the search for **focus**, **quality**, **consistency** and **holistic** approach to the resulting **experience** of the actors.

In relation to design management competences at this level, we could give an example of consistency of the message of "quality" communicated at all stages of the process. How was this message passed to the women? Apart from the obvious direct communications of the project manager and the artist at the moment of creation of the artefacts, there were events and activities that played a powerful communicative role; involving the photographer or taking the knitters to the Shipley Art Gallery, that highlighted and made clear the professional standards that the organizers were trying to achieve.

Design of the exhibition: The management of the exhibition design needed to match the emotional and intellectual expectations of the audience with the emotional and social inclusion needs of the women participants. There was a need for orchestration of design ideas at both the project and outcome levels, prior to the exhibition, when the artefacts were discussed, and during the exhibition, when interactions between the audience and the participants were built in to a co-developed experience. Here the relatively new notion of exhibition design that we use, has to do with the overall experience of the audience and the women, and the possibility to be predetermined in a way, through various designed elements. These elements can be the spaces of the museum or the catalogue of the event that captured the women's stories, but also the way the process that led to this exhibition was undertaken.

Design of the artefacts: The management of the artefact design process focused on the planning, organising and control of the participants' work, in the form of budgets, know-how, and schedules. It also included the coordination of the production process with that of the museum's schedule of events. Design at this level also meant creating forms, using materials and determining the aesthetic value of the objects. The main interconnection of this level of design with the exhibition is the thematic focus. This was the result of the fact that, the objects were initially created and, later it was decided which and how will be combined to form an exhibition.

This project combines the integration of many interesting elements, such as social, art and community issues. In this paper we have used two different perspectives (Hetzel and Borja) and our own model, to describe how design could be managed in projects that aim to generate social value.

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PATTERN LANGUAGE FOR TOUCH POINT ECOSYSTEM: A POTENT FRAMEWORK FOR MULTIDISCIPLINARY DESIGN

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Patterns and Pattern Language can provide an effective framework to meet the challenges in designing the user interactions with a Touch Point Ecosystem that mediates a service provider-customer engagement. Such a pattern language being developed was subjected to verification in practitioner workshops. The results endorse that the proposed patterns address recurring problems and the solutions are correct. It was observed that professionals tend to think in terms of connected patterns, which supports the choice of Pattern Language as a framework. Its usefulness in individual as well multidisciplinary design activity was accepted as well. Differences between novice and experienced professionals in their understanding of the pattern language were uncovered, pointing to the need of a supportive aid, or tool.

Introduction

Ubiquitous spread of Internet, hardware, software technology and new paradigms such as online communities have spawned a multitude of touch points through which firms and customers interact with each other. The conceptualization of "touch point" construct has started acquiring a definitive shape only recently (Howard, 2007) (Merholz, 2009) (Sorsimo, 2009) (Khambete, Tripathi, & Athvankar, 2009) (Saïd Business School, 2008). Concurrently, overlaps among domains such as Service Design and User Experience Design are being recognized (Forlizzi, 2010). Several concepts that can inform User Experience and Service Design, and help identify opportunities for design interventions such as Service Systems (Morelli, 2003), Value co-creation (Vargo, Maglio, & Akaka, 2008) and Experience Networks (Prahalad & Ramaswamy, 2004) have been proposed as well. These developments indicate that creation of customer value through a superior experience requires team members

bringing in expertise from their own discipline, such as service management, service design, user experience design and technology, among others. Each discipline, however, has its own theoretical orientation, methodologies, terminology and practices which address a part of the problem space. A major challenge therefore is to establish a common ground and a coherent approach. It is easy to recognize the need of a framework that helps in harmonising contribution from various disciplines.

Aspects of Service Provider – Customer Engagement

A sustained customer – Service provider relationship lasts over a long period during which several encounters take place. The encounters are interactive episodes, which have context-specific elements (Sutton-Brady, Zhu, & Zolkiewski, 2008). The conventional service encounter construct seems to imply that it is contiguous in time and takes place via a single channel. This is no longer true with the advent of multi-channel service delivery. Further, advances in Information and Communications Technology (ICT), in particular Internet and mobile access have provided the customer a great freedom to consume service via a combination of modes.

Increasingly, a service encounter could span over a long period as well, comprising several non-contiguous "sub-encounters". For instance, the encounter "purchase of a book online" starts with the customer searching for the book and lasts till the book is physically received. There is an elapsed period between the online payment and receipt of the book, and at times even between selection of a book and purchase, if the customer defers the purchase, consigning the chosen book to the "Wish List". Several entities such as a web site, partner web sites, emails, text messages and the customer care assistants play a role in a delightful conclusion of the encounter. The impact of the duration of an encounter and interruptions has been studied in the service management context (Price, Arnauld, & Tierney, 1995) (Bolton & Bhattacharya, 2000) (Noone, Kimes, Mattila, & Wirtz, 2009). The temporal aspect in designing User Experience has been recognised as well (Borchers J. O., 2000), (Blackwell & Fincher, 2010)(.

In this scenario the construct of channel appears to be inadequate to fully address the needs of designing for user experience, and there is need of another construct: Touch Point (Khambete, Tripathi, & Athvankar, 2009). This is as well evident form the journey of the phrase touch point from being a colloquial term to a well-defined construct, as it is now used in service design.

There is a need to treat all the Touch Points that are deployed by a provider in engagement with the customer as interconnected entities or a Touch Point Ecosystem (TPES). The complexity of designing a Touch Point Ecosystem demands collaboration of multi-disciplinary teams. Such collaboration implies their ability to communicate effectively with each other, going beyond the orientation and terminology of each discipline. While extant knowledge and techniques such as Service Blueprinting (Shostack, 1987), Servicescapes

(Bitner, 1992) and several others are undoubtedly relevant, there is a need of a sharable framework. Pattern Language can be such a framework, which could address the challenge (Khambete, 2011).

Pattern Language for Touch Point Ecosystem Design

Pattern Language as an approach to design, was first advocated by Christopher Alexander. It was based on abstraction of insights from architectural designs that work in practice, and converting them to a linked collection of patterns that can inform design efforts in similar contexts (Alexander, The Timeless Way of Building, 1979) (Alexander, Ishikawa, Silverstein, Jecobson, Fiksdahl-King, & Angel, 1977). Each pattern description was well-structured, identified the conflicting forces at work in a recurring problem situation, provided a solution that resolves the conflict, and an explanation of how to apply the solution. The recommendations were sufficiently abstract to provide opportunity for several valid creative implementations. Each pattern was placed within a connected network of supportive patterns at higher and lower scale. Together the approach was similar to a language where a collection of words, with the help of grammar enable creation of an infinite number of coherent sentences. The combinatory, generative and evolutionary nature of Pattern Language as a design framework enjoys an enduring appeal till date and pattern languages have been proposed in wide ranging domains such as software engineering (Gamma, Helm, Johnson, & Vlissides, 1995), Interface Design (Tidwell, 2005), Interaction Design (Borchers J. , 2001), web sites (van Duyne, Landay, & Hong, 2003) (van Welie, 2010), communications (Schuler, 2008), for computer mediated collaboration (Schummer, 2003) and customer interactions (Rising, 2002)(Rising, 2002). Among the several benefits of Pattern Languages, its use as Lingua Franca for interdisciplinary teams, as well as a potent means to explore and develop workable design solutions in complex design contexts has been acknowledged by scholars (Erickson, 2000) (Erickson, 2000) (Bayle, et al., 1998), (van Welie & van der Veer, 2003).

There have been studies for empirically validating the benefits of using pattern language in the design process (Chung, Hong, Lin, Prabaker, Landay, & Liu, 2004), (Saponas, Prabaker, Abowd, & Landay, 2006) (Wania & Atwood, 2009). Their conclusions supported the usefulness of Pattern Language approach. It was found that pattern language helped novice designers and designers not familiar with the domain; was effective as a tool to communicate ideas among the team members; helped in the early stages of design, enabling designers to avoid pitfalls and eliminate irrelevant issues and served as a reference to get specific questions answered.

Patterns and pattern languages are powerful design tools since they are grounded in practice, outline solutions that work in the context of the design problem, yet allow creative freedom by not recommending a specific implementation. Further, they support piecemeal and evolutionary development of a comprehensive design solution helping to meet the challenges of designing complex systems. All of these factors make the Pattern Language framework suitable for the domain of Touch Point Ecosystem user experience.

A Pattern Language for Touch Point Ecosystem Design which is in an advanced stage of development is discussed here.

Pattern Language for Touch Point Ecosystem Design

The recommended process of "mining" for developing a pattern language (Salingaros, 2000), (Tidwell, 2005), (Märtin & Roski, 2007) was followed. Studies were conducted to conceptualise the relevant constructs and understand the behaviour of customers as they interact with Touch Points (Khambete & Athavankar, 2010), (Khambete, Tripathi, & Athvankar, 2009). A pre-pattern collection was created using both primary data such as interviews, case studies, as well as narrations of experiences of service encounters. The format of describing the patterns, which is crucial to a pattern language, was developed after evaluating several proposals; for instance, (Schummer, 2003), (Borchers J. , 2001), (van Welie, 2010), and (Tidwell, 2005) among others. A pattern language must incorporate an organizing principle, which helps in arriving at a set of patterns that should be used to design a comprehensive solution. Since a Touch Point ecosystem is a network, a hierarchical organizing principle did not seem appropriate. Hence, a matrix organizing principle has been proposed that places each pattern on two dimensions. The two axes of the matrix are: participating entities and the interaction space. Participant entities could be a single Touch Point, a few of them or the entire ecosystem. The interaction space may be related to a transaction, an encounter or the entire relationship. (Operational definitions of these constructs appear in Annexure A). It is expected that each patterns would predominantly fit into one cell (or occasionally, in a few cells). The position which pattern occupies provides a clue to the connections to the other relevant patterns and indicates the directions in which design efforts should proceed (Organising Principle Diagram in Annexure A). In practice, each member of a multi-disciplinary team addresses different parts of the problem space. The principle allows members of multidisciplinary teams to choose entry-points best suited to their expertise. It also allows addressing the problem space part by part, and to fully cover it progressively. The matrix organisation is expected to help in a comprehensive yet evolutionary design process.

The pattern language comprising 165 patterns (or pre-patterns) was created. An illustrative pattern appears in Annexure B.

Pattern Language Verification

Since patterns are rooted in practices that work, typically pattern languages are developed and validated via participation of practitioners (Pauwels, Hübscher, Bargas-Avila, & Opwis, 2010), (Borchers J. O., 2000) (Borchers J. O., 2000), (Chung, Hong, Lin, Prabaker, Landay, & Liu, 2004) ((Saponas, Prabaker, Abowd, & Landay, 2006). A similar approach was followed. Initially, the pattern language proposal was presented to the community of HCI practitioners and professionals (Khambete, 2011). This was followed by a formative study

comprising a series of practitioner workshops for verification of several aspects of the Pattern Language. The details of the workshops and insights from the exercise are discussed below.

Workshop Objectives

The objectives of the workshop were to verify that:

a. The pattern addressed a recurrent problem in the service provider - customer relationship
b. The forces underlying the problem situation were captured correctly
c. The solution presented was correct for individual disciplines as well as for multi-disciplinary teams
d. The articulation of the problem, solution, examples and other details was clear

The intent was to obtain insights, rather than perform quantitative analysis.

Methodology

The workshops were held in groups of 4 to 15 volunteer practitioners, recruited through contacts within their organizations. Together 39 practitioners participated (excluding the eight participants in the pilot workshops). They were mainly professional connected with user experience design. About 25% were business analysts, technology managers and business executives. However, all of them were themselves customers of various services. As such, they were in a position to draw on their own experiences of service encounters. It was ensured that the participants had experience of multidisciplinary work, and at least some exposure to other aspects of Touch Point design beyond their domain of expertise. They had at least a degree of familiarity with business domains such as telecommunications, banking & finance, healthcare and engineering.

Since no participant had significant exposure to any pattern language, sessions were conducted to familiarise them with the pattern language approach and about the Touch Point Ecosystem Pattern Language (presentations are available at: https://sites.google.com/site/tpespatternlanguage/ready-reference). Considering that response to each pattern was expected to take about 20 minutes, it was not practical to obtain feedback on all the patterns. Therefore, 10 patterns were selected randomly from the 165 patterns comprising the language (Annexure A) for the feedback. An identical questionnaire was appended to each pattern. Considering the need of about four hours to give feedback, the participants were given the freedom to respond over one week.

A web based questionnaire (https://sites.google.com/site/tpespatternlanguage/launch-the-survey) was created and tested in a pilot workshop with eight practitioners, followed by one on one interviews. The findings were:

a. The participants found the approach useful for design
b. Overall they found articulation of the problem, solution, the forces sufficiently clear, and the examples adequate

c. Reading individual patterns gave a good deal of understanding. However, together they clarified each other better.
d. While detailed feedback on each aspect was sought, the participants tended to take a holistic view. Therefore, even if they disagreed with, for example, that all the forces were present in the problem situation, they still felt the overall pattern was correct.

Certain difficulties the participants faced were noted. They wanted to go back and forth while answering the questions, referring to other patterns as well to clarify the ideas. The web based survey made this difficult. They took between half to three quarters of an hour for feedback on each pattern which was significantly more than the expected twenty minutes, much more than what the working professionals could spare. Accordingly, the next questionnaire had lesser number of questions (12). Examples of the pattern from the participants' experiences, and overall comments as well were sough. The participants from the pilot workshop reviewed the new questionnaire and agreed that it would be suitable. A paper based survey instrument was used to facilitate ease in referring to several patterns at once. The workshops were carried out in a single session of about four hours.

Findings and Insights

There was significant agreement about several key aspects (Fig. 1 to 4):

a. The patterns addressed recurrent problems and provided correct design solutions
b. The patterns will help them in designing if they encounter similar problem
c. The patterns will help multidisciplinary teams in design efforts and as common reference

Aggregate Response for All patterns

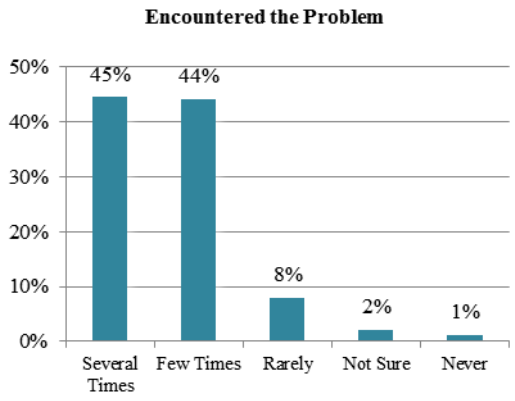

Fig. 1

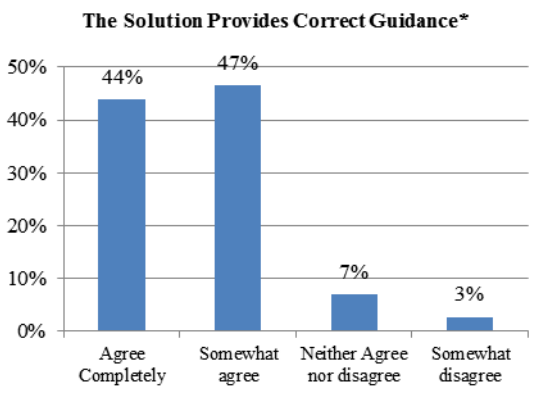

Fig. 2

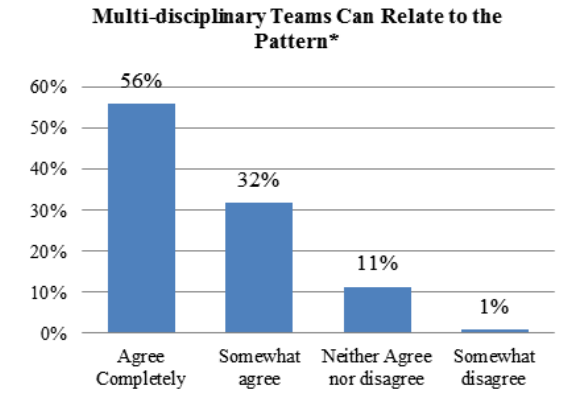

Fig. 3

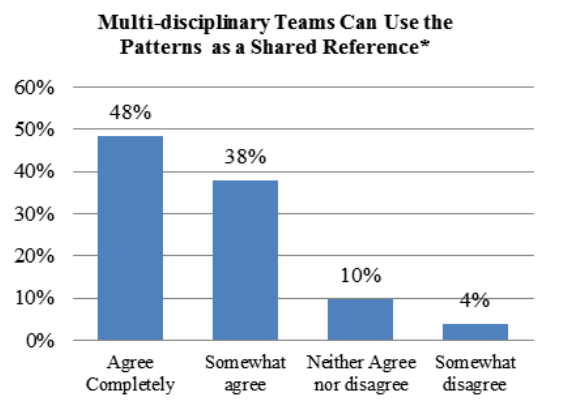

Fig 4

* No respondents said "Completely Disagree". Total exceed 100% in Figure 2 due to rounding off error

Apparently the appreciation of the utility of the patterns is higher as the professional grows in experience. To illustrate:

Table 1: Comparison of Responses between Experienced and "Novice" Respondents

Question	Agree Completely		Neither Agree nor disagree	
	>10 Years	<=5 Years	>10 Years	<=5 Years
Pattern will help in arriving at a solution	55%	40%	5%	4%
Pattern helps in arriving at a complete solution	45%	35%	3%	19%
Multidisciplinary teams can relate to the pattern	62%	49%	5%	14%
Multidisciplinary teams can use it as shared reference	61%	35%	3%	23%

Being able to give own examples of the patterns and offer comments can be considered as an indication that the respondent has understood the pattern. In this regard as well, only 14% of respondents below the age of 25 offered more than one example or comment, against 69% of those above 25.

It appears that repertoire of workable patterns tacitly held by the professionals grows with the experience in the practiced discipline. They were therefore able to relate to the patterns presented for feedback, and draw on their longer experience as customer of a range of services resulting in a greater understanding of TPES Pattern Language. It seems, therefore that novice designers would benefit if they are provided support in understanding and using the pattern language. Apart from instruction, an aid, possibly a software tool, which can help in in their design efforts may be a practical option.

In terms of the form of writing the patterns and articulation, there was significant agreement that the patterns conveyed the substance (Fig.5), which was corroborated during post workshop discussions as well. There were few valid suggestions to change the articulation to convey the correct intent. For example, some participants initially interpreted the phrase "Solution" as "the solution", whereas the intent is to provide "guidance".

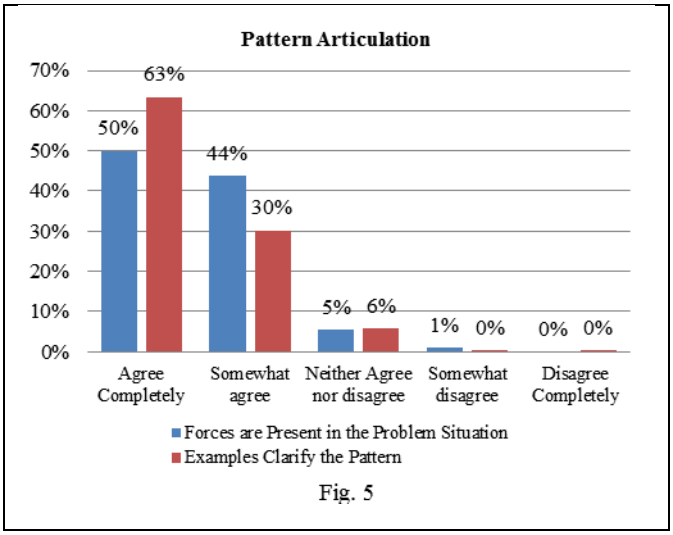

Fig. 5

The post-workshop discussions with the participants confirmed the insight from pilot workshops that juxtaposition of several patterns helps to understand individual patterns better. The pattern descriptions which the participants used did not indicate the connected patterns, apart from occasional references to a few of them. Yet, several examples and comments from the participants suggested that they visualised the need of other connected patterns, including ones not appearing in the set given to them, for effective implementation of the pattern under consideration. Together these findings indicated that the participants though in terms of connected patterns, thus supporting the rationale of building a Pattern Language. A couple of illustrative comments (the connected patterns already proposed in the language in parentheses):

- For the pattern UNOBTRUSIVE WATCHFULNESS (70): "(A related pattern) could be 'Supportive Intervention' … not covered in this survey" (SUPPORTIVE INTERVENTION).
- For the pattern TOUCH POINT AT THE HUB (165): "I was booking airline tickets online on XXX.com, and was towards the end of the journey (payment made). But before receiving confirmation, there was a problem somewhere and my journey got terminated. I had other important work to do, and did not have time to contact XXX, so I decided to check on that later. But after 15 minutes, I received a call on my mobile from them, and they completed the journey for me (SMOOTH TOUCH POINT HANDOVER). There was no 'handover' but somehow the Touch Point (call center) continued, and helped me out" (RECOVERY FROM UNCONTROLLABLE DISRUPTIONS, SYSTEM INTELLIGENCE).

Certain interesting examples given by the participants indicated the wide range of service situations where the Touch Point Ecosystem approach and the pattern language could be fruitfully applied. For instance:

- CUSTOMER BEHAVIOUR GUIDED SUBTLY (150): Donation boxes kept near temple idols (The context: In India, temples are managed by trusts which derive their income mainly from the devotees' donations. They could therefore be considered as a "service" organisation! Many such trusts as well run conventional service organisations such as hospitals and schools established using the temple income).
- TECHNOLOGY REVEALED TO BUILD CONFIDENCE (158): Video scenes display all safety features to those waiting in in queues of scary roller coaster rides.

It conclusion, there appeared to be a significant agreement that:

- The patterns addressed recurring problems related to service encounters
- The solutions proposed were appropriate
- The pattern language under development would be useful in their individual design efforts, as well as to the members of multi-disciplinary design teams

The implications of the insights on the refinement of the language and other possible directions for developing it as a potent tool are discussed in the next section.

Discussion

Probably the most significant insight is that the users of the pattern language sought connected patterns when they considered a problem situation. Clearly, there is a need to provide novice as well as experienced practitioners, an easy way to see the connected patterns, and be able to select a set for arriving at a design solution. It is planned therefore to develop a software tool which can be used during design.

The key contribution of the pattern language is to help practitioners in a comprehensive manner to address the problem space in service design and management. The overall utility, was reasonably confirmed in this study. Some aspects of the TPES Pattern Language such as the form of writing the patterns and articulation were acceptable as well. These inputs are helpful in refining the language.

Most of the real life projects in service design are about “redesigning”. In practice, the entry point in the problem space can be either a Touch Point and a specific transaction, or a set of Touch Points that are involved in an encounter. The organising principle used in the TPES pattern language allows the practitioner to identify just a few appropriate patterns related to any one aspect of the problem, and then progressively incorporate the connected patterns across the entire problem space. The ability of the organising principle to facilitate this will be verified in the future studies. The pattern description includes guidance for designing the supporting IT systems and business processes, which are invariably essential for functioning of Touch Points. This is likely to enhance the ability to implement the patterns well. This would be verified as well.

The pattern language is expected to help practitioners in arriving at a comprehensive solution, in lesser time than otherwise. It is also expected to help in multi-disciplinary team activity. It can as well be used a tool to evaluate existing as well as evolving solutions. While supportive indications have been obtained, the next stage of work would be aimed at validating these claims. Another set of practitioner workshops are planned, in which multidisciplinary teams will use the pattern language in designing solutions for real life problems.

It is hoped that the pattern language once ready, will be a significant addition to the repertoire of the frameworks and techniques available to the design community.

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Annexure A

For the purpose of this discussion the following definition of the phrase Touch Point (written this way in this paper) has been used (Khambete, Tripathi, & Athvankar, 2009):

a. An entity with which a User interacts to perform a transaction aimed at achieving a goal,
b. OR an entity that plays a mediating role while a User performs a transaction aimed at achieving a goal
c. The Provider has control on the presence and behaviour of a Touch Point

- Transaction: involves an interaction that lasts for a short duration and a sub-goal is achieved at the end of it. It involves a single Touch Point.

- Encounter: Interaction that comprises several transactions, even interspaced in time, which together enable the user to accomplish the goal composed of sub-goals. It may require interaction with several Touch Points.
- Relationship: Several encounters take place in the tenure of the relationship between a customer and a provider.

Keeping this complexity in mind, a matrix organizing principle is proposed. The two axes of the matrix are: participating entities and the interaction space. Participant entities could be a single Touch Point, a few of them or the entire ecosystem. The interaction space may be related to a transaction, an encounter or the entire relationship. It is expected that each of the emerging patterns would predominantly fit into one cell.

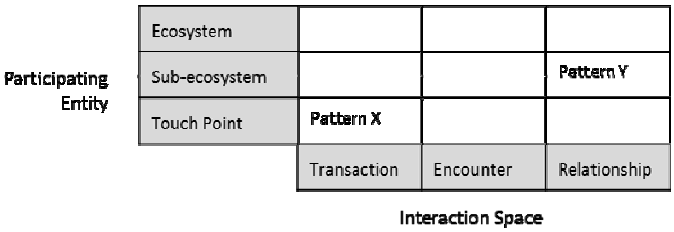

Figure 1: Organizing Principle

Annexure B

The following ten patterns were used for the practitioner feedback. Key details of the patterns are available at https://sites.google.com/site/tpespatternlanguage/home.

TOUCH POINT PRESENCE IS NOTICEABLE (23), CUSTOMER AND TOUCH POINT ARE COLLABORATORS (64), CUSTOMER BEHAVIOUR GUIDED SUBTLY (150), SHORT FEEDBACK AFTER ENCOUNTER (21), ENCOUNTER COMPLETED IN DISCRETE SESSIONS (29), UNOBTRUSIVE WATCHFULNESS (70), TOUCH POINT AT THE HUB (165), TOUCH POINT CREATED ON THE FLY (105), ASSURING DISPLAY OF TECHNOLOGY (158), IMPLICIT PROMISES HANDLED WELL (17)

The full description as it appeared in the survey (Illustrative):

Pattern Name: UNOBTRUSIVE WATCHFULNESS (70)

Problem Statement

When a user is engaged in a self-service encounter, he may get confused or lost. This can happen in spite of correct application of the user interactions principles like error prevention, error recovery, feedback etc. Self-service and technology based Touch Points are convenient, and can give the customer a sense of control. However, customers may have varying abilities and inclinations to use them. While they attempt to use them, it is likely that they may run into difficulties and need assistance. They may even abandon the use of a self-service Touch Point, and lose the benefits such as convenience and choice. At the time of the encounter, confused customers may block resources for which others are waiting as well. In a different context, certain kinds of services are necessarily enjoyable if the customer is on his own (e.g.

having a family meal in a restaurant, playing a game in an arcade). Customer's service experience can however be enriched if he receives assistance from someone (e.g. a customer does not know how to use the controls of a game machine in an arcade). The customer may not be aware of this, or may feel shy to ask for assistance. This is quite likely if the customer is in a public place. At the same time, they do not like forceful intrusion as well, apprehending curtailment of freedom or loss of privacy.

The solution to solve the problem:

Monitor unobtrusively the actions and states of a customer as an encounter progresses. Care should be taken to ensure that the customer does not feel intrusion in privacy and discomfort (e.g. customer noticing that he is being watched). This should not diminish the customer's sense of freedom either (e.g. a shop assistant offering help too early when a customer starts exploring the displayed goods). Monitor their interactions with the Touch Point. This can be done by suitable design of the Touch Point, use of technology, or with the help of another Touch Point in the Touch Point Ecosystem. The back end systems should provide the requisite support. However, the act of monitoring should follow social and legal norms. In case of encounters mediated by a human Touch Point, the individual should be trained and able to do so. The monitoring should be done intelligently, so that it should be possible to trigger SUPPORTIVE INTERVENTION at the right time, if needed.

The situation makes following conflicting demands (forces) either on the customer or the provider:

a. Customer: Lack of knowledge and skills, Attitudinal constraints in seeking help, Desire of privacy
b. Provider: Desire to progress the encounter, Adherence to social norms and legal requirements, Cost and Efficiency consideration

The examples of the pattern implementation:

a. In shops with open displays the sales persons monitor the user exploring the displayed goods. If the user seems to be taking lot of time in selection, they politely intervene to offer help. However, they do not force the help.
b. In restaurants, the waiters unobtrusively observe the progress of meals to sense if they need anything (e.g. they need another helping), and intervene politely.
c. Google mail: Monitors to whom the person is writing mail. Suggests other names that can be added with a single click.

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The Emperor's New Clothes or The Magic Wand? The Past, Present and Future of Design Thinking

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Design thinking is a discourse that – at least within its managerial realm - has been described as *the* best way to innovate, and a saviour of the economy! The claim suggests a magic wand; but maybe this is a situation of the Emperor's new clothes – instead of being everything, it may become nothing. We do not assume this will happen; instead we relate the design thinking managerial discourse to the discourse of design thinking within the design research area. We observe that the managerial discourse has a surface and popular character and is less academically anchored than the designerly one. Also, the managerial discourse seldom refers to the designerly one and thereby hinders cumulative knowledge construction, and this makes it easy to criticize from an academic perspective. We find five different discourses of "designerly thinking" or ways of making sense of what designers do in practice that have distinctly different epistemological roots. These different discourses do not stand in competition with each other but could be developed in parallel.

INTRODUCTION

"Design thinking" has an extensive literature in books, journals, and the news media. Recently the popular press and semi-academic literature has displayed a zeal for the concept as if "design thinking" will save the US economy, if not the world! Design thinking is often likened to a magic wand – a mysterious process that once applied, becomes a catalyst for growth. Turning to the academic literature for a more reasoned treatment, we find, to our surprise, there is no sustained development of the concept. And even though there must be some relationships between the academic discourses of design(erly) thinking and the

management discourse based on the same concepts, there are seldom references linking the two. It is as if design theorists such as Richard Buchanan (1992) and management writers such as Roger Martin (2009) coined the label of "design thinking" to describe the thought processes of designing completely independently of each other. This might be possible, but is hardly plausible.

It is therefore easy for the discourse to turn into what we metaphorically call "the Emperor's new clothes," thereby implying that design thinking is "nothing", or at least not an enduring concept to be used in academia or the management world. This path seems even more certain since some of the more prominent prophets of design thinking have renounced the concept – like Professor Bruce Nussbaum of Parsons The New School of Design, formerly associate editor at *BusinessWeek*, who has turned away in favour of "creative intelligence" (Nussbaum 2011), Professor Fred Collopy of Case Western Reserve University, who has become increasingly "bothered" by the term (Collopy 2009), and Dean Roger Martin, Rotman School of Management, University of Toronto, who continues to explore different varieties of executive thinking. Continuing in this way, however, would be to make a messy situation too easy; instead, we propose stepping back and surveying the field to see what the more serious academia has to offer.

The paper is structured as follows: First we discuss the demographics of the discourse, how it has grown and what types of literature have been published, followed by a description and characteristics of the two main discourses, the designerly and the managerial discourses of design thinking. We then identify five distinct sub-discourses of the designerly thinking discourse, and two perspectives that shed some light on the growth of the managerial fad discourse. Finally we draw our conclusions about the emperor's new clothes and the magic wand.

THE DEMOGRAPHICS OF THE LITERATURE

Identifying the populations

The literature base[1] consists of almost 200 items, where more than 80% are from this side of the millennium. It includes books (38), academic refereed papers (12) and journal articles (56) professional papers (19), magazines & newspapers (35) and web sites (18). The numbers gradually increase by years, from Simon's (1969) foundational work about the nature of design, with design theorists' publications beginning in the 1980s, becoming more numerous

[1] Our initial scoping search, using academic electronic databases, book publishers' lists and informal methods such as Google Scholar, was intended to cast light on the structure and different streams in the overall discourse. Afterwards we refined the list by selecting books and articles published academic and practitioner journal articles, and conference papers available in the public domain that included "design thinking" in the title, abstract or keywords, and books that were referenced frequently as references in the scholarly papers. The literature base was further refined as we read the articles and books; some were eliminated as not directly related to our interests and others were added from the reference lists of relevant works.

around 1999, and reaching a high point in 2009. Management scholars first showed an interest in links between business and design in the mid-1980s, followed by scholars in other areas. The subject gathered popular media attention starting around 2004 and peaked in 2009. The development of the broad field is shown in Figure 1, Timeline of publications by type. Here the literature is divided into three genres: (1) books (black column) (2) substantial articles in scholarly (peer-reviewed) and respected practitioner journals (dark grey column), and (3) short pieces in the business press and online media (light grey column).

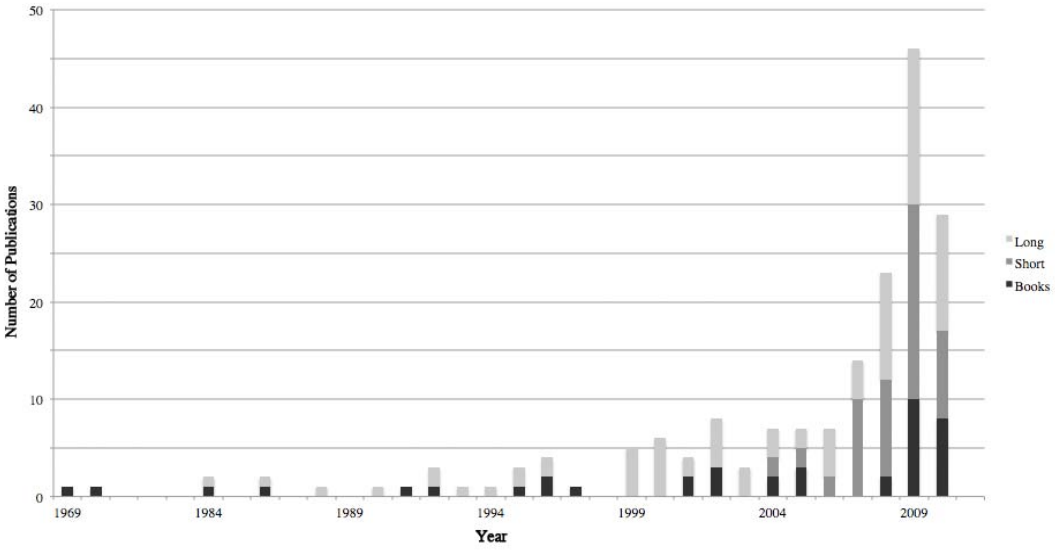

Figure 1. Timeline of publications by type

Books provide an elaborated argument, and an opportunity for the author to demonstrate proficiency in the field. Some books are theory driven (e.g., Simon 1969); the early books tend to be of this nature due to the publication norms of the field at the time. Other books allow the author to present cases and examples that elaborate and develop theory (e.g., Rowe 1987), while others are "recipe books" or "how to do design thinking" for practitioners (e.g., Liedtka & Ogilvie 2011) or textbooks for students (e.g., Ambrose & Harris 2010). Such books have simplified arguments, little or no theory development for practitioners or a review of theories for students, and diagrams, checklists, pictures or vignettes to reinforce the author's point. Most of the recent books are of this nature.

Articles in scholarly journals and respected practitioner journals are the foundational ground for any subject. In total we located 48 relevant articles, excluding those with an engineering focus because as scholars in "design management" we were unprepared to evaluate them appropriately. Not surprisingly, most of the articles developing theory on design thinking were in design journals, in particular UK-based *Design Studies* and US-based *Design Issues*. Some scholarly management journals included conceptual articles related to design thinking, while many practitioner journal articles tended to be explanations or case studies of

successful practice. The *Harvard Business Review* and the *Design Management Review* deserve special mention: the former for its prestige among US executive and managers, and the latter for its long-standing focus on "demonstrating the strategic role of design in business" (www.dmi.org). Finally, a few scholarly conference papers were included in our review to gauge trends in theory development; here our selection forms a convenient sample.

Using the "trade" and "popular" literature, culled from magazines, the business press, and reputable online sources, is controversial as part of an academic literature review. We included these sources to gain a sense of the scope and timing of interest in the topic outside of academe and professional practice. Determining the total number of contributions in these areas is impossible, but the overall trend-line is revealing. The news media comments on changes in firm strategy or personnel (e.g., Birchall 2008): here the same event is likely to be taken up across several publications effectively "promoting" the use of design thinking in context. Magazines include interviews with "experts" on the topic (e.g., Tischler 2009), here the interviewee is "newsworthy" in some way or other, effectively establishing expertise in the field. Finally, many publications support regular blogs by subject matter experts (for example, Bruce Nussbaum at *BusinessWeek*, or Fred Collopy at *Fast Company*): this is the space where opinions are stated and viral news begins, such as the "hot news" that "design thinking is dead!"

THE NATURE OF THE TWO DISCOURSES: DESIGNERLY THINKING AND DESIGN THINKING

A simple way of discussing the discourse of design thinking is as two distinct discourses:

- One is what we call "designerly thinking". With this we mean the academic construction of the professional designer's practice (practical skills & competence) and theoretical reflections around how to interpret and characterize this nonverbal competence of the designers.
- The other discourse is "design thinking". We reserve this term for the discourse where the design practice and competence reflected upon above is used beyond the pure design context, for and with people without a scholarly background in design, particularly in management. "Design thinking" therefore by necessity becomes somewhat of a popularized version of "designerly thinking".

The academic discourses of designerly thinking

Design thinking might seem like a new fad (or temporally intensive management discourse)[2] from this side of the millennium, but within design research the characteristics of designers' work and practice has been discussed for at least 40 years, and the managerial discourse of

2 For a discussion on the development of fads and hype, see Johansson and Woodilla, 2010.

design thinking within the last decade is only slightly related to the designerly discourse. The designerly part of the discourse forms an academic stream, with contributions from both designers and other related disciplines (like architecture, planning, design history etc). The aim has been purely academic, either understanding for its own sake or for communicating such understanding to students. The consultancy genre that is typical of the managerial discourse is generally absent and normative elements are much more rare. The writing style with excessive praise found in the managerial discourse is absent.

Theoretical perspectives can be categorized into five sub-discourses with the foundational work(s) within parenthesis:

1. Design and designerly thinking as the ***creation*** of artifacts. (Simon1969/1996)
2. Design and designerly erly thinking as a ***reflexive practice***. (Schön 1983)
3. Design and designerly thinking as a ***problem solving activity***. (Buchanan 1992)
4. Design and designerly thinking as a ***way of reasoning/making sense of things***. (Lawson 2006/1980, Cross 2006, 2011)
5. Design and designerly thinking as ***creation of meaning*** (Krippendorff 2006)

1. Design and designerly thinking as the creation of artifacts (Simon 1969)

Simon (1916-2001), winner of the 1978 Nobel Prize in Economics for his critique of the optimizing model of rational decision-making and its replacement with the concept of bounded rationality, earned an international reputation as one of the founders of artificial intelligence. His research extended from computer science to cognitive psychology, business administration and economics, with design becoming a great interest in his later years. With "design" Simon understood all conscious activities to create artifacts, thereby differentiated it from natural science, social science, and humanities – but not from engineering. His main concern was about research – what constitutes the character of design research? His point of departure was like this: Design is about creation while other sciences deal with what already exists. What then is research about creation? His seminal work *The Sciences of the Artificial* is an answer to that question - and a legitimization of an experimental approach to design research in academia.

As far as we know, Simon himself never used the term "design thinking". However, with his cognitive approach to decision-making and with his often-mentioned definition of design as "the transformation of existing conditions into preferred ones" (Simon 1969: 4), he is a reference point for the academic writings about design and design thinking. He is almost a foundational father of design research in the way Taylor was for management research.

What is striking about Simon's view of "design thinking" is that he distinguished between activities that create something new and activities that deal with existing reality, but not between artistic creation and engineering. The difference between designers' and engineers' ways of thinking – something that in practice is very much noticed and problematized – therefore became a non-issue for Simon.

Another issue is Simon's epistemological platform. He was critical of positivistic approaches both in economics and in design. However, at the same time, he created his argument within a neopositivistic and rationalistic realm, in order to have the positivists understand that their arguments were incorrect. Maybe it is not surprising that the neo Simon movement (cf., Hatchuel 2002, Hatchuel & Weill, 2003) originated in engineering schools rather than from design management or design.

2. Design and designerly thinking as a reflexive practice.

Schön (1930-1997) was originally a philosopher with pragmatism as his theoretical frame of reference. He first focused on the logics of inventions and later, with Argyris, turned to organizational learning. The last 20 years of his life were devoted to practice theory. In *The Reflective Practitioner* Schön (1983) challenged both researchers and practitioners to reconsider the role of technical knowledge versus "artistry" in developing professional excellence. The book can be read in many ways, such as from an organizational competence perspective or from a practice perspective. From a design thinking perspective it is a critique of Simon's cognitive perspective. At a time where there was a big division made between positivism and hermeneutics, Simon, with his analytical reasoning, was close to positivism while Schön, with his philosophical pragmatism, was close to hermeneutics. In contrast to Simon, Schön constructed a picture of the designer where he took a practice-based focus on the relation between creation and reflection-upon-the-creation that allows for constantly improved competence and re-creation. Such reflection, that Schön found in the work of both architects and psychoanalysts, became understood as the core of design work. This reflection was not something that was separated from the practice as such, but rather was understood as part of the practice.

Schön also considered management practice, and noted that managers are well aware of the important areas of practice that fall outside of technical rationality. While managers deal with decision under uncertainty through intuition, they build up an essentially unanalyzable capacity for problem solving through long and varied practice rather than through studying theory or techniques. Managers reflect-in-action, but they seldom reflect on their reflection-in-action.

Differences between Simon and Schön's views of design have been discussed frequently (cf., Dorst 1997). In our view, Simon created an objective framework for the field of design, while Schön fleshed it out with descriptions of designers in practice. Their writings, therefore, belong to quite different worlds from epistemological point of view.

3. Design and designerly thinking as a problem solving activity.

Buchanan's (1992) article about "wicked problems" in design has become a foundational reference not only for the discourse about design thinking, but also for the whole design area. Buchanan presented designers' professional way of thinking as a matter of dealing with wicked problems, a class of social systems problems with a fundamental indeterminacy without a single solution and where much creativity is needed to find solutions.

Buchanan is the first to really take a designerly perspective on design thinking. He builds on Rittel and Weber[3] (1973) who 19 years earlier developed the wicked problem approach as an alternative to the step-by-step model of the design process, with its two distinct phases: an analytic step of *problem definition,* followed by a synthetic sequence of *problem solution.* Buchanan introduced the concept of placements as tools that allow the designer to position and reposition the problems and issues at hand. Placements are the tools by which the designer intuitively or deliberately shapes a design situation, identifying the views of all the participants, the issues that concern them, and the intervention that will serve as a working hypothesis for exploration and development. As Wylant (2010) notes, design thinking is the discipline of cycling through many contextual exercises of placements to understand "how sense can be made of something and given this, the designer is then in a position to choose which contexts should dominate and the manner in which they should". The notion of placements in response to worked problems dissolves the boundaries between modernist and postmodernist design thinking.

Buchanan takes a process perspective on design and designers' way of thinking. He is concerned about gaining a deeper understanding of design thinking so there can be communication among all participants engaged in the process of design, and in particular to understand the foundations and value of design thinking in an increasingly complex technological culture. He suggests four distinct areas of design thinking, as places of interventions where problems and solutions could be reconsidered. (1) Symbolic and visual communications (or graphic design), (2) material objects (or industrial design), (3) activities and organizational services (or service design), (4) complex systems or environments for living, working, playing, and learning (or interaction design).

4. Design and designerly thinking as a practice based activity and way of making sense of things.

Lawson and Cross, who both have foundational training in architecture, each described and reflected on practical cases of designers thinking and working. Their interests spanned many years: Lawson's book, *How designers think: The design process demystified*, has had four revisions since 1980, and Cross' research included design thinking workshops at Delft University of Technology in 1991, continued with a series of articles on "designerly ways of knowing" (see Cross 2006) and, recently, his book *Design thinking* (2011). Cross works from ethnographic research to reveal what designers do during the activity of designing, while Lawson draws on the psychology of creative design processes to turn his research knowledge into forms designers can use.

Lawson and Cross might be seen as part of the reflexive tradition started by Schön. However their texts are within a different discourse: they are practice-based through presenting

[3] Rittel attributes the phrase "wicked problems" to philosopher Karl Popper. See also Churchman, 1967.

examples rather than a philosophical perspective. Both Lawson and Cross appear to use abductive processes to make sense of and generalize from observations, and hence find patterns that are grounded in practical experience and can be described through practical examples. Ultimately each scholar suggests a "model" of the design process: Lawson in a number of process-driven steps that attempt to describe the complex processes of designing (2005: 289-301), and Cross in a recursive representation of the design strategy followed by creative designers (2011: 78).

5. Design and designerly thinking as creation of meaning (rather than artifacts)

Krippendorff (2006), starting from a philosophical and semantic background, defined design and designers' work as a matter of creating meaning (rather than artifacts as in Simon's notion). Compared with Simon one could say that Krippendorff reversed the relation between the design object and its intention. For Simon the artifact is at the core, and he would probably say that meaning is an attribute, while meaning for Krippendorff is the core of the design process and the artifact becomes a medium for communicating these meanings.

Krippendorff is concerned with the textual and intertextual matter of discourse "the artifacts it constructs and leaves behind...(and) the connections created between these artifacts" (2006: 23-24). Design thinking concerns him only as articulated by designers, that is, when it creates a text that becomes part of the discourse of the design community. "The primary aim of a discourse is to stay viable … to be kept alive within a community of its practitioners ...(and) to justify its identity to outsiders" (2006: 24).

Unlike Simon's "design science" (an explicitly organized, rational and wholly systematic approach to design, not just the utilization of scientific knowledge of artifacts, but design in some sense a scientific activity in itself), or Cross' "science of design" (with accurate representations of design practices, designers, institutions of design, aesthetic conventions or history of particular designs), the semantic turn leads to Krippendorff's "science for design", as "a systematic collection of accounts of successful design practices, design methods, and their lessons, however abstract, codified or theorized, whose continuous rearticulation and evaluation within the design community amounts to a self-reflective reproduction of the design profession." (2005: 209)

Verganti (2009) extended Krippendorff's work to innovation processes, arguing that innovation in meaning often is as important as technological innovations that are mostly related to the concept of innovation. One of his examples is Alessi´s kitchenware that gives radical new meanings to commonplace objects like a corkscrew and a lemon squeezer. Before they were designed, the company had an extensive collaboration with a psychologist, and the way the objects look -- as stylized products rather than mundane tools – was based on frame theories of boundary objects that individuals are especially attached to (Verganti 2005: 40-43). Alessi products are instantly recognizable and have been a commercial success. Nintendo's Wii is another example of a product that could not have been conceived by video game players before its appearance in the market, yet the console was a radical innovation in

meaning, from an entertainment gadget for children to active physical entertainment, in the real world, through socialization (Verganti 2005: 4-6). In other innovation research, design students have radically changed meanings of gender conveyed through chairs or objects to sit on (Janhke & Hansson 2010).

Comparison among the five discourses of designerly thinking

The five discourses of designerly ways of thinking can be compared as follows[4]:

Founder	Background	Epistemology	Core Concept
Simon	Economics & political science	Rationalism	The science of the artificial
Schön	Philosophy & music	Pragmatism	Reflection in action
Buchanan	Art history	Postmodernism	Wicked problems
Lawson & Cross	Design & architecture	Practice perspective	Design(erly) thinking
Krippendorff	Philosophy & semantics	Hermeneutics	Creating meaning

In general within research into design, there has been a move towards hermeneutics and practice perspective, and there seems to be a growing reluctance of design scholars to isolate "designerly thinking" from the design practice process as a whole.

The managerial discourse of design thinking: Academic, practitioner and popular

We have identified three different origins in this discourse :

- One emanated from IDEO and Tom Kelley's (2001, 2005) two books "opening up" the San Francisco design consultancy, with stories of innovative practice, followed by CEO Tim Brown's (2008) generalization and naming the process as "Design Thinking" in a *Harvard Business Review* article.
- The second emerged from management strategy consultant Roger Martin's long-time interest in the cognitive processes of successful executives, and the need for more than analytical thinking. Working with IDEO led Martin to use the concept of design thinking to reconceptualize his earlier models (Martin 2009), and promote teaching design thinking to management students (Dunne & Martin 2006). Martin's model of mysteries becoming heuristics and then algorithms through the "knowledge funnel", and the need to use both right and left halves of the brain have gained widespread acceptance with practicing managers curious about design thinking.

4 For an alternative historical view of design thinking in terms of "Models of Man" see Bousbaci, 2008.

- The third origin can be traced to a book written by a group of international management scholars gathered in 2002 to celebrate the opening of the Gehry-designed building for the Weatherhead School of Business at Case Western Reserve University. The theme of the book was "Managing as Designing" (Boland & Collopy 2004), and while it nominally focused on "the design attitude", individual chapters link to issues of the intersections of design, organizations, and managing, including "design thinking" (Lietka 2004).

Literature within this managerial realm of design thinking is broad. Topics cover a wide range as management researchers, intrigued by the concept of "thinking about design", found ways to integrate it into their own area of interest (cf., Lockwood 2010). Examples include connections with strategy, (e.g., Fraser 2007, Holloway 2009), innovation (see below), organizational processes such as change and development (e.g., Sato et al. 2010), and social innovation in non-profits (Brown & Wyatt 2010). Design thinking is promoted as a useful process in different disciplines, often using quotes from Roger Martin, for example, in education (Norman 2000), library administration (Bell, 2008), in hospitals (Uehira 2009), legal practice management (Szabo 2010), HR (Birchall-Spencer 2010).

Following a recent literature review, Hassi and Laakso (2011) concluded that the concept of design thinking in the managerial discourse consists of a set of practices (human-centered approach, thinking by doing, visualizing, combination of divergent and convergent approaches, collaborative work style), cognitive approaches (abductive reasoning, reflective framing, holistic view, integrative thinking), and mindset (experimental and explorative, ambiguity tolerant, optimistic, future-oriented): together, these characteristics form elements of design thinking. Such characteristics have been developed piecemeal, yet there is a sense that by using in-depth ethnographic studies and an analysis framework based on the work of Lawson and Cross, it may be possible to develop a more scholarly approach to the discourse of managerial design thinking.

The growth of "design thinking" the last decade

Looking for what characterizes the "design thinking" discourse and its growth over the last decade, we suggest there are two perspectives that capture the importance of the discourse and explain why it has become such a fad. The first is the relation between design and the innovation area and the second is the relation between design and the managerial discourse in general and how they have interacted with each other the last three decades.

Design thinking: Design enters the innovation area

Around the millennium, "innovation" became a hot area for many reasons. During the 1980s and 1990s, the discourse of strategy had been a significant area in both academia and practice, with Porter's prescriptive theories of competitive advantage as the leading authority. But, with the new millennium, there was a need for something that could catch the more chaotic and unforeseen aspects of business. Rather than competing within the existing industry or trying to steal customers from rivals in the "red ocean", a company can create an

uncontested market space that makes competition irrelevant; this is a "blue ocean" (Chan & Mauborgne 2004, 2005), and the discourse is concerned with *creating strategic moves*, as managerial actions and decisions, rather than analyzing the companies position in relation to competitors or rivals. Design as a strategic tool was first mentioned in 1984 (Kotler & Rath 1984) and was the subject for one of the first academic PhD dissertations in design management within a management department 10 years later (Svengren 1995), but it was not until the blue ocean concept another 10 years later that there was any sustained discussion (cf., Fraser 2007, Junginger 2007, Martin 2007) with wicked problems (Camilius 2008) and design thinking (Brown 2009, Holloway 2009) joining soon after.

The academic innovation area, however, was far from the creative discourse that an outsider would expect. Instead, with an anchor within engineering, it was much occupied with statistical relationships and rational models of innovation (Johansson & Woodilla 2009). The insufficiency of such an approach emerged at the same time as IDEO, the world's largest design company, started to market itself as "an innovation company" rather than a design company (Kelley 2001, 2005). IDEO's practical experiences made them trustworthy, and their cooperation with Stanford gave them academic credentials. This, plus a view of a more complex rationality than strategy could offer, boosted a design interest in the innovation discourse (cf. Bruce & Bessant 2002, Feldman & Boult 2005, Ward 2009)

Having some experience from design practice, we find it hard to think about innovation without including design. And it is from this perspective that "design thinking" has to be understood. Here design thinking is a concept that captures the design practice and the way designers make sense of their task, and "a way of thinking" that non-designers can also use (Johansson & Woodilla 2009), rather than being limited to a professional group of designers as Schön might argue. And here might be one of the keys to the popularity of the concept, a reason why it became such a fad just after the millennium.

Design thinking: A way to "get" managers to "get" design

When design management started as an academic area in the 1970s it was taught mainly by designers to managers. To try to help managers to understand what design is and its relevance, designers talked about design in a managerial way, referencing Porter (Olson, Cooper & Slater 1998), considering design as a metaphor (Liedtka 2000), or through descriptions of successful cases (e.g., McCullagh 2006). This approach to using the managerial discourse might be understandable, but the result was probably counterproductive since such positivistic descriptions stripped design of its constructionist and contextualized meanings.

Both the design based "designerly thinking" and the management oriented "design thinking" discourses do exactly the opposite. They start with the designers' way of thinking and invite managers to come and share this world rather than the opposite (c.f., Cooper at al. 2009). Some authors highlight differences between the two functions and suggest ways to come to together (cf. Liedtka 2010, Martin 2007). The discourse of "design management" seems to

have made managers curious about the designers' way of making sense of things on the designers' own terms. And this is what design management scholars have always have strived to do, but with only limited success.

CONCLUDING REMARKS

When asking the question, "What is design thinking?" it is easy to fall into the essentialist trap and ask whether there is – or could be constructed – one single definition holding for all situations where the concept is used. However, as social constructionists we regard such an approach as old fashioned, and prefer to look for how the concept is used and whether it creates a shared meaning.

Both our demographic overview and presentation of the more academic/scientific versus the more practical discourses show that there is very little literature that bridges the design and management discourses ("the designerly thinking" and "design thinking") in a way that relates to both. It therefore seems necessary to discuss the discourses separately to see whether, like the emperor in our title, they have "clothes" or not.

The designerly ways of thinking

In this paper we have identified five different discourses with different epistemological underpinnings that we refer to collectively as a "designerly way of thinking". Each of them has both forerunners and followers that exist as parallel tracks. Anyone wishing to make an academic contribution therefore needs to have this pluralistic perspective in mind, because without recognizing the plurality and identifying the specific perspective, it is impossible to make an academic contribution. Academic knowledge always needs to take earlier knowledge into consideration, and to build upon a similar epistemology (this holds even for a critique that takes distance from a specific discourse).

The management discourse of "design thinking"

The management discourse of "design thinking" is united as a fad yet there is far from a single meaning. Rather, it seems that the concept of design thinking – like many other fad concepts – is used in a way that connects different streams that are united only because they are not analytical. Perhaps those designers and design researchers who are not comfortable with the concept of design thinking believe it implicitly makes a distinction between thinking and doing. Conversely, management practitioners like the concept of design thinking because it gives a label to something needed within management, and a normative description written with industrial leaders as the target group.

Does the emperor have clothes? Does the wand work magic?

The question whether the emperor has clothes needs to be asked in a different way. The reason is that we have found two different emperors, one more designerly and academically oriented, with "clothes" of discourses that divide into sub-discourses in a scholarly way. This

"emperor" is well dressed and academically anchored, though the discourses are seldom mentioned by the followers of the "faddish emperor".

With the fad discourse of design thinking the emperor's situation is very different. First of all, as mentioned above, there is very little academic anchoring in earlier research, and generally no references to the designerly thinking discourses. From an academic point of view it is therefore hard to label this discourse as scholarly or even academic, though it a number of academic scholars are authors of various articles. But how to describe the clothes? Is it a naked emperor or not? From what we have seen the emperor is clothed, but only scantily.

The magic wand does not exist. And yet, there are traces of the way it waved in many companies, even if it did not produce instant results. These traces may be picked up by a more epistemological attention to the discourses of design management/design thinking and how they can connect the realities of managers and designers.

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Craft as a Tool for Multidisciplinary Collaboration and Design Practice

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This research investigates how craft, as a way of thinking, can facilitate the successful integration of knowledge in multidisciplinary design teams. A review of the process of design thinking and design management elicits the challenges arising from the recognition of its complexities. In this context, craft is introduced as new way of addressing this complexity. Relevant knowledge management theories serve to explain the role of craft within design management. Two case studies are used to illustrate the benefit of craft thinking within the management of multidisciplinary design teams.

INTRODUCTION

This research investigates how craft, as a way of thinking and working, can support multidisciplinary design teams by facilitating the successful integration of knowledge from different disciplines or knowledge fields. The idea of craft has recently become an issue of increasing academic (Sennett 2008, Crawford 2009; Frayling 2011) and political interest, for example, through recent UK government policies and the creation of apprenticeships.

Traditionally craft is often seen as the poor relation of design or art, being perceived as inferior in status either due to its economic value (Greenhalgh 2002: 6) or lack of intellectual rigour (Dormer 1997: 19). However, new approaches to craft (e.g. Sennett 2008, Crawford 2009, Niedderer 2009, Niedderer and Townsend 2010; Niedderer and Townsend 2011) contend that craft plays an important role in our everyday lives and that it enables engagement with human values and the combination and exploration of concepts not otherwise questioned.

The importance of craft has been acknowledged as contributing to the pre-industrialised (Epstein, 1998) and industrialised economies, both corporately (Graham and Shuldiner 2001) and sectorally (Freeman and Soete 1997). For example, recent research has shown the concept of craft being applied to problem solving within the knowledge-based enterprise, where non-standardised working practices encourage its adoption (Miles 2008).

Due to its affinity to human values (Sennett 2008; Crawford 2009) and its exploratory potential (Niedderer 2009), we propose that craft can function as a tool for knowledge integration within multidisciplinary collaboration and practice and thus as a tool for supporting design-related management processes. We propose further that this is useful in bridging micro (design teams) and macro levels (firms) of management processes.

In order to demonstrate these two propositions, we review the recent developments of design and design management. Parallels between developments in design thinking and design management reveal the complexities of the relationship of micro and macro level processes on individual, social and organisational levels. We introduce the concept of craft as a way of managing this complexity and explain how it can be beneficial using relevant knowledge management theories. Two case studies are used to illustrate the benefit of craft thinking within the management of multidisciplinary design teams.

THE CHALLENGES OF MANAGING MULTIDISCIPLINARY DESIGN TEAMS

This section discusses recent changes in design thinking and how these have influenced developments and current frameworks used in design management. This analysis highlights the current challenges arising from the recognition of complexity in design management.

How designers work

Designing is an activity and process, the understanding of which has undergone significant changes over the last decades. In 1965 and 1970 respectively, Bruce Archer and John Chris Jones established, perhaps for the first time, clear guidelines for design, which provided a milestone in defining the design profession and its processes. With *Systematic Methods for Designers* (Archer 1965) and *Design Methods* (Jones 1970), they laid down a canon of rules that developed into what is now known as systems design. Systems design regards designing as a linear and highly structured activity, being generally favoured by engineering designers (e.g. Stewart 1981).

However, recent research into the design process has revealed that systems design is not representative of the actual design process as understood by practicing designers. For example, Cross (2011) found that professional designers are happy to work with uncertainties where solution and problem evolve in response to each other, where the end product is not clearly defined from the beginning, and where different options are kept open as long as possible before making final decisions (p.11-12). This confirms the findings of Durling's

(1996) study of designers' personalities. Using the Myers-Briggs Type Indicator, Durling established that designers exhibit certain personality types. For example, designers are largely intuitive and tend to prefer partly personal values, partly 'hard logic' (p.49, 54), while mechanical engineers (or indeed business managers) predominantly exhibit preferences for fact-based reasoning and hard logic (p.50).

This highlights two challenges for multidisciplinary collaborations within design. Firstly, designers are comfortable with situations of uncertainty and risk, which organisational management generally tries to minimise. For example, in spite of the recognised benefits of creativity and design, they are traditionally subordinate to marketing and market research, both of which aim for certainty (Burns and Ingram 2008: p.2). Secondly, design is an inherently multidisciplinary activity because it deals with materials, processes, and people from different disciplines such as material science, engineering, ergonomics/health, sociology, psychology, and many more. According to Cross,

> Large projects demand […] reconciling the variety of interests […] that inevitably have to coalesce around a major project. In these cases, designing becomes not just a personal cognitive process, but a shared, social process. (Cross 2011: p.19)

This means that different personality types, experiences and knowledge areas need to be negotiated to establish a common language or means of communication between different parties for the effective management of the design process.

Design management in organisations

As with design, design management in the 1980s was represented, both visually and metaphorically, as a linear process (see Lawson, 1980; Rothwell and Gardiner, 1983). At macro level, these chronological models describe the major actors in the environment such as science, manufacturing and sales. At micro level, they depict the process as a series of stage-gated activities with minimal interaction between the actors and with it occurring at the boundaries of those activities (Cooper, 2000). Design management is presented as a logical, sequential process that is and can be managed. This orthodox view still persists in some elements of practice (Clark and Smith, 2008).

As the general paradigm of management shifted to incorporate advances from different schools of thought such as design, interactive systems, network and complexity theory, so design management has flexed successively to adopt these changes. Lester, Piore and Malek (1998) present two contrasting approaches to design management as being analytical and interpretive. For the former, design is viewed as part of a contribution to a project that is "essentially an engineering challenge – a problem that must be solved" (Lester et al. 1998: 88). The interpretive approach, on the other hand, presents the project management process as an open-ended process with design used to facilitate and mediate within it. It recognises that markets are dynamic, that users find it difficult to articulate their needs, and that there might be multiple future possibilities. Hargadon (2005) further argues that design needs to integrate the competing needs of markets, technologies and businesses. He presents the core practices

of discovery, synthesis and delivery as being fundamental to design to achieve this, including the significant role of prototyping as an operating principle.

Definitions of what comprises good design management are varied (Bachman, 1998), but various authors have argued that it includes: understanding organisational structures and decision-making processes at a strategic level, the management and leadership of people, teams and processes at an operational level, the facilitation of creativity, ideation and innovation, including collaboration and conflict resolution, at a tactical or project level, as well as understanding the role and importance of design in itself within the organisation (Cooper and Press, 1995; Borja de Mozota, 2003). Borja de Mozota (2008) further advocates the adoption of Kaplan and Norton's (1996) Balanced Scorecard model within design management so that the complexity of the company can be captured and the contribution of design – both to processes and organisational knowledge – can be recognised financially through this. In doing so, it also positions design management as contributing to a company's capabilities as a core competence and elevates it from a project-based restriction to potentially multidisciplinary adoption.

Addressing the changes

The different approaches to design show that the understanding of the design process has changed over the last four decades from that of a linear, orderly, systemic process to one that is complex and intuitive, which draws on, and brings together, various aspects of different disciplines, their knowledge and procedures. The understanding of design management has changed accordingly and is facing a point of inflection both at strategic and operational level. In particular, there is a need to acknowledge its complexity and to bridge the macro and micro levels of management.

Recently, craft has been recognised as a process and a way of thinking to which complexity is intrinsic because of the holistic nature of the process. Applied to design, it represents a more unified approach to experimentation and prototyping combined with the simultaneous tighter integration of clients, designers and users (e.g. Woolley 2011). This is similar to the change that has occurred in software development, where the sequential approach to design and development – the waterfall model, characterised by hierarchical, process-oriented micromanagement (Royce 1970) – has been replaced by adaptive approaches incorporating rapid iterative design and prototyping, collectively referred to as agile methodologies, which stress collective self-management and an emphasis on outcomes.

In the following section, we analyse the idea of craft as a way of thinking and draw parallels with the knowledge management process to propose ways of sharing knowledge and expertise, and to negotiate different approaches within the design management process.

INTRODUCING CRAFT THINKING IN DESIGN MANAGEMENT

This section looks at craft as a unified process of thinking and working, and draws on the concept of 'tacit knowing' (Polanyi, 1961, 1969), in order to provide a holistic approach to multidisciplinary collaboration, which can be useful to design management. First, the concept of craft is introduced and related to ideas of tacit knowing through Polanyi's (1961) notion of 'physiognomy'. From this a proposal is developed for the integration of knowledge and understanding from different disciplines.

Understanding craft as a way of thinking

Craft is an elusive concept (Greenhalgh 2002: 4, Niedderer and Townsened 2010), which is variously used to denote a discipline or practice, or which has been used interchangeably with 'skill'. More recently, craft has been viewed in a new way as an activity or way of thinking (e.g. Sennett 2008, Crawford 2009) to which complexity is intrinsic because of the holistic nature of the process. We propose that this way of thinking can be beneficial in dealing with the complexity of design management at micro (design teams) and macro (firms) level.

At the heart of this new understanding of craft is its capacity to engender complex thinking (Crawford 2009: 23ff), based on the combination of cognitive and experiential knowing. This arises from the link between hand and mind which is created within craft activity, and which enables a unique state of openness, engagement and comprehension (Sennett 2008: 26, 126-7, 144-6, 237-8). Crawford distinguishes between three benefits of complex thinking: these are the concretisation of a matter or task at hand, the reflection on, and questioning of its qualities, and the expansion of its sense (Crawford 2009: 23ff).

The benefits of craft to the design process have been recognised by Woolley (2011) who explains the "strategic role for the crafts in relation to contemporary industry" (p.11) based on the idea of a 'pervasive craft ethos (or influence)' which is "a conflation of values, beliefs, culture and aspirations, underpinned by developing technologies" (p.16). Woolley describes the benefits of craft for design:

> First, as a pervasive craft influence that stimulates new design thinking, markets and values within appropriate industrial contexts; and second, as a series of hands-on craft interventions that directly affect the quality and aesthetics and enhance the value of the product. (p.30)

These two roles of craft can be seen respectively to pertain to the macro and micro levels of the design management process. While Woolley concentrates on the design process or micro stage of design management, design is a social activity, which can only succeed when understood as "a shared social process" (Cross 2011: 19).

Focusing on the social aspect of design and design management, we propose that craft can offer a number of supporting insights concerning sharing knowledge and negotiating different approaches. Firstly, complex thinking engendered by craft knowledge can benefit knowledge

exchange and shared understanding based on human values. Secondly, the integration of complex thinking can increase the ability and motivation to share and negotiate different approaches promoting experimentation. In order to understand how craft thinking can become a supporting factor in design management, it is useful to look at some of the underpinning mechanisms as explained within knowledge management.

Managing different ways of knowing

The idea of complex thinking is based on Polanyi's notion of tacit knowing (1961, 1969) to accentuate the inseparability of knowledge and action. Polanyi (1961: 460) argues that an expert can describe the particulars of a skill (explicit knowledge) and 'integrate' those particulars to make a general understanding of the particular entities through a process of 'tacit knowing'. Thus, experts have the ability to analyse and integrate, which are complementary endeavours (pp. 260-262). He terms this 'physiognomy', which for example, explains how a wine expert not only can describe the characteristics of a good wine but can also integrate those rules to differentiate between wines. In our debate, physiognomy can explain how individual experts in a design team know (and can explain) the rules of their skills/expertise, but cannot describe to others how they apply those rules. In that sense, the concept of physiognomy reveals the limits of an individual's ability to explain to other team members 'how' she applies her expertise.

Some knowledge management (KM) scholars argue that tacit and explicit knowledge can be converted into each other, and tacit knowledge can be largely explicated and codified allowing it to be shared in different contexts (see Nonaka & Takeuchi, 1995; Nonaka et al, 2000). Others argue that tacit knowing (embodied knowledge) can only be known through its expression in action hence it cannot be explicated or codified (e.g., Gourlay, 2004; Tsoukas, 2005; Ray, 2007). A mediating approach by the 'knowledge integrationists' argues that, whilst explicit knowledge is inherently communicable, tacit knowledge cannot be shared, converted or transferred in collaboration between experts in multidisciplinary teams, but that it requires integration (Grant, 1996: 379, 2002). Grant (1996) identifies common knowledge as critical in knowledge integration in multidisciplinary teams and argues that the efficiency of communication depends on "the commonality of vocabulary, conceptual knowledge and experience between specialists" (p. 380). Knowledge integration, according to Grant, could benefit from mechanisms such as directions and routines.

Collins (2004) offers further insights into how knowledge integration works in practice. He argues that experts learn from experience of their own domain (contributory expertise) and by communication (interactional expertise) with other experts from different domains. He suggests that contributory expertise comes about as the result of an expert being fully immersed in a domain (p. 127) while interactional expertise is:

> The ability to converse expertly about a practical skill or expertise, but without being able to practice it, learned through linguistic socialisation among practitioners. (Collins 2004:125)

Thus, interactional expertise is acquired by an expert being immersed in the linguistic culture of a domain other than her own (ibid.). Interactional expertise can explain how different experts in multidisciplinary teams can learn not just a common knowledge but an expertise valuable in understanding other experts' domains.

Brown and Duguid (1998) suggest three methods of facilitating knowledge integration between different groups (communities) of experts. These are translation (carried out by people with knowledge of different domains), knowledge brokering (carried out by those who participate in the practices of several communities), and boundary objects (objects of common interest, e.g., contacts, blueprints, techniques, technologies, etc.) (pp. 103-104) Although Brown and Duguid's debate is about enhancing the effectiveness of knowledge sharing between communities of experts (macro level), it offers useful insights for multidisciplinary design teams (micro level).

In summary, physiognomic expertise of an expert is manifest in the characteristics that an expert can describe and their application that s/he cannot describe. The concept of contributory and interactional expertise can explain how individual expertise may extend beyond a 'native' domain and how interactions between experts in multidisciplinary teams can result in secondary expertise that goes beyond common knowledge.

Adapting the notion of craft thinking for multidisciplinary design teams

Looking closely, it becomes apparent how different stages and methods of knowledge management match and explain the craft processes of complex thinking/knowing described by Sennett (2008) and Crawford (2009), and how craft can function as a tool for sharing knowledge and expertise, and negotiating different approaches within multidisciplinary collaboration and practice (Table 1).

Polanyi's concept of physiognomy can be seen to match Crawford's observation of complex thinking in generating expert knowledge. Extended by Brown and Duguid's (1998) methods it enables knowledge sharing on three levels. For example, the use of boundary objects has been adopted by Ehn & Kyng (1991) and is widely used by craft based design companies, such as Alessi. Ehn and Kyng (1991) showed that simple cardboard models were used effectively to stimulate users' imagination of how they think a product should work. Such working methods are helpful because they draw on people's experiential/tacit knowing and create shared meanings, following Sennett's (2008) principle of the *concretisation of matter, reflection and expansion.*

In many ways, the use of boundary objects can be seen as the basis of the other two methods of knowledge translation and brokering, where experts (who have contributory expertise) or brokers (who have interactional expertise which they have developed through interaction with other experts) translate knowledge from one area of knowledge into another area, using matching examples or analogies that can provide non-experts with the appropriate experiential knowledge. This ability of translation, which is based on somatic experience (Shusterman 2011: 155), is commonly known as empathy where it relates to people, or

transferable skill where it relates to material/technical experience, and may be seen as *reflection and expansion* 'by proxy' (because of the lack of direct experience).

Finally, craft thinking offers a further benefit, which is essential for successful knowledge sharing. This is the motivation to share: Craft is an activity which instils individuals with a sense of pride and confidence (Crawford 2009: 20, Sennett 2008: 21). Both pride and confidence motivate people to share their knowledge which, if missing, can be detrimental to knowledge management (Lin, Lee & Wang 2009).

Having discussed craft as an integrative process that can be beneficial to design management, in the following section, we discuss two case studies to support the theoretical discussion. The first case study looks at knowledge sharing within the craft process, the second looks at knowledge sharing in a multidisciplinary team.

Table 1- extending craft thinking

<table>
<tr><th>Analysis Level</th><th>Craft thinking/processes</th><th colspan="2">KM and Complexity Theories</th></tr>
<tr><td>Individual</td><td>Complex thinking (Crawford 2009:25) - based on the combination of cognitive and experiential knowing. This arises from the link between hand and mind which is created within craft activity. It enables a concretisation of matter, reflection and expansion of sense of task leading to openness, engagement and comprehension</td><td colspan="2">Physiognomy (Polanyi 1961)
Explicates how 'individual' experts draw on their tacit knowing (analyse and integrate) and act/decide without being able to explicate it to others
Limitation: cannot explain how a team of different experts can work together.</td></tr>
<tr><td>Social (including micro level/ design team; macro level/ design firm)</td><td>Craft encourages pride and confidence (Crawford 2009) and motivates individuals to share their knowledge (Lin et al 2009).

Application of the concept of craft to problem solving to encourage non-standardised working practices in knowledge-based firms (Miles, 2008).

a. Artefacts such as sketches, customer drawings, models and prototypes are commonly used (Ehn & Kyng 1991) to create shared meanings.

b. & c. Matching examples or analogies are used to translate knowledge from one area into another to provide non-experts with the appropriate experiential images to evoke shared knowledge.</td><td>Knowledge integration (Grant 1996, 2002) -team members with different discipline-based expertise 'integrate' their knowledge using a common language. Two mechanisms effective for knowledge integration:

Contributory expertise: where an expert is fully immersed in a domain with being able to practice it (Collins 2004). (Shared) Routines can be useful to create a common knowledge basis. (Grant 1996)

Interactional expertise: ability to converse expertly about a practical skill or expertise without being able to practice it. (Collins 2004)
Directions such as the description of clear goals and responsibilities can help to acquire new knowledge (Grant 1996).</td><td>Three methods of knowledge integration (Brown and Duguid 1998)

a. Boundary objects: objects of common interest used to aid understanding;

b. Translation: carried out by people with knowledge of different domains

c. Knowledge brokering: carried out by those who participate in the practices of several communities.</td></tr>
</table>

CASE STUDIES OF INTERDISCIPLINARY COLLABORATIONS

This section discusses two case studies as examples of multidisciplinary work, based on the principles of negotiation and knowledge sharing in the crafts as developed through the theoretical discussion. We draw on one case study from craft itself in order to demonstrate the principles developed from 'within'. The second case study looks at negotiation and knowledge sharing within the context of a multidisciplinary team dealing with Research and Development (R&D) in engineering and new technologies.

Case study One

This case study discusses the commission of master goldsmith Martin Pugh to make a golden jug, and how he managed the design, research, innovation and skilled contributions of other makers in realising the commission. The description is based on an account by Carey (2010) and a presentation by Carey and Pugh, 26 January 2011, 5pm, School of Jewellery, Birmingham City University.

Description: Pugh was invited to produce a 36cm tall jug out of pure gold. According to Pugh "[t]he original request for a pure gold claret jug was initially and immediately dismissed […] as technically unrealistic–pure gold being too soft" (Carey 2010: p.1). When asked again, Pugh explored metallurgical developments in high karat gold alloys with positive results. In discussion with metallurgists, he determined the most suitable alloy(s), although there was some risk in how the alloy would perform under workshop conditions.

In terms of project management, Pugh first had to negotiate with the client about the risk. Second, he had to contend with scientific and technical problems of choosing a suitable alloy and getting it produced in form of sheet metal in the required dimensions, which entailed research and negotiations with metallurgists and relevant companies who produce fine metal sheet. Third, the jug had to be made including several different processes, including spinning, casting, laser welding and polishing, for which he employed specialists. According to Carey,

> Pugh consulted a number of leading specialists and brought together a skilled team willing to impart their knowledge and share the challenges of such a project. It involved a wide spectrum of knowledge, the convergence of new and old techniques, and the reassessment of workshop practice with respect to the characteristics of an unfamiliar material. (p.1)

This means, Pugh (the expert) was in direct negotiation with a number of other parties. Some of whom were experts in the same area (jewellery) with whom he could share 'common knowledge' directly (e.g. caster, spinner, polisher). Others were experts in another area (e.g. metallurgists) or non-experts (e.g. client) with whom Pugh had to communicate through contributory and interactional expertise, variably using boundary objects (e.g. design drawings, scientific figures, alloy samples) or translation to achieve his aims.

Case study Two

Project two is taken from a research and development project situated within the academe in collaboration with several external partners. As before, this project was initiated by one person (Dr Niedderer) who has a crafts background as a silversmith, but in contrast, this developed as a collaborative project where leadership and responsibility rest with different partners at different stages.

Description: Based on previous research with Argentium© silver (AS) and laser welding, Niedderer conjectured that it should be possible to use AS with Direct Metal Laser Sintering (DMLS), because this is a process essentially based on laser welding. This represents the process of complex thinking (Crawford 2009: 23ff) which emerged from the direct involvement with the material/craft process and includes a concretisation, reflection and expansion of thinking.

The first challenge was to convince the potential partners from the mechanical engineering team of the potential of the project and its feasibility. This involved negotiation on technical/operational and conceptual/strategic level, requiring knowledge brokering and translation to establish a common language. Niedderer switched to using scientific data commonly used in engineering to demonstrate the potential technical feasibility (knowledge brokering); when presented with a DMLS sample (boundary object) demonstrating the potential technical difficulties (accuracy in building in a soft metal), Niedderer explained the aesthetics that can arise from these inaccuracies (knowledge translation), thus negotiating different perspectives on a particular subject.

In the further process of the project, similar negotiations occurred between the other partners where either knowledge brokering or mutual attempts of translation on the basis described above were employed. The different areas of negotiation in the project included:

- Engineers (process) and engineers (equipment) negotiated about adaptations of the equipment to facilitate the process. Here common language was pre-existent.
- Engineers (process) and metallurgists had to negotiate about the composition, format (powder) and characteristics of the alloy. Here mutual attempts at translation were required, describing phenomena encountered to elicit conjectures about possible changes leading to improvements in the results.
- Engineers involved in the process negotiated about the DMLS scan process in relation to the characteristics of the alloy. Here too, common language was pre-existent.
- Engineers (process) and crafts people negotiate about the quality and potential of the outcomes using knowledge brokering or mutual attempts of translation.

Case study two shows that there existed a common language between some parts of the project on operational level while common language between others had to be developed. In particular, there was a need to negotiate on strategic level, and between strategic and operational, to create the level of motivation necessary to take the risk that this speculative project posed in terms of investment of money, time and resources (equipment and material).

Discussion

Case study one demonstrates the craft way of working. It was led by one central person (craftsman) who took responsibility for the entire project. In contrast, case study two presents an example where responsibilities are devolved, mirroring more closely the structures of a design firm. While it was still initiated by one person, this project developed in a non-linear way where leadership and responsibility were shared by different partners at different stages, sometimes in independently and in parallel. The craft motivation that had initiated the project was adopted by the project partners to drive the project despite the high risk and no immediate expectation of return.

This demonstrates how craft thinking can be beneficial in the initiation and negotiation of new and high-risk projects. Other examples of such working can be seen in companies, which are research intensive, such as Alessi or Phillips (e.g. knitters were recruited to explore high performance steel yarn). The framework presented here will provide the basis for further theory development and testing in projects mentioned above. Due to the limited space of this paper, it was not possible to explore these further examples here, which will form the next stage of this research.

CONCLUSION

This paper makes a contribution to both theory and practice. Theoretically, the paper makes a contribution to the literature on multidisciplinary collaboration and decision making, drawing together literature from craft, design management, philosophy and organisational studies. More specifically, we have consolidated and developed the concept of craft thinking as a useful tool in multidisciplinary design teams. We have further developed the critical understanding of how expertise and knowledge could effectively converge in such teams to help negotiate and manage different approaches (e.g. risk taking) and engender motivation for new design developments. In our contribution to practice, we have identified and explicated some enablers and barriers in managing multidisciplinary design teams and their interactions, and demonstrate them in our case studies.

The outcomes and benefit of this research is an enhanced understanding of the role and importance of craft and its underlying principles, including the use of tacit knowing, as a tool for integrating different knowledge bases within the operational and strategic processes of design management. In summary, this research found that

- Conceptualising the processes of multidisciplinary collaboration and practice as ‘craft’ is useful in explaining how shared meaning and common understanding emerge in the process of integrating different knowledge bases and skills;
- The analysis and comparison of case studies has provided new insights with regard to multidisciplinary design collaboration, in particular in relation to knowledge sharing, motivation and risk taking.

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Success Activities for Design Management - A Study

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Keywords: Ranking system, Interview

The research presents the development of a value ranking system to identify the best performing companies on the basis of their usage of previously identified success activities. Furthermore, it shows the development of the interview questionnaire that was used to cross-examine the identified four best performing companies from the Design Management Europe (DME) Award dataset. For this purpose, one of the 2009 DME Award winners was chosen for a pilot interview and the resultant feedback was used to review the interview questionnaire.

INTRODUCTION

The Design Management Europe (DME) Award recognizes European companies for best Design Management (DM) in practice. The process of considering entries for the DME Award generates a significant volume of data about each of the entrants, gathered through questionnaires. This data relates both to their DM organisation in practice, and their economic performance. Since 2008, data from 313 questionnaires from DME entrants have been gathered for further study. This dataset lays the groundwork for an investigation of the impact of Design Management on companies' economic performance.

Prior to the study reported in this paper, a chronological literature review of DM and New Product Development (NPD) research was conducted. The results showed that approaches to the NPD process underwent a significant shift within the past decades. During the mid 1980s, the NPD paradigm clearly emphasized execution activities as being critical for successful NPD (Cooper and Kleinschmidt, 1986). Over time, this emphasis changed to recognising management activities as the crucial factors for success (Zirger and Maidique, 1990, Cooper, 1994, Cooper et al., 2002, Cooper, 2009, Barczak et al., 2009, Brentani and Kleinschmidt, 2004). At the same time, approaches to the implementation of the design process also

underwent significant changes. While in the 1990s design was only one activity within the NPD process, the early 2000s brought an understanding that giving designers a more fundamental role can actually enhance the entire process. Eventually, design became the leader of the NPD process while also remaining a critical sub-process in itself (Perks et al., 2005). In combination with the recognition of managerial excellence as being crucial for the success of NPD, a new concept arose, known as Design Management (Mozota, 2003). Consequently, it was hypothesized by Hesselmann et al. (2011) that all success activities of the NPD process are also success activities of Design Management. As part of the literature review, various studies on NPD success activities were examined and a list of the nine most frequently referenced success activities was identified.

Table 1: Success activities

Management activities	Execution activities
Strategy	Customer involvement/ focus
Cross functional teams and good communication	Market research and understanding of market needs
Product/ Process Champion	Financial and business analysis
Top management support and involvement	Preliminary market assessment
	Preliminary technical assessment

This list was tested against the 313 questionnaires to determine if the DME entrants employ any or all of these nine activities. It was observed that the majority of the entrants utilize each of the nine identified success activities (Hesselmann et al., 2011). Further testing and investigation aims to identify a standard set of activities for good Design Management.

Although it was determined that the vast majority of the companies addressed each of the nine success activities, the relative importance of each the individual activities is required. Furthermore, it remains unclear if any additional success activities are present and how influential they might be for the project outcome. This research presents the next step of filling in these gaps, examining the nine identified success activities and paving the way to discover further success activities. A value ranking system will be developed, and the DME Award entrants will be ranked according to their effective utilisation of the identified nine success activities. This will attempt to ascertain the top four performing companies from the cohort of the DME award entrants based on these success activities. Secondly, an interview questionnaire will be developed to discover any additional success activities that are not included in the list. By means of the newly-developed interview questionnaire it will possible to address the open questions regarding the importance, centrality and completeness of the discovered success activities to each company. In order to test the developed interview, one of the 2009 DME Award winners was chosen for a pilot study and their feedback was used to further refine the questionnaire as well as giving initial hints regarding the centrality, importance and completeness of the success activities. Ultimately, this interview questionnaire will be used to cross-examine the identified top four companies in a further follow up study.

THE DATA

The data is derived from the DME Award entrant questionnaires from 2008, 2009 and 2010. This data relates to the DM practices employed by the entrants and their economic performance. The DME Award received 163 completed questionnaires in 2008, 73 in 2009 and 77 in 2010. Though the questionnaire sets of 2008 and 2009/2010 do not feature identical questions, the questionnaire structure and general themes remain the same, and all questions offer multiple choice answer possibilities. The questionnaires from all three years give data that can be broken down into four subcategories. These subcategories are:

1. Company data (e.g. company size, employee count)
2. Financial data (e.g. turnover, investments)
3. Design approach (e.g. selection for design, use of design)
4. Self-assessment (e.g. affects of DM on performance, customer satisfaction)

METHODS

The research study encompassed three aspects:

- Establishing a company ranking system on the basis of the nine success activities and the corresponding questions from the DME Award questionnaires
- Developing and testing an interview through one pilot interview with one of the DME Award winners from 2009
- Refining the pilot interview to be used for the four best performing companies based on the feedback

Ranking system

Each of the identified nine success activities corresponded to at least one question in the DME Award questionnaires. These corresponding questions give information about the extent of utilisation of the nine activities. However, the design of the questionnaires pre-dated the research cited in this paper which is causing an unequal distribution of questions to activities, since some activities have only one closely corresponding question while others have up to four. This inequality is exacerbated by questions having different amounts of possible multiple choice answers, as some questions allow the selection of multiple answers and other questions the selection of only one answer (Table 2).

Table 2: Success activities with the number of corresponding questions

Questionnaire from 2008			Questionnaire from 2009 & 2010	
Activity	**|Number of corresponding questions**	**Number of possible multiple choice answers**	**Number of corresponding questions**	**Number of possible multiple choice answers**
Customer test	2	8	2	11
Product strategy	1	1	2	2
Market research	2	5	3	12
Cross-functional teams	2	2	4	4
Top management support	2	2	2	2
Financial and business analysis	1	4	1	3
Product champion	2	2	3	3
Preliminary market assessment	3	4	3	3
Preliminary technical assessment	1	2	2	2

The overall score was calculated in four different steps:

1. According to the quality of the answer for each question, each answer was ranked in ascending numerical order with the highest number for the best answer. The best answers were defined by the pre-designed DME Award questionnaire. The number given to each answer equates to that answer's score value.

2. Percentage scores were calculated for each answer by dividing the answer score by the number of the total possible answer scores for the particular question and multiplying the result with 100. The end result was the percentage score for each question.

$$\left(\frac{Answer\ score}{\#\ of\ total\ possible\ answers\ scores}\right) * 100$$

$$= Percentage\ score\ for\ each\ question$$

3. The average percentage score for each activity was calculated by summing up the percentage scores for each question of the different activities and dividing it by the number of questions corresponding to the activity. The result was multiplied by 100 to calculate the average percentage score for each activity.

$$\left(\frac{SUM\ of\ percentage\ scores\ for\ each\ question}{\#\ of\ questions\ corresponding\ to\ the\ activity}\right) * 100$$

$$= Average\ percentage\ score\ for\ each\ question$$

4. The overall percentage score for effective utilization for all nine activities was calculated by summing the average percentage scores for each activity and dividing it by the total activities. The result, multiplied with 100 represents the overall score.

$$\left(\frac{SUM\ of\ average\ percentage\ scores\ for\ each\ activity}{9}\right) * 100 = Overall\ score$$

This methodology equalizes the weight of all activities, with all activities having the same influence on the overall score. This overall score was designed to show the effective utilisation of all activities for each company, with the better use of each activity receiving a higher percentage score. Based on the overall score, the four best performing companies were identified. In order to test the spread of the calculated scores for the different activities the standard deviation was calculated.

Companies which did not give a sufficient amount of data to be able to calculate an overall score had to be deleted from the dataset. The dataset from 2008 excluded 11 companies, resulting in 152 valid questionnaires. In 2009 and 2010, 20 companies were excluded which resulted in 130 valid questionnaires in total from both years combined to be used for analysis. The size of the dataset used in the analysis therefore amounts to 282 questionnaires.

Interview

A semi structured pilot interview was developed to gain further insight into the importance, centrality and completeness of the current identified success activities. The company for this pilot study was selected from the cohort of the DME Award winners from 2009. This manufacturing company was chosen as an award winner by a jury consisting of internationally recognized DM experts.

The interview questionnaire was divided into the following categories:

1. Company details
2. General questions regarding the companies' DM
3. Success activities
4. Self-assessment
5. Success measurements

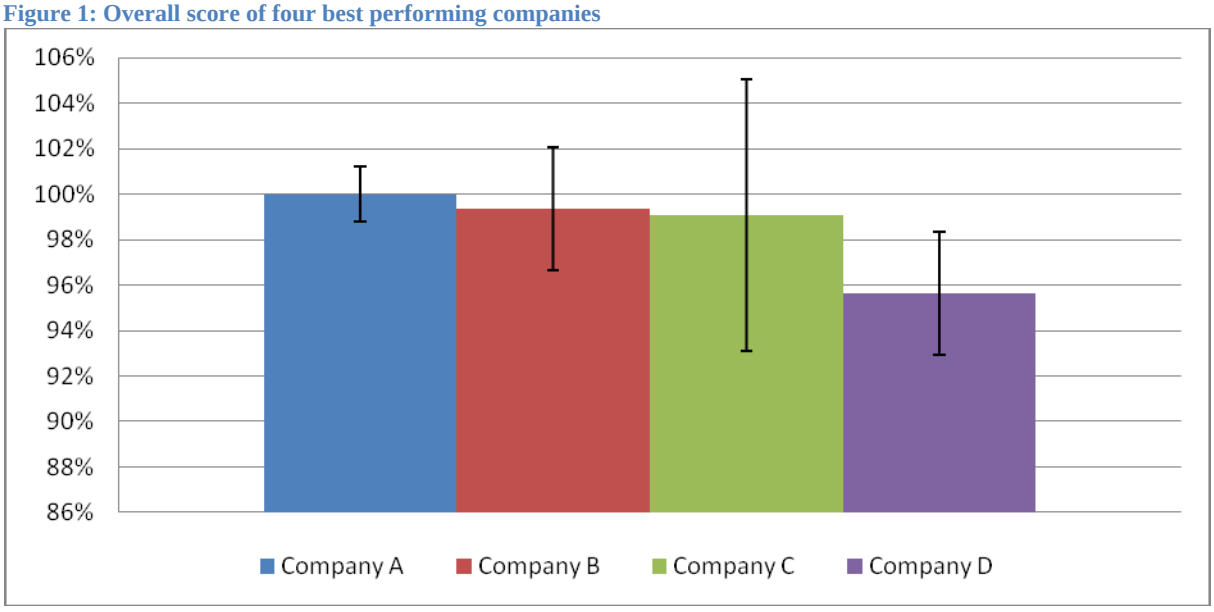
The answers from the pilot interview questions, together with feedback from the interviewed company were reviewed with a view to determining the effectivess of the interview questions. Section four of the interview "self-assessment" included a six point ranking scheme for the nine activities and any additional activities which the company identified as important. The two interviewees were asked to rank the activities according to their influence to their company from one to six with six indicating the highest influence.

RESULTS

Ranking system

212 out of 282 companies achieved a score of at least 50% in their effective utilization of all nine activities, meaning that over 75% of the companies have a percentage utilization score greater than 50%.

Figure 1: Overall score of four best performing companies



The top four companies from the analysis achieved scores of 99.35%, 99.07%, 99.07% and 95.62% for Company A, B, C, D respectively (Figure 1). Company D was from the 2008 dataset, and the remaining companies from the 2009-2010 dataset. All four companies were chosen for the proposed interviews.

The standard deviation for all four company scores is less than 0.1. The overall score of the company from the pilot study amounts to 87% placing the company 32nd in the overall ranking with a standard deviation of 0.098.

Interview

The pilot interview was conducted with the two owners and CEOs of the chosen DME Award winner. This company was chosen because of its relative high 32nd place in the overall ranking and its accessibility. Furthermore, it was chosen because it had been rewarded for good DM by an international recognized jury. The procedures of the interview were explained to them before the interview start as well as the use of the interview for research purposes. No concerns were raised.

The interview time amounted to 55 minutes and the respondents answered all questions. Due to a satisfying result it was decided that no amendments have to be made to the interview questionnaire.

Two additional activities, “prototyping” and “embedding feedback of unrelated individuals” were pointed out. Embedding feedback of unrelated individuals refers to gaining feedback from not intended users of the product. The ranking of these eleven activities according to the interviewees is displayed in Table 2.

Table 2: Success activity ranking

Success activity	Raking
Customer test	6
Product Strategy	4
Market research	6
Cross-functional teams and communication	3
Top-management support and involvement	6
Financial and business analysis	6
Product champion	6
Preliminary market assessment	6
Preliminary technical assessment	6
Prototyping	6
Embedding feedback of unrelated individuals	4

Although, eight out of eleven activities were ranked with a six, company managers expressed the views that the activity of prototyping was of the highest importance to them. The activity preliminary technical assessment was considered of similar importance.

DISCUSSION

Previous research identified a list of the most frequently referenced success activities from NPD research. It was discovered that the majority of the DME Award entrants employ each of these activities (Hesselmann et al., 2011). In spite of this it should be noted that these are all companies which are looking for being rewarded for good DM. Therefore it might be more likely that these companies address all of the identified activities.

However, the inclusiveness and relative importance of these nine activities remained unclear. A sub-step to obtaining this data was a development of a ranking system used to identify the four best performing companies based on their utilization of the nine activities. Primarily, this ranking system was developed to exclude possible subjectivity regarding the identification of the best performing companies since the DME Award winners were chosen based on the subjective views of a jury and not based on the data. It is to notice that none of the DME Award winners is amongst the four best performing companies. The top four companies showed an effective utilisation of over 95% indicating a very good use of all nine success activities. The standard deviation for all four company scores was less than 0.1, indicating that the scores for each activity hardly deviate from the overall score and the chosen companies effectively utilise all nine activities equally. Therefore, it can be concluded that the chosen companies are potentially good subjects for a further follow up study investigating the inclusiveness and the ranking of the nine activities. Furthermore, the percentage score ranking system provides the opportunity to micro-analyse the effective utilisation of single activities for further research.

Initial information regarding any additional activities was gained from the interview. In addition to the nine activities, “prototyping” and “embedding feedback of unrelated individuals” were considered to be important activities. Furthermore, the activity “preliminary technical assessment” was perceived as almost equally important as prototyping. Both activities, prototyping and preliminary technical assessment have been identified as crucial success activities in various studies (Cooper and Edgett, 2008, Cooper and Kleinschmidt, 2007, Cooper, 1994, Balbontin et al., 1999, Brentani, 2000). According to Cooper (1994, 2008) an execution of these activities at a very early stage of product development has been proven to promote success improving performance by up to 43%. Both activities are important to progress the product development in a successful manner. Technical assessment is considered as being important to provide the foundations for the appropriate design solutions and the production of the product (Brentani, 2000). By prototyping, the product can be tested on an early stage in the development process, providing the opportunity to identify and fix mistakes, improving the quality, reliability and feasibility (Brentani, 2000). Whereby, prototyping can also provide valuable conclusions regarding the technical feasibility of the product. Both activities tie into each other and function supplementary to each other.

In particular, testing the developed prototype with users has been identified as one success activity (Balbontin et al., 1999). Cooper (2008) suggests the execution of this process as a

“spiral development” by testing the prototype on users and using the feedback to adjust the prototype and so forth. The embedding of users into this process offers more insight into the high perception of importance for activity “customer test/ involvement/ focus” of the interviewed company, especially since it is arguable if “embedding feedback of unrelated individuals” should not be considered as part of the already identified activity “customer test/ involvement/ focus”. This shows that the three activities which were ranked the highest by the interviewed company are closely related to each other and work synergistically together.

Based on the preliminary hints from the pilot study, it can be concluded that a set of equally important and interacting activities is considered as more important than single activities. This is even magnified through the ranking of the remaining activities since six out eight remaining activities were ranked with the highest possible importance. Particular emphasis seems to lie on the interaction between technical assessment, prototyping and customer testing. However, it has to be taken into account that the interviewed company is a manufacturing company which has to place more importance on activities just like prototyping and technical assessment than for instance a service company.

In the light of these results new research angles are opened up for the next interviews with the four top performing companies. The conducted pilot interview met the aim to gain further insights into the activities. Nevertheless, since the results give first hints that the interaction between the different activities might be a crucial point the interview questionnaire will be adjusted to gain further insight.

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The Arts Value Matrix: Understanding the Aesthetic Impact of the Arts on Organisational Development

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Keywords: arts-based initiatives, aesthetics, organisational development, value creation.

The arts represent a new territory for management to develop organisational people and infrastructures and improve value creation and business performance. In this paper the concept of Arts-based Initiatives is introduced as a management instrument to deploy and exploit the aesthetic powers of the arts to support organisational development. To assess the value of the ABIs for enhancing organisational value creation capacity the model of the Arts Value Matrix is introduced both as an interpretative and descriptive framework.

INTRODUCTION

In today's global economy, organisations are searching new and innovative strategic and managerial approaches to compete and create value. The complexity of the competitive scenario requires to organisations to build up new competencies capable of driving the business growth as well as the creation of new business solutions. It is emerging that the successful 21st-century organisations will be those able to develop competencies to manage their energy and emotional states in order to govern the value creation dynamics (Adler, 2006; Boyatzis et al., 2002; Bruch and Ghoshal, 2003; Cross et al., 2003; Gratton, 2007; Steers et al., 2004). Then dimensions such as passion, emotions, hope, moral, imagination, aspirations, and creativity are establishing as the new strategic organisational value drivers.

Moving from the above arguments, the arts in business can be considered as a powerful means to develop an organisation as well as to increase an organisation's value and value creation capacity. The role of the arts within an organisation can be interpreted as a catalyst, a

lever, and a trigger to support and drive organisational changes, to increase the competencies of an organisation and to develop organisational potential and latent energy (Schiuma, 2011). As a consequence, artists and organisations are discovering the benefits of developing partnerships. The understanding of the ingredients of the artistic process and of the transformational power of the works of art is becoming one of the artist's business. Artists are learning to reflect on their own artistic processes, outputs and outcomes, and sell them to organisations in order to address organisational change management issues, to support the development of new creative and innovative capabilities, and more generally to deal with people and organisational development. Organisations, from their point of view, are discovering the learning influence of bringing in artists, artistic processes and simply works of arts in order to support organisational development mechanisms through the arousal of a positive organisational energy. But arts are not only a mechanism to spur and develop emotional and energetic states within an organisation. They can play different instrumental functions generally related to the development and transformation of an organisation.

From an operative point of view, the involvement of an organisation in arts can be performed through different approaches and activities. The set of the possible involvement solutions can be grouped in and represented by the concept of Arts-Based-Initiatives (ABIs). In the following paragraph the meaning, contents and forms of ABIs are analysed.

THE ARTS-BASED INITIATIVE

An Arts-Based Initiative (ABI) is any organizational and managerial action using one or more art forms in order to enable people to undergo an art experience, as well as to embed the arts as a business asset (Schiuma, 2011). It can take different forms ranging from providing art-rich environment, by infusing the arts into the different organisation areas such as hanging art on walls, incorporating arts in other activities, playing arts in the organisation, to involving employees into arts activities, using art as a learning tool or instructing people directly in the arts. An ABI can use a wide range of art activities, including painting, poetry, film, dance, theatre, photography, sculpture, storytelling, decoration, graffiti, comics, writings, cartoons, circus, cooks and music. Potentially the range of arts activities grounding an ABI is limitless from the outset. Not only different forms of arts can be adopted to implement an ABI, but these can be combined and integrated in various ways so that the modalities of their application could be potentially unlimited.

An ABI is primarily and fundamentally an experience-based process involving and engaging people both rationally and emotionally through either active or passive participation. The focus of an ABI is not the work of art in itself, but the arts experience instead. The intention is to use works of art and arts as media to trigger, catalyze, drive, harness and govern the emotional, energetic and experiential dimensions of an organization, which can have an impact on people and on the organizational tangible and intangible infrastructure's components. ABIs serve as alternative means or ground to address issues related to business,

which require intuitive thinking, emotional arousal, aesthetic understanding, social intelligence and more generally creative capabilities, such as imagination, improvisation, perception, empathy and flexibility.

THE ARTS VALUE MATRIX

The implementation of an ABI can have an impact on two fundamental dimensions of an organisation, these are: the people, that is the organisation's human resources, but also potentially any other organisational stakeholder, and the organisational infrastructure, i.e. the overall tangible and intangible structural assets grounding the working mechanisms of an organisation's business model. Therefore, the assessment as well as the definition of an ABI within an organisation has to take into consideration the people and the organisational infrastructure level. The people level considers the benefits of an ABI for an individual and/or a group of people. While, the organisational infrastructure level contemplates the benefits that an ABI can generate in terms of acquisition and/or development of an organisation's tangible assets, such as the physical workplace, properties and the working facilities, and particularly of the intangible assets, such as culture, values, identity, brand recognition and reputation, moral, motivation, and organisational atmosphere.

A work of art can play different roles within an organisation and can be adopted for diverse organisational business purposes. It can be adopted to achieve diverse impacts on organisational performance. In order to assess the potential value of ABIs for an organisation, the Arts Value Matrix model can be adopted (Schiuma, 2011). It allows to identify, classify and analyse the potential benefits of ABIs and to understand the role and the relevance that an initiative can play to achieve organisation's business strategic and managerial goals. The model identifies nine purposes for adopting an ABI within a private or a public organisation, defining the fundamental nine conceptual categories which allow to comprehend and assess the organisational value of arts. The main goal of the Arts Value Matrix is to help managers and arts providers as well as any other stakeholder interested in the role of arts within organisations to assess the benefits that ABIs can generate. It allows to recognize more clearly how to design and implement proper ABIs to drive organisational development and business performance improvements by creating an artful organisational context, i.e. an organisation environment and atmosphere full of arts experience. Adopting works of art and/or the artistic process organisations can shape the workplace and the facilities, can create product and services for internal and external use, can stir social processes and facilitate collective interactions, can influence people by leveraging individual's emotional and energetic sphere. All this affects people change and/or organisational infrastructure development.

The Arts Value Matrix maps the potential impacts of ABIs within an organisation and identifies the possible organisational value or benefits dimensions of an ABI. It has been built on the dimensions of people change and organisational infrastructure development.

Accordingly, the categories of the matrix identify the possible impacts that an ABI can have in terms of benefits related to people change and/or of the benefits linked to an organisational infrastructure development (Figure 1).

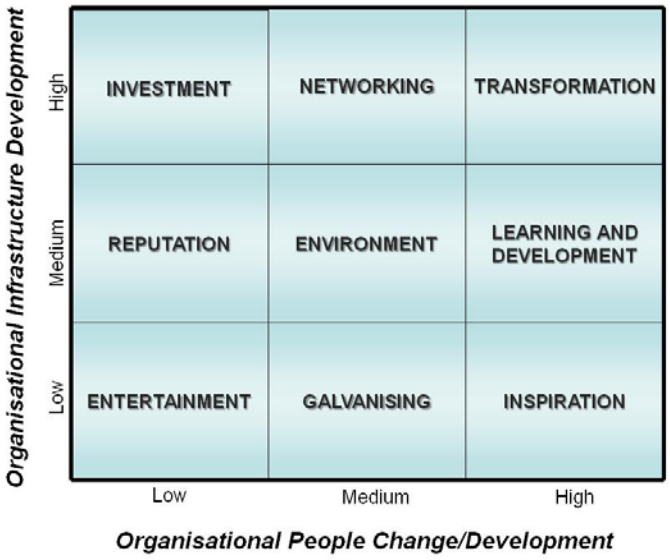

Figure 1. The Arts Value Matrix.

People change can be analysed from different perspectives, but using a simple "low, medium, and high" is best here for simplicity's sake and captures most of people change we discovered in our research findings. In general, ABIs can be used by organisations as a powerful instrument to induce a people transformation both at individual and group level. On the base of the nature and intensity of the ABI the effect on a people change differs.

A low people change occurs when people transformation is time and space circumscribed and has a transient impact on the individual and social emotional and energetic state. For the time during which the people experience an ABI they feel engaged, i.e. emotionally and energetically aroused, but the ABI's effects fundamentally disappear after the experience and people generally maintain just a short memory of their temporary transformation.

A medium people change is realised when in the people is activated and/or recalled an emotional and an energetic state which has an influence effect on people's attitude. In this case an ABI does not only stimulate feelings, but is able to touch the inner dimensions of people's mind, and particularly the emotional one, in a such a way that people feel mentally energised for some time after having experienced the ABI. This energetic state affects for a period of time the people's way of seeing and approaching the reality and the issues around them. If this energy is properly channelled, it can involve change in behaviours at least in the short-medium time.

Finally a high people change involves a self-reflection and self-evaluation which brings people to analyse and eventually challenge their beliefs and values, deeply modifying their attitudes which in turn drive the emergence of new behaviours. In this case, ABIs play the

role of triggers and catalysers of the rational and emotional mind leading people to understand differently themselves and the world around them.

The infrastructure of an organisation corresponds to the group of tangible and intangible assets which define the operative context in which takes place an organisation's operation processes. Even if people, as employees, can be considered as an integrated part of an organisational infrastructure, we distinguish the actors of an organisation from the tangible and intangible infrastructure components which are left in the organisation when people go home at night. A continuous development of the organisational infrastructure affects the efficiency and effectiveness of an organisation's business activities and more generally the organisational value creation capacity. To denote the possible forms of organisational infrastructure development, again, we have identified three levels "low, medium, and high".

A low level of organisational infrastructure development fundamentally corresponds to maintenance interventions aimed to guarantee the functioning of the components of an organisational system, but the components and features of the operative platform remain unchanged. At this level ABIs have a low level of impact on organisation's infrastructural components and are mainly addressed to people.

A medium development of the organisational infrastructure involves a change although partial and circumscribed of some components and/or features of the organisation's infrastructure. In this case an ABI can be adopted as an instrument to restore, renew and modify some characteristics of the infrastructural components of an organisation, such as for instance the design and setting of workplaces.

Finally, a high level of organisational infrastructure development is realised when new components are introduced in the organisation and/or the existing components are deeply modified. In this case, the ABIs can operate as change vectors of organisational infrastructure affecting for example the organisation's culture features, the property stock, the characteristics of the products and/or services produced by the organisation.

Depending on what organisations need to get from the implementation of ABIs, whether they are focusing on people development or on organisational transformation, or on both dimensions, there is a level of people change and organisational infrastructure development that can be expressed as one of nine impacts in the Arts Value Matrix. Each position of the matrix identifies and classifies the potential organisational value of an ABI and defines the kind of benefits an organisation can achieve by the ABI implementation. On the base of the above three levels of assessment of people change and organisational infrastructure development the following nine categories of benefits are labelled: Entertainment (L:L); Galvanising (M:L); Inspirational (H:L); Reputation (L:M); Decoration (M:M); Learning and development (M:H); Investment (H:L); Networking (H:M); Transformation (H:H). In Figure 1 the Arts Value Matrix is depicted and in the following each dimension of the Matrix is presented.

Entertainment – The direct contact with the arts or artists can be fun and give pleasure. In this case, a work of art or the artistic process can be adopted from an organisation as an entertainment means to offer to people an opportunity for fun and enjoyment. The work of art or the artistic process is used as a means to release an ejection of adrenalin. To the employees it is given the opportunity to go, see and enjoy a work of art in theatre, concert house, or an organisation can invite artists in-house and create recreation time and space. The attendance of cultural events such as theatre, concerts or exhibitions tends to reduce blood pressure and creates hormonal benefits (Konlaan et al., 2000). When ABIs are implemented as entertainment means people's participation in arts tends to be limited in time and space and generally the benefit effects of the arts experiences are weak and not deep, basically just related to a stimulation and an awakening of feelings. After having a taste of the arts experience a person is left with a pleasant memory of the experience itself, but it does not involve any behavioural and/or mindset change. Therefore the nature of the impact of ABIs implemented with an entertainment goal is transient and usually people after taking part or being involved in arts go back to their life as usual and nothing is changed in their mental energy and attitudes or ways of seeing the reality and the world around them.

Galvanising - An ABI plays the role of galvanising when it is able to involve people into an intense, revealing and meaningful experience in a such a way that it produces not only pleasure, but most importantly a deep feeling of emotional and mental energy together with a sense of satisfaction. In this case, arts are able not only to release adrenaline and pleasure, but to create a frame of mind. People feel energised and in a good humour. Through the arts experience people can awaken and being totally present with a high level of intensity. This ignites passion and creates a potential energy to be released. The ABIs that are implemented with a galvanising purpose tend to create a psychological and social tension towards actions and changes. To translate galvanisation into action it is important that the direct contact with arts and/or with the artistic process creation is put into a context and follows up by a debriefing or reflecting process which allows the release of the energy to perform business activities.

Nestle's marketing team looking for innovative approaches to enhance creativity as well as to develop communication skills and collaboration in terms of sharing ideas and expertise, with the consultancy of tradesecret, had worked on an initiative which was a mixture of the Dragons Den and the Apprentice (two well-known t.v series). The team were taken to the venue where the original t.v series was filmed. The marketing team's individuals were spurred to develop ideas for generating new products with a combination of industry outsiders and brand specialists acting as facilitators. The people were coached on their presentation style and then had to pitch to a panel of five dragons, made up of entrepreneurs and actors. The teams were allowed to view each other's presentation on monitors in a specially designed studio in the basement to learn from each other's successes and failures.

Inspirational – Arts and the artistic process represent a powerful inspirational lever. They are able to touch people's feelings and mental energy so deeply to generate thoughts that cause

ourselves to think and reflect, driving our assessment and understanding against our behaviours and actions. These mechanisms provoke an awakening of our emotional mind which can generate changes in our mindsets and behaviours.

Art is inspirational from two main points of view. An artist to create a work of art has to be inspired. It is this the metaphorical idea of a muse visiting the artist and then stimulating his/her senses and artistic abilities. But art has also the power of inspiring a receiver by deeply touching the emotional dimensions of people. It drives a self-assessment and can question our daily life, making us to reflect on who we are and who we would like to be. Inspiration involves a self-reflection which can force a profound mindset change. The self-reflection involves the ability to be aware of our mind, spirit, emotions and body and through this new consciousness being able to see the world and ourselves differently and change our behaviours accordingly. Inspiration is the pathway for entering the zone of rethinking our assumptions, concerns, values and beliefs. Thus, the fundamental idea is that ABIs can provoke people in order to make them ask questions about the way they live. They encourage self-assessment, self-discipline, self-efficacy, self-confidence, self-esteem and reflection on life which in turn drive the development and renew of personal attitudes and behaviours towards organisation and work activities. The studies on attitudinal and behavioural effects of arts stress that the process of individual behavioural change starts from beliefs to involve first attitudes and afterwards intentions and behaviour (Stone et al., 1997; 1999). The possible benefits associated to an attitude and behaviour change can cover a wide range of aspects from people's motivation and critical thinking to pro-social actions.

Reputation – The most common use of the arts to shape reputation is through sponsorship. Through sponsorship an organisation can patronage an artist, an artwork and/or an artistic process. This can be done for different reasons, such as ethical and cultural aims, for getting the attention of institutions, to strengthen ties with the local community or community of interests, for creating an opinion and an identity of the organisation both internally and externally, and for raising the brand reputation. Arts production sponsorship and co-sponsorship can present different formats. Usually organisations sponsoring arts productions and events get marketing benefits, such as credit in television and print advertising as well as credit on all arts event related materials including banners, posters, performance programs, and ticketing options. Sponsorship is a traditional and quite common approach of interaction between arts and business.

Environment – The employment of arts as a means of shaping the environment represents most probably the traditional form of an organisation' use of works of art. In this case, art through its aesthetic qualities becomes an element of beauty of an organisation. The adoption of arts as an embellishment instrument covers fundamentally an ornamentation function of the spaces as well as of the buildings in which the organisational activities take place. In this case people within an organisation can read, talk or hear about arts and the artistic process, but fundamentally there are not direct interactions between artists and business people. Embellishment presupposes the use of arts as an instrumental means to create an

organisational physical environment and an intangible aura within and around an organisation which can have a positive impact on the organisation's assets and particularly on people by stimulating constructive emotional and energetic state. The use of arts to increase the value incorporated into buildings, facilities and products through, for example, design is a benefit mapped in the investment area. The goal of embellishment is to exercise an influence on the perception of the organisation about the organisation mainly internally, but eventually also externally to the organisation's context. Therefore, the art through its symbols and expressions can be adopted within an organisation as an instrument to define a physical space and an atmosphere capable of affecting the people's attitudes and behaviours as well as their level of satisfaction. Adopting work of art it is possible to define an organisational context in which people feel comfortable and are spurred to express themselves and communicate with others. Indeed, the organisational environment contributes to shape people's emotional and energetic state. This affects the level of people's satisfaction. Moreover, the decoration through arts contributes to design and arrange an organisational physical workplace which can spur creativity and facilitate, support and improve knowledge work. In fact, the workplace design is recognised as one of the major factor affecting the performance of knowledge workers and knowledge-based organisations (Davemport et al., 2002). Physical setting and workplace arrangements have measurable effect on building a relational capital, social life and organisational context which in turn influence knowledge work (Davemport and Beers, 1996). The use of arts with a embellishment purposes contribute to shape a workplace which stimulate, encourage, express and create a positive emotional and energetic organisational atmosphere. Knowledge workers are more productive if they work into a stimulating and enjoyable environment which help them to arouse and manage positive feelings and sensations.

Learning and development – It is this the benefit area addressed by most of ABIs implemented by organisations. The underlying assumption of the use of ABIs for training and personal development is that many artistic capabilities and skills are important for business, such as presentation and communication skills, listening skills, storytelling, improvisation and the use of body language. These skills can be taught to business people by artists. The fundamental idea is that by exposing people to arts and to the artistic process creation, people's skills levels can growth, particularly in some domains such as design, creativity and imagination, personal communication, improvisation, seeing and representation, and so on. In today's complex and fast changing business context these competences are becoming more and more important as relevant features of knowledge workers' capabilities. For example, improvisation is a managerial skill which is acknowledged as an important factor grounding the ability to respond spontaneously in the moment to problems and opportunities as they arise (Crossan, 1997). More recently, arts and the artistic process has been used to address the development of more complex capabilities such as, in particular, leadership and self management. Leaders can learn a lot from artists and the artistic process. For example, they can learn "the courage to see the reality as it actually is [..]; the courage to envision previously unimagined and unimaginable possibilities; and the courage to inspire others to

bring possibility back to reality" (Adler, 2006: 494). Among other competences, ABIs have particularly a powerful impact on communication skills. In today's business, this is a critical competence for everyone within an organisation. But it is particularly important for chief executives and managers who continuously stand in the spotlight and have to be able to communicate effectively and with high-profile. Being a good communicator is the result of a bundle of factors, which are related both to communication technical skills, such as the use of voice and body language, and personal attitudes, such as strong confidence, self-consciousness, passion and personal energy. These factors can be developed by exposing people to arts experiences. Training in arts and arts creation process is not meant to make people within an organisation artists, but to develop some specific professional skills and capabilities. The focus can be paid on different competence domains such as creative writing, advertising, journalism, reading, storytelling, listening, seeing, presenting and improvising and they can be aimed to develop diverse people's abilities such as the use of voice, the control of posture, body language and gesture. With ABIs people can learn techniques to better perform specific activities which require particular artistic abilities. In this case, an ABI operates essentially as an instruction guideline. For example, ABIs can be valuable to: develop people's breathing in a way that enhances their presentation style; structure and articulate messages in a way that brings them to life; identify people's unique tone of voice and how to vary their intonation to best effect; inject more energy into people's performance; improve the choice of words to get a better impact of people's work; manage and organise people's thoughts for mutual benefit.

***Investment* –** The involvement and participation of an organisation in arts can trigger a variety of direct or indirect economic-financial benefits. The direct benefits are those related to the use of arts as an economic activity in which case arts are a source of income. In today's knowledge economy the role of arts can be viewed both as an industry and as a value added vector. The first represents the so-called business arena of the creative industries, such as film and music business, design, architecture, and more generally the arts business, in which case arts are converted into products and/or services to be sold in the market. Instead, referring to arts as a 'valued added vector', we consider those organisations that are discovering the relevance of arts as an economic activity in terms of their use to increase the value incorporated into products and services. The attention is focused on the use of art principles, contents and processes to increase the economic value of a product and/or service by incorporating aesthetic dimensions. As a result in today's highly competitive business context many companies are starting to positioning themselves at the intersection of commerce and arts (Bangle, 2001). More and more the competitiveness and the economic value of many products as well as services are strongly related to company's capacity to incorporate into products/services the features and quality which characterise works of art. From a business perspective the idea is not to create artworks, but rather than to infuse into the products/services the artful energy which distinguish works of art. A number of case examples can be provided from diverse industries. For instance the famous carmaker companies such as Ferrari, Lamborghini, Maserati and Aston Martin just to name a few, pay

great attention to artistic components of their products from design to colour-and-materials and to any other components which as a work of art can affect client's experiences. Chris Bangle (2001), global chief of design for BMW, consider his company's products as "moving works of art that express the driver's love of quality" (p.48, 2001) and considers is job as director to oversee 220 artists, mediating the corporate pragmatism and the artistic passion and mind-sets within the company. On the same line Robert Lutz from General Motors pointed out: "I see us being in the art business. Art, entertainment and mobile sculpture, which, coincidentally, also happens to provide transportation" (Hakim, 2004).

Arts also pervade and can be considered as a fundamental component of the success of Italian home-furnishings companies, such as Alessi, Artemide, Cassina, Flos, B&B Italia, Cappellini and many others. Indeed, at the heart of the success of these companies' products can be recognised their artistic nature. The products leveraging aesthetic dimensions are able to interpret, evocate and communicate emotional states appealing consumers. These products can be considered as the result of a free-floating community of architects, suppliers, photographers, critics, curators, publishers, designers, artists and craftsmen (Verganti, 2006), who implicitly use art principles, contents and processes as a medium to develop new and existing products. Many other examples of the use of arts to develop products and services can be provided. A further case example is reported by Darsø (2004) who pointed out that at Uniliver's Innovation Center, where Sean Gogarty head of the business unit, with the goal of spurring the creativity of his group requested a poet-in-residence. Bringing in a poet and using words as a powerful way to expand people's viewpoint was recognised as a lever to develop new thinking approaches and thoughts about products.

Networking – A direct involvement of people in the artistic process as well as the interaction between business people and artists allow to define an organisation common ground which promotes and facilitates a high quality and intense interaction among people. This supports people in giving and receiving feedbacks as well as in questioning and dialoguing around important organisational issues. Arts create an unique context in which people can interact in a way that makes them to feel connected, full involved and supported by each other. Through arts the social boundaries collapse and the members of a group can be integrated and co-inspired. This allows to bond people and to drive teambuilding as well as to encourage collaboration. Then ABIs implemented with a bonding purpose are able to generate collective effects, i.e. a positive impacts on organisational groups and communities. Through arts and art processes social processes can be stirred and developed, creating group energy and social emotions, that is energetic and emotional states which are constructed in and between people's relationships. ABIs can be designed and implemented with the intent to create an arts social experience. The arts and the art processes force people to interact, to dialogue, to share their point of views, beliefs, values, and ways of seeing the world, to break-down their social barriers, to give away their comfort zones and allow people to come in touch each-other.

Transformation – The use of art within an organisation can create a new consciousness. It drives the creation of a new culture, involves the transformation of organisational infrastructure components and supports change management. Transformation occurs when people change their beliefs, attitudes and behaviours in their day-to-day working activities and the organisational infrastructure components, such as workplaces, furniture, process procedures and routines, are modified. At this level people are profoundly touched and involved into an inner transformation which is aligned with the needs and wants of the organisation in terms of strategic and performance objectives. Through arts people are inspired and energised in order to accept and prompt changes both in their behaviours and in the reality around them. This drives organisational renewal. Thus at this level of the Arts Value Matrix there is a convergence of people change and organisational infrastructure development.

THE POLYVALENT NATURE OF ABIs

Which impact, or combination of impacts, is best for an organisation? That depends on the strategic, managerial and operative objectives spurring an organisation to adopt ABIs. Ideally, starting from the origin of the Arts Value Matrix's axes and moving along its two sides, the impact of an ABI on people and on the organisational infrastructure tend to be more intense and wide.

The analysis of the literature and of the empirical evidences collected along the on field research highlight the polyvalent nature of the potential impact of an ABI on the components of an organisation system. The adoption of an ABI within an organisation although can be essentially focused on a specific organisational value objective, tends to generate multiple benefits in virtue of the spill-over mechanisms' effects. Moreover, the benefits related to people and to the organisational infrastructure are likely to converge. Then an ABI can have first an impact on the organisational infrastructure, generating a benefit at this level, and afterwards tend to involve and have an impact on people, or vice versa it can generate at the beginning a benefit for the people and then have an impact on the tangible and/or intangible organisational infrastructure components. The Arts Value Matrix takes into account the polyvalent nature of the ABIs' impacts on the different organisational dimensions, identifying nine possible ABI's organisational value categories which are not mutually exclusive. The assessment of an ABI has to be mapped against the nine categories of the Arts Value Matrix, considering that the intensity of its impact can be nothing for some areas of the matrix and vary for other areas on the base of the contents and nature of the art-based initiative as well as of its main value focus.

FINAL REMARKS

ABIs represent powerful means to develop a business' capacity for value creation. This not only involves the ability to improve the existing mechanisms of value creation, but also to re-think the organization and its business model. In the future, the company's competitiveness

and efficiency will be increasingly based on the ability to harness complexity. This will involve the capability to be creative, proactive and flexible to change. The economy of the future will require of organizations to rethink their management assumptions and corporate practices. Organizations will not only need to manage their knowledge domains, but also to dynamically renew their capabilities. Most importantly, however, they will need to engage people's imagination, passion and energy both at an individual and at a social level. ABIs provide a possible answer to these new challenging emergent managerial needs.

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Design-Driven Approaches: The Dichotomy Between Corporations and Consultancies

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Employing design-driven approaches at strategic level enables companies to transform organisational culture into design-driven culture and to develop differentiated products and services which consumers both need and desire. Along with this notion, researchers have started to highlight how design-driven approaches (DDA) – 'design thinking' and 'design-driven innovation' – can provide competitive advantage through the implementation of these approaches at the strategic level within organisational culture. With this view, a new role of consultancies is highlighted in which they move away from conventional participation in the development process to a creative contribution within product and brand concept generation. Although many corporations are aware of the potential benefits of working with external design consultancies, there is limited empirical evidence to identify the manner in which design-driven approaches are (or are not) integrated into organisational activities beyond collaborations between corporations and consultancies.

Thus, this research seeks to investigate both corporations and consultancies' approaches in the development process in terms of external collaboration within the Fast Moving Consumer Goods (FMCG) industry. From this diagnosis, the paper suggests a roadmap for how to share and support DDA between corporations and consultancies.

1. Introduction

It has been acknowledged that design can envisage the way toward competitive products and services (Montaña et al., 2007; Mozota, 2003; Press and Cooper, 2003), while 'good design'

has the ability to contribute to the competitiveness of business (Bruce and Bessant, 2002). This insight calls for design engagement at strategic level in order to impact on entire activities within organisations. Thus, design has evolved from developing the aesthetic or functional parts of tangibles for competiveness to being integrated into organisational activities at strategic level. The role of design resonates with developing a platform in the organisation in order to support creating competitive products and brands. Recently, design-driven approaches (DDA) – design thinking and design-driven innovation – have been highlighted and sought after to be embedded into organisational activities (Roscam–Abbing, 2010; Verganti, 2009; Brown, 2009; Esslinger, 2009; Martin, 2009; Neumeier, 2008).

In aligning the importance of DDA integration at strategic level within corporations, a role for design consultancy as an external network (the authors will refer to 'design consultancy' as 'consultancy' in this paper) has started involving discussing how consultancies transfer and implant DDA into clients' organisations through design-led projects (Verganti, 2009; Esslinger, 2009). However, Brazier (2004) argues that, after such external collaborations, it is still unclear if and how such benefits are transferred into the business as a whole. There is limited empirical evidence to identify the manner in which design-driven approaches are (or are not) integrated into organisational activities after collaborations between corporations and consultancies. Thus, first of all, it is necessary to articulate how corporations and consultancies perceive the development process within the same projects.

From a design perspective, Fast Moving Consumer Goods (FMCG) brand development has received limited attention in academia, and as Olins (2007) points out, the FMCG industry has lost out on initiatives to find ways of developing brands due to the propensity of the *status quo* within the industry. Organisations demand fuel to ignite the transformation of brand development and, as such, demanding a new role for consultancies is required. Thus, this research investigates the features of DDA and argues how such approaches are disassociated from external collaboration. Ultimately, this paper aims to suggest how collaboration between corporations and design consultancies can enhance the integration of DDA at a strategic level within the FMCG industry, by addressing the following questions:

1) What approaches are claimed to employ design-driven approaches for organisational performance and brand development?
2) What causes different views between corporations and consultancies?
3) How can corporations and consultancies transcend different views when collaborating with each other?

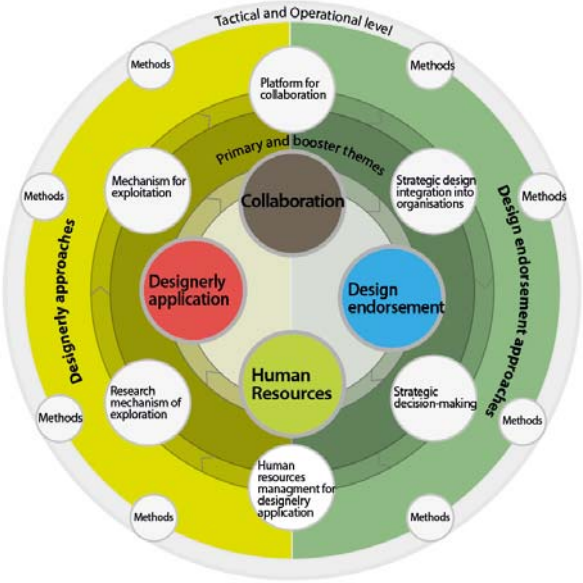
2. Design-Driven Approaches from the Literature

Design-driven innovation (DDI) and design thinking (DT) are the primary notions in a selection of recent literature. From a literature review, the work of seven authors were used as key sources: Berger (2009); Verganti (2009); Brown (2009); Martin (2009); Essllinger (2009); Neumeier (2008) and Lafley (2008). These publications are highly recommended in a

design-thinking discussion on LinkedIn, highly cited in contemporary design research literature, and as such were used as starting points for this research. The selection process is keen to embrace two aspects, business vs. design, and with specific viewpoints (innovation or specific disciplines) vs. general design empowerment.

By exploring the literature, features are distilled into a notion which we label design-driven approaches (DDA); the combination of conceptual and practical designerly approaches applies to design projects as well as to entire corporate activities. DDA can be appreciated with respect to the following two primary themes: 1) designerly application (DA): provide ways that designers can explore and exploit within organisations; and 2) design endorsement (DE): changes the conventional behaviour of organisations, such as sales-driven and short-term effectiveness. To bridge these two opposing themes, two booster themes unify the first and second attributes to form a design-driven culture: Collaboration (CO) and Human Resources (HR). Under these four themes, specific features are categorized into strategic level and tactical (operational) level. Figure 1 describes four overarching themes and their features to accomplish DDA culture at strategic level and tactical level.

Figure 1. Primary and booster themes for DDA



In this paper, each theme is delineated in detail below.

Designerly Application (DA): This theme indicates the features which help to stimulate mechanisms to embed designerly ways, beyond a limited design development process, as a way not to dilute design-driven approaches in design thinking and in the design-driven innovation literature. It focuses on exploring the prospective possibilities of the challenges facing organisations and solving them in designerly ways.

Design Endorsement (DE): Simply providing designerly ways of doing things cannot achieve a design-driven culture. This requires design integration at the corporate strategic level. Thus, the intention of this theme relates to how business endows authority to designerly exploration and exploitation in order to embed them throughout the organisation as a core value.

Collaboration (CO): The above two cultures often confront paradoxical situations, because some features in the two cultures are contradictory or run in parallel. Collaboration calls for an integrated way, both internally and externally, to bridge the gap between designerly applications and design endorsement.

Human resources (HR): Each person's behaviour is composed of every culture's activity, internally or externally. In order to transform the habitual attitude toward designerly exploration and exploitation, it is imperative to engrave design-driven culture on employees' minds.

The four themes form the epicentre for a design-driven culture in an organisation. However, "the major challenge of cultural change is that culture is transformed through actions" (Ind and Bjerke, 2007: 189). The subordinated features which resonate with the mechanism for actions in Figure 1 need to be employed and utilised in order to achieve the fulfilment of design-driven culture.

3. Procedure of the Research

Based on the identified themes and their features, separate survey questionnaires were developed for corporations and consultancies. Survey questions are of three types: 1) profiling questions to identify respondents, 2) five rating-scale questions (RSQs) to identify attitudes towards DDA, and 3) categorical scale questions (CSQs) to identify a way to exploit DDA. The lists of intentions of CSQs and RSQs are illustrated in Figure 3 and Table 3. However, given the limited space for this paper, instead of presenting all the questions' results, only questions which show statistical difference are included. Since this paper is part of a whole area of research, the contents of the following data collection procedure (3.1) and profiling of respondents (3.2) are drawn from other work by the authors (Lee & Evans, 2011).

3.1. Data Collection Procedure

Initial pilot research in the form of face-to-face semi-structured interviews (N=9) underpinned the development of the survey approach. A key finding from this initial research was that interviewees tended to respond to the questions in a positive way. Online survey methods were applied for the respondents' convenience and the research intention in order to collect frank and forthright opinions. Sampling was based on FMCG corporations and consultancies that operate businesses in the UK and globally. However, there is no category relating to FMCG and their consultancies in UK National Statistics or in other statistics publications. In spite of this circumstance, to attain representative sampling, cluster sampling is employed in this research; there are two strata to list organisations. Firstly, corporations are listed by looking at different ranges of brands in UK supermarkets and drugstore websites and their stores: Sainsbury, ASDA and Boots. This list is categorised into two subsets: global, and the EU & UK, as well as encompassing various FMCG industries and sizes of organisations. Since FMCG corporations tend to have more than one brand, when FMCG corporations are listed, the number of corporations and number of brands are not the same. 162 organisations are listed as FMCG corporations. Consultancies, which are relevant to FMCG clients, were selected from the directory of the Design Business Association (DBA) and the Institute of Practitioners in Advertising (IPA) in the UK. 80 branding consultancies, which won DBA Design Effectiveness Awards and have strong relevance to FMCG, were

identified from the DBA directory. Employing the same extraction method, advertising consultancies were also listed. The last tier seeks to identify what positions and disciplines exist within these organisations. This identification is attained and transferred into the indicators of the profiling questions.

3.2. Profiling of Respondents

Table 1 illustrates respondent numbers and details for each type of question. In the survey of corporations, 40 people from among 61 respondents completed the first section online (65.6%), and 27 people among those 40 respondents to the first section completed the second section (67.5%). In the survey of consultancies, 33 people from among 56 respondents completed the RSQs (58.9%), and then 26 people among those 33 respondents to the first section completed the CSQs (78.8%).

Table 1. Participant numbers

	Rating Scale Questions (RSQs)	Categorical Scale Questions (CSQs)
Corporations (61)	40	30
Consultancies (56)	33	27

Corporation profiling can be summarized by the following characteristics:

- Respondents are from Food & Beverages, Personal Care, and Household – typical 'FMCG industries' (74%);
- 67.5% of respondents operate businesses in over 10 countries;
- 87.5% of them have over 250 employees: large and established corporations (adapted from the categories and definitions of SMEs used by the EU (cited in Krake, 2005);
- 52.5% of them have marketing departments;
- 72.5% of them have marketers or brand managers for ownership of brand development.

The characteristics of consultancies in this paper are illustrated below:

- 57.6% of respondents operate businesses in over 6 countries;
- Consultancies work in diverse-sized consultancies;
- 45.5% of them have design departments;
- 75.8% of them have a marketer or brand manager for ownership of brand development.

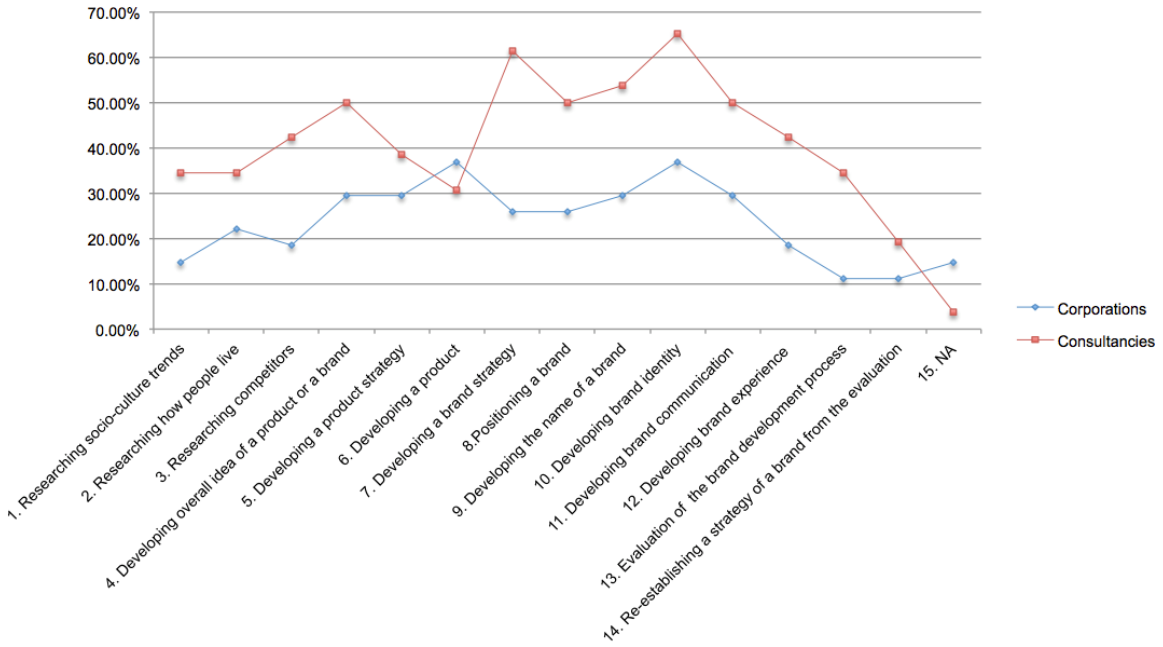
4. The Dichotomy Between Corporations and Consultancies

There are two steps to identify differences or similarities in the current employment of DDA features between corporations and consultancies, depending on the type of questions: RSQs and CSQs. An independent-means T-test is applied to the RSQs. This method is appropriate to two experimental conditions and different participants in order to compare two group means: corporations and consultancies. On the other hand, it is not easy to apply a statistical method to CSQs and these are applied to a preliminary frequency table which shows each variable's value is used to identify differences. Respondents were asked to choose three

indicators of CSQs which are applicable. Thus, an arbitrary parameter is applied to CSQs and their details are illustrated in Section 4.2.

Before outlining the results of the analyses, it is necessary to identify the perception of external collaboration between corporations and consultancies. One result – stage for utilising external collaboration – attempts to explain it (Figure 2). Consultancies reveal a higher rate than corporations, except for stage 6 (developing a product). Except for stages 5 and 14, consultancies show more than 10% difference. This represents a difference in perception in the involvement between corporations and consultancies. While consultancies perceive that they take part in most stages of the development process, corporations perceive that they work with consultancies in developing a product, a brand and communication: developing tangible output instead of developing a brand. Since the majority of respondents in the consultancies survey are from branding consultancies, this profiling seems to affect the results. The result of this variable shows in two ways: 1) branding consultancies rarely commit to developing products, while clients undertake external collaboration for competitive products which corporations hardly develop; and 2) consultancies regard their engagement highly. These might cause consultancies to overestimate their activities and thus hinder their initiative regarding new directions for collaboration and FMCG corporations.

Figure 2. The stage for utilising external collaboration

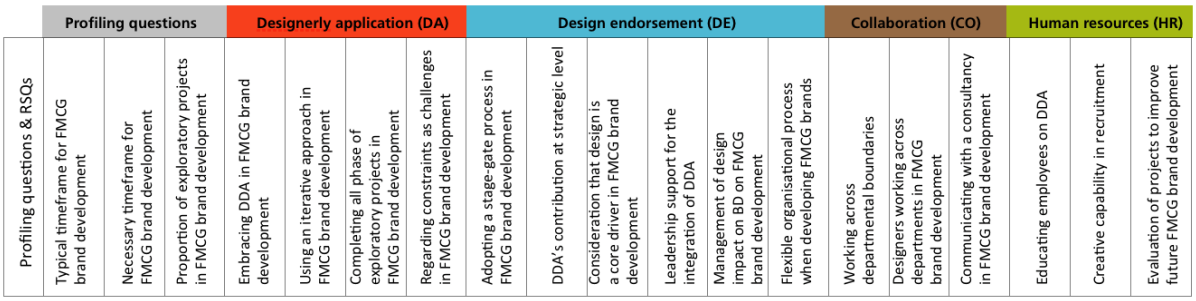


4.1. T-test in RSQs

19-paired RSQs were subjected to a T-test (Figure 3). Of these, three questions were extracted from the profiling questions: typical timeframe for FMCG BD; necessary timeframe for FMCG brand development; and proportion of exploratory projects. Others were extracted from the RSQs. Eight variables among 19-paired RSQs show significant differences in the T-tests. This will suggest what variables hinder collaborations between

corporations and consultancies in FMCG brand development. In this test, two-tailed probability was applied to make specific predictions (difference or similarity).

Figure 3. Variables in the T-test – Three profiling questions & RSQs



As shown below, only a Levene – homogeneity test for violation of assumption – for 'flexible organisational process' is significant (p=.015 which is less than .05), thus it indicates that the variance of the subgroups is statistically different and violates the assumption. The *t*-value of flexible organisational process' is perceived as *Equal variances not assumed.* The other nine questions below show a Levene test is not significant (P>.05), so the *t*-values in other questions are perceived as *Equal variances assumed.* Overall, corporations' distributions are wider than those for consultancies. This means that corporations' variability with regard to variables is diverse.

The eight questions are reported individually and are illustrated in Table 2. In summary, the variables which show significant difference do not fall into the theme of 'designerly approach' and questions on the other three themes – design endorsement, collaboration and human resources – show significant difference. 'Design endorsement' and 'collaboration' among the previous three themes mostly indicate dichotomy between corporations' and consultancies' observations of corporate activities.

The following two findings from this test enable the drawing of some inferences. Firstly, the initial two variables – 'typical timeframe for brand development' and 'necessary timeframe for explorative brand development' – indicate that consultancies do not engage with the entire brand development process. That is to say, consultancies only participate in a particular part of the whole development process, even though consultancies think they are involved in entire brand development and contribute to clients' brand establishment. Secondly, each corporation's mean is greater than that of consultancies (except for 'management of design impact on BD' in Table 2) and has wider distribution. Only one variable's mean in consultancies – 'design management impact on brand development' in DE – is greater than those of corporations.

Table 2. T-test: Variables which show significant difference between corporations and consultancies

		N	Mean	Std. Deviation	df	t
1. Typical FMCG brand development timeframe	Corporation	40	2.88	1.042	71	4.289***
	Consultancy	33	1.91	.843		
2. Necessary timeframe for exploratory brand development	Corporation	40	2.25	.927	71	2.060*
	Consultancy	33	1.82	.846		
3. Adopting a stage-gate process	Corporation	40	4.38	.774	71	4.374***
	Consultancy	33	3.52	.906		

4. Management of design impact on brand development	Corporation Consultancy	40 33	3.23 3.73	1.025 .977	71	-2.128*
5. Flexible organisational process	Corporation Consultancy	40 33	3.45 2.82	1.154 .846	70.112	2.695**
6. Working across departmental boundaries	Corporation Consultancy	40 33	4.25 3.33	.927 .816	71	4.436***
7. Designers' engagement with other departments	Corporation Consultancy	40 33	3.78 3.12	1.050 .992	71	2.714**
8. Evaluation of projects	Corporation Consultancy	40 33	3.60 3.03	1.033 .951	71	2.430*

*p<0.05, **p<0.01, ***p<0.001

The previous two findings imply two stances: 1) actual corporate attitudes are stronger than those of consultancies engaged in clients' organisations, and 2) although corporations and consultancies refer to the same attitudes, consultancies evaluate variables from a design-oriented viewpoint so that consultancies criticise them more. In contrast, regarding only one variable for design's contribution, consultancies have a higher mean than those of corporations. This indicates that corporations have a tendency to overestimate their attitudes in terms of DDA. Looking at it another way, since consultancies cannot be involved in the entire client's organisation, they evaluate partial attitudes within organisations. Regardless of any other points, since consultancies work with departments or respondents who are the closest to design, consultancies' lower means indicates that corporations may overestimate their attitudes. In contrast, the other low variable in corporations – management of design's impact on BD – indicates that consultancies that are design-oriented organisations tend to overestimate design's contribution to corporations.

These different perceptions of attitudes lead to unresponsive corporate attitudes with regard to moving forward in new directions and consultancies provoking what design can do without transferring value to clients' organisations or convincing clients. Since the variables, which show statistical significance, account for corporations or consultancies certain high value in the preliminary analysis, this difference indicates that what they take account of hinders the understanding of each other's organisation. Each different attitude draws parallel lines without there being a consensus view of the value of design's contribution to business.

4.2. Comparison of CSQs between corporations and consultancies

This subsection intends to identify whether there is difference in the exploitation of design methods in brand development between corporations and consultancies. Since there is the same number of respondents in both datasets, the variables illustrate valid numbers instead of percentages. The selected variables in Table 3 account for over 5 responses' gap between the two datasets: corporations and consultancies.

In 'design methods', item 'visualisation' in consultancies scores higher than the one for corporations. Although 'visualisation' – concept visualisation (Fraser, 2009) or visual practice (Kimbell, 2009) – enables the instigation of designerly approaches, this might be a critical approach in consultancies for the sake of communication or delivering the output within consultancies. Additionally, in corporations, this approach does not seem relevant. It can be asserted that corporations do not prefer to employ visualisation as a primary method.

In ‘approaches to exploratory brand development’, consultancies perceive that an ‘iterative process’ is not a relevant feature. From a consultancy’s perspective, consultancies consider that their clients do not utilise iterative processes so this feature does not carry considerable value in either corporations or consultancies. This also implies that, even though corporations conduct iterative processes internally, they may not allow consultancies to utilise iterative process externally. In ‘approaches for design to be integrated at strategic level’, in some ways corporations regard this indicator importantly: ‘legitimate commitment to design’, but consultancies have not thought about it. It is probable that consultancies consider this item to be beyond their capability or that they take design integration for granted without instilling designerly approaches. In ‘approaches for designers to collaborate with other departments’, among these, the ‘co-location’ and ‘foster free flowing ideas’ variables are more interesting to discuss here. The others show a less considerable gap, respectively, between corporations and consultancies. While corporations regard physical environment as an important feature of leading designers to collaborate highly, consultancies regard generation or exploration ideas importantly. It can be interpreted that, since it is hard for designers to collaborate with employees in other departments without legitimacy for DDA, they might call for co-location to enhance designers’ collaboration.

In ‘necessary mode of thinking for brand development’, a difference is found in ‘visual thinking’, which enables the distillation of effective interpretation in communication and engagement into a project (Dziersk, 2008). More respondents from corporations draw on this variable than the one for consultancies. This can be indicated in two ways: 1) Corporations appreciate the importance of visual thinking and its benefits more; 2) Since visual thinking is innate to consultancies, they do not feel a need to draw on this indicator. Both inferences imply a role for consultancies, which provide experience for visual thinking. In terms of ‘necessary mode of thinking for exploratory projects’, different views are found in integrated thinking; corporations have more value than consultancies. This mode of thinking can be explained as a concept incorporated into the mainstream, to be manipulated or tailored. Hence, it can be asserted that if corporate organisations are strongly dominated by business-oriented minds, a designerly mode of thinking (e.g. visual thinking, intuitive thinking, abductive thinking) might not supersede a business-minded organisation radically, but will adjust it to fit into the organisation. Even though a designerly mode of thinking is claimed as a way to develop competitive or differentiated products and brands (this claim is found in the literature in section 1), this result indicates that corporations still regard management efficiency as being of utmost importance.

In ‘factors to terminate exploratory projects’, consultancies blame a lack of understanding of DDA and the infrastructure of clients as terminating exploratory projects. In ‘results from external collaboration’, corporations want new concepts for products rather than new concepts for brands; on the other hand, consultancies draw on more value in new concepts for brands. Corporations tend to call for methods that will impact on the direct development of tangibles.

Among the CSQs, two variables, 'approaches to enhance employees' creativity' and 'situation when undertaking external collaboration', do not show statistical difference, so these are not included in Table 3, below.

Table 3. Differences in the comparison between corporations and consultancies

	Corporation	Consultancies
Design method to support FMCG brand development	Visualisation (5)	Visualisation (14)
Approaches to exploratory FMCG brand development	Iterative process (6)	Iterative process (0)
Approaches for design to be integrated at strategic level	Legitimate commitment to design (7)	Legitimate commitment to design (2)
Approaches for designers to collaborate with other departments in FMCG brand development	Foster free flowing of ideas (9) Co-location (13) Mutual interaction between people (13) Multi-disciplinary team (24)	Foster free flowing of ideas (17) Co-location (6) Mutual interaction between people (8) Multi-disciplinary team (18)
Necessary mode of thinking for FMCG brand development	Visual thinking (12)	Visual thinking (7)
Necessary mode of thinking for exploratory projects	Integrated thinking (9)	Integrated thinking (4)
Factors to terminate FMCG exploratory projects	Senior member(s) resigning from a project (4) Lack of infrastructure of organisation (5) Uncertainty of outcomes (11)	Senior member(s) resigning from a project (9) Lack of infrastructure of organisation (11) Uncertainty of outcomes (18)
Results from external collaboration in FMCG brand development	New concepts for products (22) Special skills for undertaking projects (18) New concepts for brands (10)	New concepts for products (17) Special skills for undertaking projects (5) New concepts for brands (18)

(n): number of response

Briefly, among the variables which show differences, corporations account for variables that enable the organisation to facilitate the growth of brands or the company directly, not for the sake of DDA being ground into organisation. On the other hand, consultancies tend to find more value in the variables for flexible ideas generation and a deficiency of DDA in clients' organisations. This can be interpreted as corporations recognising a strategic design role, but not rigorously employing methods for exploitation or attitudes for the foundation of a culture. It might be presumed that a predominantly sales-driven mind-set projects into this diagnosis: the interruption of DDA into organisational activities in FMCG industry.

5. Conclusion

From the T-test, the typical and necessary timeframes for FMCG brand development for corporations and consultancies are different; corporations' timeframes are longer than those of consultancies. This already indicates that consultancies' engagement is limited to a portion of the whole development process. This finding impacts on interpreting this section's conclusion. This section seeks to explain the underlying causes of timeframe difference and its effect.

Firstly, regarding corporations' (clients') attitudes, eight variables show statistical difference among twenty one-paired variables, so it can be asserted that overall attitudes are not significantly different between corporations and consultancies. Among the RSQ variables, those which do not show difference account for low value. This implies that these variables are not integrated into FMCG industry organisations. In detail, there is no variable that shows

significance in the DA theme and this denotes that the DA theme does not dominate. Corporations evaluate their attitudes more strongly than consultancies do, except for the management of design's impact on brand development. As previously addressed, this means that, a client's (corporation's) attitudes are not the same level as a design (consultancy) perspective.

Secondly, in terms of how to utilise DDA features, corporations rarely utilise visualisation but consultancies consider their clients draw on it more than corporations do. In another sense, corporations draw on visual thinking as a necessary mode of thinking more than consultancies do. This indicates that, actually, visualisation and visual thinking are not yet widespread in FMCG industry, but these are applied when consultancies collaborate with clients. In tandem with visualisation and visual thinking, corporations draw on more features which are related to DDA. For example, corporations consider that they utilise more iterative processes and legitimate design in their organisations than consultancies do. This indicates that corporations still ask for legitimacy for DDA integration (e.g. corporate policy for DDA integration) because of the current lack of it. Thus, it can be interpreted that utilising iterative methods is overestimated by the corporations. Regarding collaboration, corporations take account of physical space and a team for collaboration; on the other hand, consultancies take account of ideas flow. In summary, corporations appreciate DDA methods and the role of DDA but they overestimate their exploitation; conversely, consultancies take DDA utilisation by clients for granted. Hence, this dichotomy hinders the exertion or transfer of DDA methods in both corporations and consultancies.

Thirdly, the extent of perceiving DDA in corporations is different from a design perspective (consultancy view). Corporations and consultancies seem to be satisfied with what they are doing but, from a counter-perspective, different results arise. It can be asserted that each corporation and consultancy's DDA culture does not reach to the extent of a counter-perspective. Hence, it is necessary to audit their performances with a parallel view and to refine their own mechanisms to integrate with each other. Especially, corporations need to audit the extent of appreciating and utilising DDA features from a critical viewpoint. Corporations and consultancies have different opinions about external design collaboration. Since corporation utilise these collaborations in developing tangibles, it can be asserted that DDA features are rarely utilised for exploring an idea at the beginning. Hence, corporations need to refine mechanisms to enhance the exploration of ideas in order to avoid mundane products and brands.

Lastly, although FMCG corporations recognise the benefits of DDA, it can be presumed that corporations' attitudes and exploitation methods for DDA are abandoned or neglected easily for the sake of sales growth or short-term corporation growth. Hence, it is necessary to develop a way to maintain and reinforce DDA in the face of a business-driven strategy.

6. Suggestions and Implications

From the survey results, a roadmap can be suggested to both corporations and consultancies in order to enhance DDA within FMCG brand development. Firstly, corporations' implications are discussed in the following:

- **Audit organisational activities from a designerly viewpoint**: Since FMCG industry seems to take for granted what they are doing within a business-driven view, it is necessary to diagnose current organisational activities from a designerly viewpoint to transform their value via DDA.
- **Reinforce or enhance a way to integrate DDA into brand development over business-driven views**: The variables which, respectively, account for high value show significant differences in the T-test. This indicates that the other eleven variables which do not show significance are not integrated into FMCG industry well and that variables with high value are exaggerated or undervalued in corporations or consultancies. However, FMCG industry seems to be seeking a way to integrate DDA. Considering FMCG context (e.g. typical timeframe, wide range or brand line), it might be unrealistic to suggest sudden changes across an entire organisation at a stroke. It might be helpful to develop a way to integrate DDA within brand development and let this experience of DDA yield or underpin DDA integration into the entire FMCG organisation.
- **Use external collaboration to instil DDA**: FMCG industry seems to be seeking DDA integration but does not know how or when to achieve this. Hence, corporations ask consultancies not only to develop final output but also to distil DDA and project it into collaborations to obtain DDA experience.

Secondly, the implications for consultancies are detailed in the following:

- **Play a lucrative role to envisage DDA's value to clients**: Consultancies do not take for granted the status quo of clients' DDA integration and the perception that all clients have the same level of appreciation of DDA as do consultancies. Especially, since FMCG industry is criticised in terms of generalising new directions for brands by Olins (2007), consultancies are keen to provide DDA experience as well as to deliver final output. Through this effort, DDA is able to be integrated into clients' culture as an institutional component.
- **Develop a way to transfer consultancies' DDA experiences for clients' transformation**: In order to operationalise the previous implication, consultancies develop a way to provide DDA experience with clients. Since consultancies work on a wide range of work, they need to apply their special way of engagement with clients agilely.
- **Make a relationship with clients as a partner**: Consultancies need to develop a way to engage with clients' activities as a partner or a beacon beyond limited stages. Since

FMCG industry does not allow external consultancies to participate in brand development, consultancies are obliged to demonstrate reliability and competence in delivering output as well as in suggesting new directions for a brand, as consultancies do for their own organisations.

7. Limitations and Further Research

There are some limitations to this paper. Firstly, in terms of the collection of respondents, calls for respondents were made to different sizes of organisations, industry, departments and positions. However, respondents are limited in a certain departments (e.g. sales department, HR) and industries (e.g. cosmetics, healthcare and etc.). Secondly, due to the limitation on space, descriptive analysis and other further analyses cannot be provided in this paper. Thirdly, flaws in the survey limit identifying the detail of employing DDA and raise some questions about the survey. Further research will be conducted to address the limitations of this paper. Specifically, through a series of interviews, the authors seek to resolve the limitations arising.

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A Framework for Designing Profitable Variety

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Keywords: automotive, decision making, design process, product design, product variety

This paper explores why design processes supporting delivery of complex products drive the tighter integration of business functions and disciplines. The central argument is that design and down-stream process efficiencies are realised where knowledge is openly shared between business functions early in the specification of a product and its variants. The imperative is increased profit which is achieved through cost avoidance or increased revenue; precisely how profit is increased depends on the nature of the product and the analyses to which its design is exposed.

Introduction

Whether variety is a concern or an asset is a function of the capability of the organisation. Those businesses that recognise a demand for product variety, either at a base or more refined level, tend to incorporate scope to introduce variety in their product offer and have a Business Intelligence toolset to support this. However, the temptation to increase variety to maintain market position can lead to a proliferation of variants and an increase in associated costs. Whether this consumer oriented variety can be profitably delivered by manufacturing to the required quality at volumes that are relatively low compared to the core product is dependent on design decisions that require a wide range of inputs [Holt & Barnes, 2009]. Our experience in the automotive sector indicates that there is often a discontinuity between the marketing vision, the capability of manufacturing to deliver the product and an understanding of the profit making potential of a particular product configuration. Higher variety related costs threaten profit margins, help to maintain an illusion of competitive & profitable product positioning and where unmanaged may negate any meaningful benefit. The design of the

product often determines the options available to contain costs and provide functionally acceptable alternatives. Drawing information and insight from all relevant functions in an appropriate framework, rather than semi sequentially, ensures a balanced strategic view of the options and protects the profit making potential. Equally important are an appropriate pricing strategy for, and packaging of, variety to ensure that feature and functionality demand can be exploited to extract the greatest revenue.

Although our research is set in an automotive context the outcomes are applicable in other sectors where high, or unmanaged, levels of variety threaten profit margins [Ramdas & Sawhney, 2001] as a result of elevated / un-quantified costs, or failure to exploit variety's price potential. Our work began with the recognition that the impact of design decisions on levels of variety was usually un-quantified. There was no process to measure variety and it was generally assumed that more variety equated to greater profit - albeit with a management overhead. The gap that we sought to address was the availability of management tools and processes to analyse, quantify and understand the implications of variety, the premise for the work being that this would support more informed and better decision making for the business as a whole.

Automobiles and aircraft are examples of relatively complex products that are of particular interest since they comprise interconnected systems that may be developed in parallel by specialised teams where knowledge exchange is essential for successful integration and functionality. The significant investment required to develop, manufacture and assemble these products is protected by development processes that share similarities in terms of stages or phases of activity and gateways or milestones that ensure readiness of all engineering teams. While these processes are mature and allow for the local accounting of costs, cross-functional investigation of the implications of the design are partial where they exist.

The importance of robust processes with tools that support the analysis, management and control of variety increases as the product portfolio grows; where products are highly customisable, or the manufacturer has a build-to-order strategy, the full complement of parts has to be available to satisfy demand with consequences including increased inventory levels and space requirement for storage etc. In the automotive sector some manufacturers of premium products, for example Audi, have developed sophisticated approaches to the question of profitable variety, often under the heading of product complexity [Tanner & Alders, (2003)]. Customers of premium products expect to be able to be able to specify highly personalised configurations for their purchases. In this case the challenge for the manufacturer is significant in that the range of features that is expected to be available to select from can be large. This may be a consequence of target market requirements, satisfying a consumer need identified and interpreted by Marketing or a particular functional specification that may be significant depending on the utility of the product, or alternatively from the perception of gaps between competing products.

Irrespective of the drivers of variety both manufacturer and consumer have a vested interest in minimising costs. Automotive manufacturers are undertaking increasingly detailed

analyses of their products while in development to ensure that the hidden costs, those required to deliver the specified variety as well as those that have failed to be identified but are incurred later, as well as the direct costs are minimised. Although the actual figure is debated [Ulrich, 1993] and varies between products it has been reported [Anderson, 2006. Dowlatshahi, 1992] that as much as 80% of the lifetime cumulative cost of a product is determined by its design and that 75% of this cumulative cost is a consequence of the product concept or architecture. This represents a significant cost reduction opportunity for those involved in the design and highlights the importance of making the right design decisions at this stage in the product development process.

Without processes to manage variety based on decisions that reflect the cumulative benefit to the business, manufacturers face the prospect of narrowing margins between cost and revenue streams. It is this recognition that motivates action to develop and implement strategies to analyse, manage and control the effect of variety. Our work has involved two main activities: developing tools that constitute a variety management toolkit focusing on the product design, the manufacturing process and the associated costs, and integrating these within the product and technology development processes of a premium automotive manufacturer.

Development Processes

The key processes that we have been concerned with are product and system development, underpinned by more research oriented technology development. In the context of our work, technology development is the process whereby engineering concepts are tested for business and technical feasibility and proved in successively more production representative environments. The end point is a proven technology with a clear product implementation plan. Processes that are concerned with product systems are focused on how proven technologies, components or sub-systems can be effectively delivered across various product lines. While these processes are independent of vehicle programmes they have representation from the programme business teams with responsibility for ensuring that their product delivers an acceptable level of profit to the business. Product Development operates to strict commercial goals and objectives and is supported by both system and technology development processes and is the process that brings together all business units necessary to realise the product. Where the product is complex, for example with many interfaces between systems, it is usual for progress to be checked at project gateways or milestones. Coordinating the input of these various functions is a challenge; at the outset of our work the process did not accommodate formal knowledge sharing to support variety related decisions – the first opportunity for stakeholders to present their position formally was at a development gateway which did not promote consensual or efficient decision making. Time constraints forced decision making ‘from the hip’ based on an individual’s perceived knowledge of the situation rather than fact. This is a process failure mode noted by others, for example Dörner’s ‘immediate acting’ in Lindemann [Lindemann, 2009, p30].

A significant benefit of the framework we propose is that cross-product, and –functional, decision making is promoted and more holistic decisions are reached.

Problems with complex products

Dörner, a cognitive psychologist, identified some general categories of failure that lead to decision making failures when working with complex problems [Lindemann, 2009, p30]. A number of these behaviours or failures are a consequence of data constraints and were witnessed during our work. Closs et al discuss the importance of information provision to (product variety related) complexity decision making through the application of socio-technical system design principles [Closs et al, 2008]. Their proposition is that businesses with a competence in complexity related decision making require supporting processes that integrate their technical and organisational (social) systems. These must include mechanisms for provision of reliable information in a timely manner to decision making designers and engineers. At the outset of our work the challenge was identifying which business systems held the required data and who needed to be approached to authorise extraction of the subset of interest. Our strategy at this point was to work with senior management to identify the appropriate functional managers and areas where aggregate data was held. Subsequently the distributed nature of data within the business was less of a concern as the key linkages/people required to provide access were exposed.

A further challenge was to actively engage all stakeholders in the decision making process. The principal barrier was the lack of demonstrable benefit arising from application of the method to the end product. However, once the process and its potential outcomes became clear the quality of engagement improved. The sponsor of our work was Manufacturing which had to deliver the complexity created through product variety related design decisions and, needed a mechanism to check increasing levels of variety through an objective assessment of the true value to the business. Without a common approach to quantifying cost and revenue streams associated with variety, departments that used their own methods to calculate and report on the implications of design decisions, rarely met in a forum where knowledge could be exchanged. The consequence was that analyses were partial and failed to capture the full implication to the business.

Complexity framework

It is clear that the best opportunity to contain and minimise design related problems and their associated costs is early in the product development process. We have found that it is the integration of the tools as a method within the development process and their use to undertake systematic analyses and investigations of the design that ensures cost effective delivery of variety perceived by both customer and business to add value.

Sequence of application

The essence of our approach is investigation of design alternatives in a sequence that reflects stages within the development processes. The individual tools can be applied in isolation

however their full potential is only realised when they are used in a structured format. This working method is based on the recognition that the product design has a central role in determining all following manufacturing and peripheral activities. As a result the design undergoes a number of analyses that focus on (i) the variety of parts required to build the full range of products comprising a product family, (ii) a design improvement exercise based on modularisation, and (iii) a parallel activity based on the Design for Assembly (DFA) method. A process based FMEA is also undertaken to contain adverse consequences related to variety, during assembly operations, once the design has stabilised.

A Complexity Cost Framework, to quantify the impact of variety related decisions, is maintained to support these activities, together with a Complexity Analysis Model where the data, supporting information and final decisions are documented providing a point of comparison for future, related, decision making.

Product design

The first stage in the process is to investigate the impact of variety at part and assembly level. This analysis is conducted for the product family as specified at design time, if additional variants are introduced subsequently, for example to meet new market opportunities, additional analyses will be required. The investigation employs a Product Variety Matrix (PVM) which displays the variants available to the customer as well as the parts or components comprising those variants [Galsworth, 1994], figure 1.

		Mission	High Altitude Long Endurance 1	High Altitude Long Endurance 2	Medium Altitude Medium Endurance 1	Medium Altiture Medium Endurance 2	Low Altitude Short Endurance 1	Low Altitude Short Endurance 2			
Part Type	**Part**	Demand / Part Number	10%	25%	15%	15%	30%	5%	Part Type Count	Design Ratio	Specification Ratio
Engine	Turbofan	ETF1	1						3	17%	10%
	Turboprop 1	ETP1		1	1	1	1			67%	85%
	Turboprop 2	ETP2						1		17%	5%
Nose	Small	N001					1	1	2	33%	35%
	Large	N002	1	1	1	1				67%	65%
Fuselage	Small	F001	1	1	1		1		2	67%	80%
	Large	F002				1		1		33%	20%
	Mid forward	F001a		1	1	1			2	50%	55%
	Mid rear	F001b	1	1	1	1				67%	65%
Wing	Inboard 1	W123	1	1		1	1		4	67%	80%
	Inboard 2	W124			1			1		33%	20%
	Middle	W125	1	1	1	1	1			83%	95%
	Outboard	W126	1	1		1	1			67%	80%
Empennage	Horizontal Small	EH1						1	2	17%	5%
	Horizontal Large	EH2	1	1	1	1	1			83%	95%
	Vertical Small	EV1					1	1	2	33%	35%
	Vertical Large	EV2	1	1	1	1				67%	65%
		Part Count	9	10	9	10	8	6	17 / 52		
					Product Variety Index				884		

Figure 1. *Completed Product Variety Matrix for an aircraft showing six product (mission) variants. (Evans et al, 2008)*

Our enhancement to the PVM includes consideration for part demand as well as metrics that clarify the extent of part usage within the product family. The PVM can be modified,

depending on the nature of the product, to focus on assembly level variety although in either case the aim of the analysis is to minimise the number of components required, to prepare for Design For Assembly (DFA) analysis and to move the design towards a modular structure. The starting point for the analysis is to take the Bills of Material, that is the inventory of materials and parts that are required to manufacture the product or assembly, for the product variants in question and to use these to compare the structure of each assembly.

In the context of a PVM, product variant refers to the discrete products that will be offered to, or are specified by, the customer. Parts or subassemblies that comprise the parent structure are referred to as 'part variants' and collections of parts that are similar by function and known as 'part types'.

To continue this analysis either the actual or predicted demand is included which allows an estimate of the total demand for each part, based on the product variant, to be made. In the PVM part level demand is represented by the Specification Ratio, and use of the part as a proportion of the potential maximum by the Design Ratio. The completed matrix shows the level of variety within the product family and highlights where subsequent investigation and analysis should begin.

Value Stream Analysis

In order to study how the variety of a system or product family will affect the profitability of a business, or its impact on operational costs, it is essential to understand how a business's processes operate, for this purpose we apply a lean process tool, Value Stream Analysis. Rother & Shook define a value stream as "all of the actions required to bring a product from (1) concept to product launch, and (2) raw material to finished product" [Rother & Shook, 1998]. To establish the costs associated with variety it is important to assess the true cost of a product which involves developing both the Product Creation and the Material Value Streams. To build an accurate description of the cost of variety it is important to focus on the detail of the differences between individual variants rather than averaged values.

Although Value Stream Maps (VSM) are typically associated with Lean Manufacturing they are a valuable source of detailed information for variety and complexity analyses. To understand the complexity caused by the product positioning, features offered and the physical product, it is necessary to investigate the entire value chain for the product family in slightly more detail than is usual on a standard VSM. The additional information is the number of variants produced at each process step and individual records for each variant, as opposed to aggregated values.

Two forms of VSM are used to gather the information required and although similar in concept, showing the steps required to turn raw materials into a finished component, work at different levels. The Logistics Map [Jones & Womack, 2002], shows how the organisations in the total value stream interact with one another while the 'Wall to Wall' Map [Rother & Shook, 1998] shows what happens within a single organisation.

To show where complexity begins to affect the value chain it is necessary to interrogate the detail of standard VSM data and add additional information. Additions are made to reflect the creation of variants along the value chain. This addition focuses attention on those steps where variety is added as these are areas where further investigation will be required. Plotting variant generation below the value stream map creates a further dimension to the map and allows generation of a 'Variety Funnel'. The main departure from the standard VSM is the emphasis on differences between variants which is highlighted as follows:

(a) Cycle times - shown as minimum and maximum as opposed to average values since differences cause imbalances in the manufacturing/assembly process.

(b) Reject rates - individual rates are shown to highlight which variants cause more rejects than others.

(c) Inventory levels - to show where low off take parts create slow moving stock due to minimum order quantities.

The Variety Funnel [Hines & Rich, 1997] illustrates how the variants build up along the manufacturing process and assists in pursuing a design which can be late configured. With products that have many potential functions or configurations it is desirable to be able to set this as late as possible preferably selecting the discrete or discriminating elements from a small number of modules, the alternative being to hold a larger inventory of products that can be selected.

Case studies

Our research approach is based on a collaborative case study model. Case studies represent opportunities to develop and apply our research in an industrial context from development and refinement of individual tools to application of a final 'tool set'. The following examples are based on our work in the automotive sector.

Case study 1 – Cooling packs

Problem

In this first example, the absence of a process through which Product Development and other involved business functions were able pool their knowledge to improve product configuration decisions led to a proliferation of variants with no clear supporting rationale. As new vehicles were introduced the number of uniquely designed systems, in this case cooling modules, increased as special configurations were designed for new vehicles. When programme management, responsible for the introduction of new vehicles, asked why the number was increasing there was no knowledge of how the number proposed had been reached. The question was posed because of the number of modules specified together with a lack of knowledge and understanding; there was an intuitive belief that the number was too high, but no one was able to substantiate this or provide a justification.

For the three vehicles involved there were 13 cooling pack modules proposed. The costs for tooling, facilities, launch, engineering and logistics were significant and the concern was that there would be a negative impact on profit as a consequence. Complicating the situation was the requirement for the supplier to deliver the modules to the assembly plant fully assembled which meant that the logistics costs were comparatively high.

Resolution

Responsibility for development of discrete vehicle systems lies with a module leader. This is an experienced engineer who typically has a small team dedicated to support the activity. The decision was taken to first investigate how much cooling pack variety was actually being designed for the vehicles concerned. Our role was to work with the team to deploy the appropriate analytical tools and advise on interpretation of the results. Since the driver for the activity was the number of cooling pack variants a Product Variety Matrix was generated to define the current state.

The requirement to ship completed modules then led to a Value Stream Map of the supply chain being prepared. At this point it was clear that fact holders were located in a number of business functions as well as the supplier; workshops including all those involved were initially held at an assembly plant and a supplier facility. The workshop held at the manufacturer premises focused on the module design and that held at the supplier's facility on the process or supply chain. These initial workshops were supported by a number of our team reflecting the need to capture and clearly present the significant volume of background information; as the process subsequently matured we were able to reduce the facilitation needed. In both cases the workshops provided a forum for a broader spectrum of people to share knowledge and ideas about the product than was possible in the formal process at that time.

As a result of the analyses and workshops six scenarios comprising alternative design and supply chain configurations were proposed. These were reviewed at a final workshop where the cost and benefit for each option was assessed.

The culmination of this third workshop was agreement on a cost driven optimum. Cost was chosen as the driver since cooling module specification is a function of vehicle powertrain rather than customer preference.

Outcome

The outcome of the exercise was that the OEM reduced the number of variants from 13 to five modules. The promotion of modularity is not a new strategy, however in this example it allowed the manufacturer to 'in source' module components which were eventually delivered unassembled. An additional assembly cell was introduced where components were selected and sub-assemblies customised immediately prior to assembly on the finished vehicle. Finally the fan motor was standardised across all variants since the cost of providing additional cooling capacity for some vehicles was more than offset by the savings.

The importance of integrating those business functions and teams able to contribute to design and systems strategy is highlighted in this example not solely by the realised benefits. The investigations undertaken also showed the potential to reduce the number of cooling module variants to three. However due to decisions made by one programme team (responsible for one of the vehicles) it was not possible to standardise the mounting points which limited the options available.

Case study 2 - Wheels & tyres

Problem

The second case study was based on an assumption that the wheels and tyre combinations offered to the customer were deficient. It was intuitively felt that the variety was either too great or that the composition was wrong. Competitor bench marking had reinforced the impression that there had to be a change in strategy, to control costs and maximise revenue, but there was limited understanding of how this should be achieved. As in the case of the cooling modules, limited knowledge regarding the evolution of the combinations offered, and their business benefit, was compounded through different strategies being adopted by different vehicle lines.

Resolution

A cross functional team was formed to investigate the opportunity led by Product Development, with representatives from Marketing and Purchasing. Suppliers were not involved directly but were represented by the purchasing function. Logistics were not required to contribute as the wheel and tyre combinations were delivered to all assembly lines in sequence by a single supplier. Additional personnel representing different vehicle lines and brands were engaged to ensure that a comprehensive picture of the current state was captured.

Data was collected for all vehicles but once it had been collated the team didn't understand what type of analysis to conduct or how they should interpret the results. Concentrating on acquisition of data was a relatively easy activity for the team and has parallels to the complexity interaction failure mode described by Dörner as 'encapsulation' [Lindemann, 2009]. At this point the team were recommended to broaden their enquiries to include revenue opportunities. This entailed working with Sales & Marketing to develop a revenue model for each product family. This was a key stage in the development of the variety management framework with the team focusing on profit rather than cost reduction alone.

An important perspective for the wheels & tyres data was that of commonality. In the context of this study commonality refers to wheel diameter, rim width and position – front / rear and tyre diameter. An investigation of commonality focusing on wheel width (the rim width) and vehicle centre-line offset showed there were two distinct wheel types, sport & saloon and off-road. As a result of this study two product variety studies were conducted.

These investigations led to the conclusion that there were four principal business opportunities: to standardise the wheel and tyre options available for the customer to choose from for each vehicle in particular markets, to increase the levels of cross-vehicle sharing within the sport & saloon and off-road groups, realignment of the market offer for each vehicle to improve the competitive position (there had been examples of underselling compared to the competition) and finally to improve utilisation of the wheel casting tooling capacity to offer alternative finishes for standard designs (different colours, finish, chrome and polish).

Subsequently a strategy of 12 wheels for each vehicle was developed consisting of eight wheel styles with four alternative finishes calculated to be optimum in terms of profit opportunity.

Outcome

The learning from this case study was that to maximise the business benefit the product portfolio needed to be considered as a whole. Prior to introduction of a variety framework there had been strength in each vehicle / programme team but cross-vehicle rationalisation opportunities had been overlooked because there was no mechanism for doing this. It was also shown that for features that could be selected by a customer there needed to be regular review of product pricing relative to the competition, and that when this product pricing and fitment information was shared by all those able to contribute to the decision making process a more robust outcome resulted.

Case study 3 - Steering Wheels

Problem

The challenge in this example was posed by the engineering team responsible for the architecture of a family of new products and concerned a high level of variety coupled with a geographically remote supplier. The market proposition for the vehicle concerned required that the customer was able to highly customise the product to their individual taste including the interior colour scheme; the initial strategy was to allow for the customer to choose from six colours of steering wheel with eight wood finishes and two switch pack configurations resulting in 90 variants, a level twice that of the predecessor vehicle. The supplier intended to supply directly from their Romanian plant to the assembly line in the UK.

Resolution

The cross functional team assembled for this problem was again led by Product Development. The core team included Purchasing, surface materials specialists and a member of our team. The first task was to quantify the number of variants. At the same time the potential demand was investigated so that any variants with a relatively high volume could be identified before seeking the input of Marketing. In the absence of a rigorous method that quantified the impact of variety, Marketing traditionally took a protective

position regarding decisions where the level of variety was threatened. Rules regarding the level at which uneconomic customer feature was removed tended to be loosely applied which contributed to a gradual increase in the quantity of 'unmanaged' variety. The initial Marketing response followed this pattern and there was insistence that all options should be made available for the customer to choose from.

Once again all stakeholders were engaged to ensure that a complete and balanced description was used as a basis for decision making. A workshop including the supplier, Logistics, Sales & Marketing and the design studio (interior styling) was held. As in case study one the supplier was asked to provide knowledge that was not in the OEM and comment on the implications of supplying the proposed level of variants for their supply chain.

During the workshop the supplier identified a potentially significant cost associated with purchasing and storing, in a controlled environment, the required quantities of wood for the steering wheels. One variant required the use of woven carbon fibre which the supplier had no previous experience of using. A further concern was the irregular appearance (scissoring and opening) of the woven fibre when wrapped around the steering wheel forging.

This additional information led Marketing to reduce the variants offered through restricting the combinations of finishes and colours which cut the number of variants to 30. Late configuration of the steering wheels switch packs was also investigated as a further supply chain simplification but although there was a cost reduction this was not judged to be great enough to justify the additional work required to implement. Had the saving been greater and late configuration introduced, the number of supplied variants would have been further reduced to 15.

Outcome

Although the fundamental design of the product did not change as a result of the exercise this case re-emphasises the importance of involving the all those with information in the product definition decision making process. Central to the final proposal was the volume of stock that the supplier would have to hold to satisfy the required level of variety. Supplier costs would have to be greater to accommodate the material volumes necessary and there would be an on-cost for the OEM as a result. The reduction in working capital as a consequence of the life-time purchase requirement was a further inducement to simplify the offer. Involvement of the supplier revealed important information that ultimately had a direct bearing on the adopted strategy.

Discussion

The three case studies presented highlight how integration of business functions, disciplines and suppliers in the product definition process results in an improved product strategy that maximises profit making potential without sacrificing customer choice. The first case presented showed the importance of drawing contributions from engineering teams and suppliers at an early point in the development process. A process that supports this approach

is particularly important where multiple product lines share parts or subsystems and where there is a cycle of product replacement or renewal. The framework we propose is able to optimise variety in these circumstances through a progressive series of structured analyses. However, the business benefit is constrained where decisions are made in isolation for discrete products rather than for a product family or group of products with common parts.

The second case study examined development of a cross product and brand strategy for wheels and tyres. The learning from this exercise built on that of the first case and showed that to maximise the profit making potential of variety the whole product portfolio needs to be considered. This work also highlighted the importance of revenue generation, as opposed to cost reduction in isolation, to maximising business benefit. Where variety is used to distinguish a product from the competition or to demonstrate equivalence there needs to be a regular review of pricing to ensure appropriate positioning and to realise its revenue generating potential.

The third case study showed how an absence of information can lead to a proliferation of variety with potentially high costs as well as the importance of considering supply chain implications in decision making. Even where the fundamental design is not the primary focus of the activity developing a product strategy without the necessary information can have unforeseen and negative consequences for competitiveness.

Our work has focused on development of a set of tools that are applied systematically to expose the underlying information regarding the cost and potential benefit of product variety. When these tools are embedded as a method to support product development and definition it is possible to address the operational complexity arising from variety and to establish how that variety can be offered profitably. A cornerstone of this work is the involvement of all internal and external knowledge holders who not only inform the analytical elements of the method but also contribute new knowledge and understanding.

Conclusion

The benefits of a framework that integrates business functions on the basis of their involvement with a product or sub-system, and the knowledge and information that they are able to contribute to product definition, design or strategy decision making, have been described. The detailed information provided by the tools deployed within this framework exposes the impact of variety for discrete products, within product families or for a product portfolio. For complex products such as automobiles the analysis typically focuses on the design of sub systems, but in all cases the early application of the tools offers the greatest opportunity to deliver profitable design and variety.

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Is There a Need to Develop Designerly Approaches For Design Management Research and Practice?

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This paper explores the position and relevance of the so-called 'design science' approach in design theory, and asserts the need to develop designerly approaches in design and design management research. The authors propose that designerly approaches are effective when conducting research into design and design management in order to emphasize the nature of design practice, which is distinguishable from a 'design science' approach, and thus provide context-relevant research approaches.

This research was accomplished via an extensive literature review and a series of interviews conducted with six UK based design professionals – including both theorists and practitioners. Rather than simply presenting a series of designerly approaches, a propositional framework for conceptualizing designerly approaches is proposed.

'DESIGN SCIENCE' APPROACHES

There has been a predominant view in design research and theory that regards design as a scientific activity, with many attributing its origins to the modernist movement in the early part of the twentieth century (Cross, Naughton & Walker, 1981; Cross, 2007a), adopting either a rationalist or empiricist philosophy of science or a Popperian view towards design (Hillier, Musgrove & O'Sullivan, 1972). Such a view was strongly revered in the design methods movement of the 1960s, and – although its relevance having been questioned by many – developed continuously, specifically in the field of engineering and some branches of industrial design (Cross, 2007a; Margolin, 2010). Bruce Archer, John Chris Jones and Herbert Simon are noted as leading scholars in this movement. Archer (1981, 1984) claims design research is a form of systematic inquiry, Jones (1970) introduces a number of design

methods that can be used in different stages of the design process, and Simon (1969) influenced other scholars significantly with the idea of characterizing design as a problem-solving activity. Such attempts to 'scientise' design has been termed 'design science' by numerous authors. Cross (2007a: 45) defines design science as "an explicitly organized, rational and wholly systematic approach to design; not just the utilization of scientific knowledge of artefacts, but design being in some sense a scientific activity itself".

One premise for this design science view is the belief that design activity can be analysed in the same way as scientific activity. However, such a premise has not been universally accepted within the design-research community, as many researchers claim that design and science are fundamentally different activities (Bonsiepe, 2007; Krippendorff, 2007; Cross, Naughton & Walker, 1981). The fundamental differences between the two can be summarized thus: science (scientific activity) is regarded as a cognitively related activity, it aims to generate new knowledge, it is concerned with how things are – i.e. the natural world; meanwhile design (design activity) is generally considered to be a non-cognitively related activity, it aims to create new experiences, it is concerned with how things ought to be – i.e. the artificial world (Bonsiepe; 2007, Simon, 1969). Even the advocates of design science distinguish between the nature of design and that of science. These differing characteristics of design and science are backed up further by Rittel and Webber's (1973) notion of design problems as 'wicked problems', along with the work of Schon (1983) on designers' reflective practice in the design process, and Cross's (2007b) observation about designerly ways of knowing – all of them emphasize the distinctive nature of design.

APPROACHES TO DESIGN/DESIGN MANAGEMENT RESEARCH

Over the last couple of decades, design has developed research approaches and methods that are substantially drawn from other disciplines: scientific approaches (Poggenpohl and Sato, 2003), humanities approaches (Margolin, 1999; Margolin & Margolin, 2002), social science approaches (Julier, 2007), and so on. In other words, design research (and theory) has yet to establish a body of 'design' knowledge, and approaches and methods identified above lie significantly outside the boundaries of design. Also, design research has inherited the tension between cognitively related activity (research) and non-cognitively related activity (designing) (Bonsiepe, 2007; Krippendorff, 2007). This means that theories, concepts and methods that are central to design research but distinctive from other disciplines are scarcely recognised within the design discipline.

There have been several attempts to categorise design research – e.g. Frayling (1993), Jonas (2007), and Findeli (1995). Building upon Frayling's (1993) categorisation of research in design, namely, research into, through, and for research in (art and) design, authors are using a form of research through design and elaborating this is relevant to designerly approaches. According to Frayling (1993), research through design is using aspects of a design type of process, doing designing and making things as a way of researching. Also, Jonas (2007)

proposes that building a genuine research paradigm is provided with epistemological concepts by doing research through design.

Design research

As examined above, approaches to design rely heavily on the traditions of other disciplines. However, research approaches to design which are distinctive from other disciplines, have recently been acknowledged by some scholars. For example, Fatina (2005) identifies some characteristics found in design research programmes and asserts that a practice-based approach is the main characteristic that can be regarded as a designerly way of researching. Stolterman (2008) mentions that designerly approaches to design have existed throughout history, but in a less structured way, while science traditions have developed approaches and methodologies with their rigour and discipline. Cross (2001, 2007a, 2007b) suggests 'designerly ways of knowing' as a concept for building an appropriate paradigm for design research.

Thus, this paper does not attempt to present designerly approaches as being entirely novel to the design and design management research community, instead it maps out some of the theoretical underpinnings of such approaches and refines them through empirical studies to reinforce their relevance to a wider audience of design and design management researchers. The approaches offered here focus less on the research processes undertaken by researchers in design and management, and more on their conceptions of 'what the nature of design practice is' and 'how designerly perspectives can address that nature'.

Design management research

There is much discourse regarding definitions of design management. Cooper and Press (1995: 3; cited Heapo, 1989) offered a definition of design management as "the application of the process of management to the process of innovation and design". According to de Mozota (2003: 79), design management is "the planned implementation of design in a company to help the company achieve its objective". While for Best (2006), design management goes beyond the effective management of a design project to achieve strategic goals and objectives in organisations. Thus, it can be concluded that design management research encompasses areas relating to the role of design in corporate strategy, the strategic use of design in the process of new product development, design's role in strategy for improving company performance, the function of design to address organisational issues – e.g. innovation, creativity, quality, improvement of process and tools, and so on (Cooper & Press, 1995; Best, 2006). This paper explores research into design management focusing on how such research is conducted and does not differentiate who conducts the research, how the research is conducted not who conducts the research. The researchers could be from a design or management discipline.

A broad design-science approach permeates not only design but also management, and organisation studies in a context of increasing interest in design where the value of design is

now recognised. A number of researchers within management and organisation studies have paid attention to design with a view of a design science characterization of design as a rational objective problem-solving activity. For example, Boland and Collopy (2004) explain the appropriateness of a design attitude - a unique mind-set and approach to problem solving, to decision-making activity in management in which design is intrinsically perceived as a problem-solving activity. Inspired by Simon (1969), van Aken (2004) adopted design science for a paradigm shift from description-driven research to prescriptive-driven research within the field of management research. Denyer, Tranfield and van Aken (2008) believe that a design science approach to management helps develop solution-oriented or prescriptive knowledge and improves the effectiveness of organisations.

The relationship and relevance of research areas between design and design management for this study are shown in Figure 1. In this propositional diagram, design research is an activity that focuses on the aspects of design, and design management research is an activity that focuses on the aspects of design management. Thus, design research and design management research belong to the design and design management fields, respectively (Figures 1a and 1b), and design management is situated as a sub-set of design (Figure 1c). Also, design research and design management research overlap to some extent, as denoted in figure 1c. There are some differences between design and design management research- design management research more focuses on the managerial aspects of design management and does not focuses on the design elements of design research. However, they are all undertaken in design and concerns with design. This indicates that research approaches which are appropriate for design can be applicable to design management research, and thus design management research will benefit from identifying appropriate research approaches to design, all taking place within the boundaries of design.

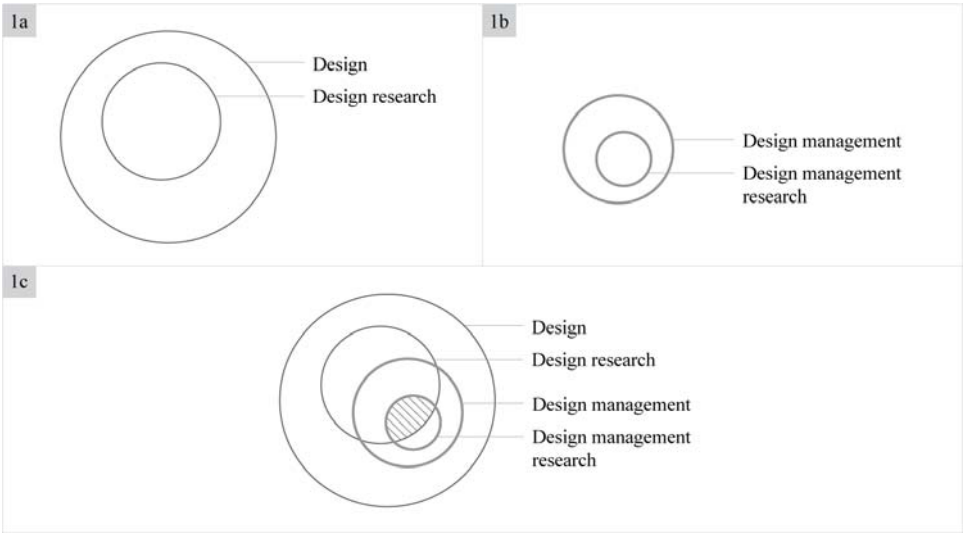

Figure 1. The relationship and relevance of design research and design management research

As discussed above, design research as a discipline is relatively young and has yet to develop a theoretical basis for researchers and practitioners. Also, a number of design management studies have tried to address managerial and organizational problems by adopting design

science approaches in which design is seen as a rational problem-solving process. In doing so, they have recognized the value of design's contribution to their fields, yet they have failed to pay sufficient attention to the nature of design and the distinctive set of practices of design professions – i.e. designerly ways of thinking and doing.

Thus, this research raises a number of questions, including: How can design harness designerly approaches to underpin research that is of relevance to both design theorists and design practitioners? What motivates scholars in management fields to study design? Is a design science perspective suitable for design management research and practice?

RESEARCH STRUCTURE

From a rigorous literature review, three main issues are raised:

1. Design science research approaches are insufficient to address the distinctive nature of design practice;
2. A theoretical basis for design (and design management) research has not yet been established;
3. Designerly approaches might be suitable for design and design management research.

It can be claimed that there is a gap between the epistemological and theoretical aspect of research and its reflection on and relevance to practice in the field of design and design management. Thus, this research is structured in a way that attempts to bridge the gap by searching for and developing designerly approaches that are relevant to both design researchers, who are developing theories and research methods, and practitioners, who are employing those theoretical bases in their day-to-day practice. For this reason, the research is structured to compare the views from two different categories: design theory and design practice; it focuses on the issues, such as the theoretical basis of design and design management research, the nature of design practice, and the relationship between them. The comparison of a theoretically-oriented view and a practice-oriented view is useful for developing designerly approaches relevant to both theorists or researchers and practitioners. This will also help to develop a propositional framework for a research perspective based on the research findings.

Method

To address the research issues raised in the literature, a qualitative semi-structured interview method, with open-ended questions, was employed for data collection. This enables researchers to gather the views and opinions that participants hold about a problem or issue, within their context, by talking directly to them (Creswell, 2009). An interview questionnaire was developed in terms of key concepts drawn from the literature, including their views of and experience in design research and practice, design management research and practice, perspectives of design practice and its distinctive nature, the role of designers and design managers, the design process, the design management process, design knowledge and

education. Interviews lasting 45-60 minutes were conducted with six design professionals – three theorists and three practitioners. All interviews – five face-to-face interviews and one video-call interview – were audio recorded and transcribed for analysis.

To analyze the interview data, inductive data analysis was employed. According to Cresswell (2009), inductive data analysis allows researchers to build their themes from the bottom up, by organizing the data into more abstract units of information (Creswell, 2009). In this way, the data are interpreted based on what researchers have seen, heard and understood. Through discussion of the issues around raised themes, a propositional framework was developed. The data (verbatim quotations) referred to here were collected in relation to the research project on the search for the core of design. A summary of this research was presented at the European Academy of Design Conference, 2011 (Jung, Evans & Cruickshank, 2011).

Participants

The participants in this study came from two different categories: design theory and design practice. However, the backgrounds of the respondents vary, all are from different sub-disciplines of design: industrial design, art and design history, engineering design, architecture, ergonomics, design studies. One reason for this is that the general direction of this research involves searching for and developing research approaches that are relevant and applicable to the practice of design and design management in general, regardless of what specific kinds of design activities take place within it.

From each category, three design theorists and three design practitioners were selected. Obviously, some areas of overlap exist between the two categories – e.g. design theorists who work as designers and design practitioners who teach design in academia. For this research, the selection of participants from the design theory and design practice spectrum sought to avoid overlapping areas and to approach the spectrum from both ends. The design theorists (DT) currently work in design academia, teaching design students in diverse design sub-disciplines. DT1 and DT2 are professors, both of them with about 15 years of experience in design academia. DT3 has about 8 years of teaching experience in design. The design practitioners (DP) were selected from amongst the design associates of the UK Design Council. DP1 is a commissioning producer and project manager, with more than 9 years of work experience, mostly working in the cultural sector, such as museums and galleries. DP2 has more than 20 years experience as a design strategist and has worked on a wide range of innovative product and service design projects, with clients including the BBC, British Airways, Hewlett-Packard, and many others. DP3 is the co-founder of a design consultancy whose clients are all in the public sector, including NHS trusts and local government, and has been active in that field for about 4 years.

As described, respondents are all experienced theorists and practitioners with substantial experience in their respective fields, which means they have established their own views and opinions. Specifically, the design practitioners selected for this study described themselves as design managers or ‘strategists’, who manage the process of design projects and create

services and opportunities for the clients, rather than designers who actually design products and services. In this sense, they are more design management practitioners than pure designers, and this gives more relevance to the research context which examines the fields of design management research and practice.

INTERVIEW FINDINGS

Two main themes emerged from the interview data analysis:

- Theme 1: The nature of design research and practice
- Theme 2: The relationship between research and practice of design management

Detailed accounts of the interview findings are discussed below under each theme.

Theme 1: The nature of design research and practice

The research revealed contrasting views on the nature of design research and design practice. One regards design as an inherently interdisciplinary activity, and the other views design as a unique set of practices. DT1 spoke of the interdisciplinary aspects of design, in terms of both research and practice. This participant stressed that "design research draws upon various disciplines, such as sociology, colour theory, aesthetics, ergonomics and so on". Also, design practice is characterised as a form of cross-working between disciplines, with designers having the role of catalysts. DT3 also acknowledged that design is useful, as general training, "but the way it is practised and taught is very specific". At the same time, most participants, regardless of their backgrounds, agreed on the uniqueness of design practice. They suggested that the uniqueness of design is something relating to studio practice in art tradition, creativity, synthesising and generating new ideas, novelty, change, attention to materiality, and so on. Thus, it can be concluded that design research and practice are inherently interdisciplinary, but the way that design is conceptualised and practised is different from the way the knowledge basis of other disciplines – e.g. management, science, engineering, etc. – is constructed and practised, i.e. there is a distinctive designerly way of thinking and doing.

There is another aspect of design research and practice that emerges from the data analysis, which is that design is always changing and evolving, embracing complexity. Participants explained that this unstable aspect of design results from it being constructed by other things, such as societal changes, social changes, cultural changes, technology changes, and so on. This complexity requires the design process to be effectively managed; as DP1 stated, "the context within which design practice is taking place becomes more and more complex, researches and practitioners need to embrace this complexity". This participant added that the use of design's capacity of dealing with complexity is getting more attention in management and business processes, specifically in terms of the disciplinary training that designers need in order to operate in that context.

Under this theme, even though specific views on what the nature of design research and practice means are not identical for all participants, both design theorists and design

practitioners demonstrated similar points of view on the general nature of design. This includes contradictions between interdisciplinarity and distinctiveness, and the complexity surrounding changing and evolving situations within design professions. Thus, the interview data show that there is consensus on the unique and distinctive nature of design research and practice, which is not about its process, but the way in which it is conceptualised and practised.

Theme 2: The relationship between research and practice of design management

Practitioners did not actually separate practice and research in design management. Instead, they tend to regard design management practice as embracing research as a part of it – finding out about problems or developing ideas – and sometimes seeing design management practice itself as research – they develop their research methods by learning through practice. In this sense, design management practice is a repetitive iterative process, rather than a rational one.

For DP3, research work is done to find out what the problems are, during which the appropriate research methods and tools needed to engage with people to extract information are developed by actually practising them. Thus, for this participant, there is no set of methods and tools which can be used for a certain type of practice, rather they develop by learning through practice. DP2 described the relationship between research and practice, based on experience. As a design strategist, this participant regards himself as a researcher rather than a designer, and articulated that research is about creating “design space”, within which massive possibilities exist with chaotic information, and that practice is about making the right choices by creating and managing that chaos. In this process, according to this participant, designers are not familiar with the theoretical basis of research, such as research methods, but know how the process is progressing in a non-rational way. This participant gave an example of a project involving working with an office furniture designer who went to a new leather shop, smelling leather and observing how it bends, because that was the information the designer needed for that project to help them make a decision. For this participant, this way of researching was “not rational, not irrational, but it was non-rational”.

Also, there is a concern over the gap between what has been theorised by research and what design management practice actually deals with. For example, DT2 stated that, “theorising design management is talking about ideal situations, but practice is adapted and is constantly about new situations”. This participant claimed that designers should or could theorise as they are making something – not getting an idea first and then designing it, but designing it first and then seeing what data and ideas are produced, as this is the way design practice proceeds in relation to research, going back and forth.

DP1 acknowledged that designers need to know about the management function in the scope of the research process. The process this participant goes through is described not as a design process but as a management process, the way management functions bring management

skills together. In that process, this participant sees the role of designers as defining and creating creative opportunities during that process, based on their design training and the creative idea-led environment that they inhabit; in that way they can bring more creativity to it. Thus, from this view, the design management process proceeds in a managerial way, with design's unique role and creative characteristics being part of that process.

Under this theme, design management research processes are perceived differently by theorists and practitioners. Theorists were more concerned with theorising through researching, while practitioners focused on the use of research to get the best results in practice. However, they both agreed that the way research is utilised is not completely structured, i.e. this is not in an orderly way, instead it is repeated, non-rational and non-linear.

DISCUSSION

Implications arising from the analysis of the empirical data are discussed below.

First, a design science perspective is not appropriate to address the complexity in design and design management practice. The notion of design complexity in design practice and research does not only appear substantially in the findings from the interviews, but also been addressed by many design scholars. For example, Stolterman (2008: 56) describes design practice as "handling complexity and a messy reality", and argues that design complexity is a different kind of complexity from other human activity, specifically that of science. Thus, in his view, scientific approaches to design practice are not appropriate; and thus, design research should develop appropriate approaches and methods with its own rigour. Even though his focus is mainly on human computer interaction (HCI) design, it can be generally applied to other design disciplines, in varying degrees.

Second, designerly approaches to research should be reflective, based on both theory and practice. They cannot only reflect on the theoretical basis of research, such as research methods and processes, and also cannot only reflect on what designerly practice is. In other words, design and design management research cannot remain just a theoretical activity – only generating information and knowledge towards research outcomes – without any significance upon what design practice is. Conversely, they cannot just remain as a practical activity – enhancing the understanding of the nature of design practice, without any significance upon what research outcomes imply for practice. They should reflect both theory and practice. Consequently, knowledge generation through research should direct towards both research outcomes and an understanding of what design practice is: it should create information that designers can use, so that creative opportunities can expand, and also help designers to make informed choices and develop their ways of doing research within the process. One of the findings from the interview data is that there is a slight difference in the views on design and design management research processes between theorists and practitioners, with theorists being more concerned with theorising by researching, while practitioners focused on the use of research to get the best results in practice. Thus, a

potential direction for developing designerly perspectives to design and design management is to address this difference, bridging the gap by reflecting on both theory and practice.

Third, the research findings also have implications for design and design management education in terms of the relationship between theory and practice. According to Ashton (1998), design schools in the UK have tried to teach design students and equip them with business and management training, yet this has not been successful, either in stand-alone business courses or in integrated business-design studios, not only because of the theoretical nature of business and management studies, but also in terms of their ability to think theoretically about design itself. This is in line with the importance of designerly perspectives to design management research and practice. Employing such perspectives enables designers and design students to be able to theorise, based on their practice and research findings which shape their theoretical basis for practice, and also to be able to improve their practice by adapting the theoretical fundamentals which are constantly evolving, in other words, learning through practice.

Finally, there are implications for the need to develop designerly approaches, and why these are of value to design management research. Design has become a source of research in management, with increasing value of design to management and its contribution to address the problems faced in management research. However, theories, concepts and methods that underlie design research have not yet been established. Kimbell (2009) suggested that the lack of a unified theoretical basis of design inhibits design's ability to serve its contribution to research in design and management. Thus, identification of a core conceptual basis of design research will serve to establish design research as a recognised established discipline (Love, 2002). This will also enable design management researchers who investigate the value of design to address managerial issues, and who try to integrate design with their disciplines so as to solve the problems they face, and thus benefit from adapting well-developed designerly perspectives in which the distinct nature of design practice is recognised well. This identification of a core theoretical basis for design research can be helped by achieving a fundamental understanding of the nature of design practice. Stolterman (2008:55) asserts that "any attempt by interaction design research to produce outcomes aimed at supporting design practice must be grounded in a fundamental understanding of the nature of design practice". Stolterman emphasises the importance of such an understanding to develop design research into a well-grounded and rigorous discipline equipped with a set of design methods and techniques to better support practising designers. Design practice in a management context and management practice in a design context will both benefit from well-developed designerly research approaches which reflect on an understanding of the nature of design practice.

Based on these implications, a propositional framework for developing designerly approaches to design and design management has been developed, based on what the interview findings revealed and implied (Figure 2). Inspired by the work of Dorst and Dijkhuis (1995), this framework represents the differences between the two main paradigms in design research:

design science approaches and designerly approaches. According to Dorst and Dijkhuis (1995), there have been two contrasting paradigms for describing design activity: design as a rational problem-solving process and design as a process of reflection-in-action. The former is linked to the fundamental concept of design science approaches in which design is seen as rational problem-solving – rooted in Simon. The latter is akin to the designerly approaches in which design is a more reflective and iterative process rather than a rational process – founded on Schon.

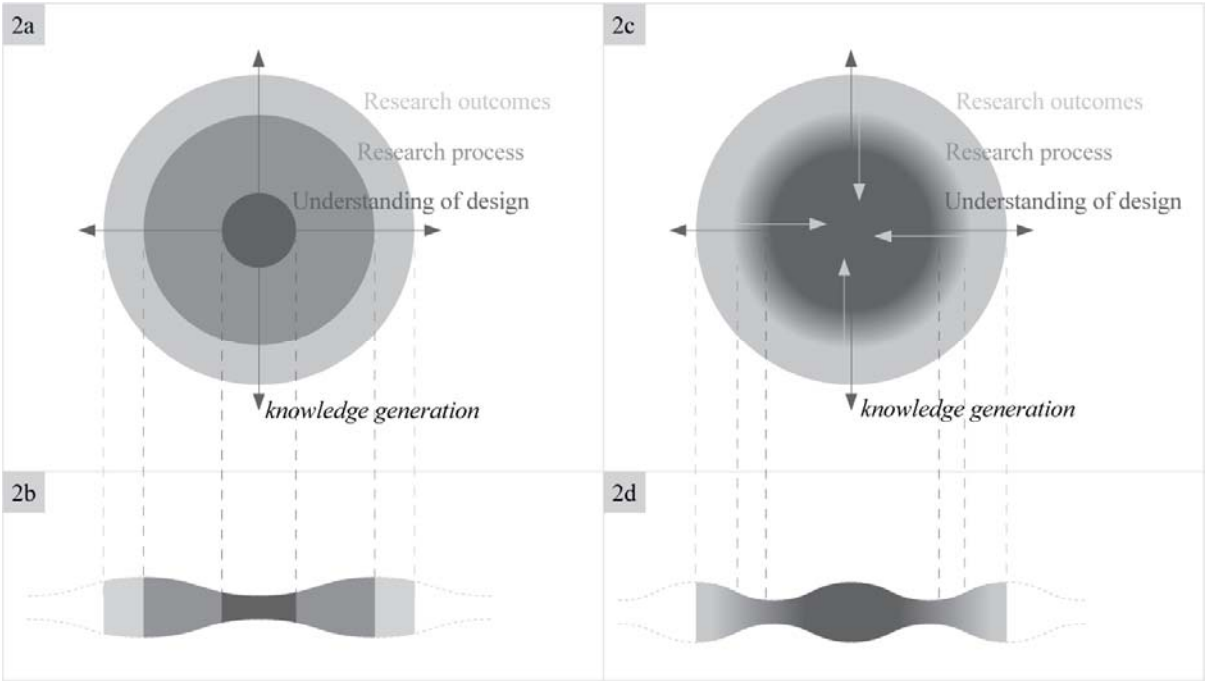

Figure 2. A propositional framework for developing designerly approaches

In the above figure, 2a and 2b (LHS) describe an interpretation of design science approaches while 2c and 2d (RHS) illustrate the way that a propositional viewpoint of the research is visualised. Specifically, 2a and 2c are the overlooking views on the activities in research and 2b and 2d are side views where the importance of each activity is shown. Fundamentally, this framework hints that research in the design and design management fields has its core based on an understanding of the nature of design practice and that, based on that, the research process proceeds towards research outcomes. Within 2a and 2b, how research starts is based on a less established theoretical basis of design practice in which the importance of the nature of design practice is less recognised. It moves towards research outcomes through a concrete rational research process in which design is seen as problem-solving, and in which the importance of research process and methods is significant. Here, the knowledge expands from design practice, though research process, and toward research outcomes. In contrast, 2c and 2d demonstrate research starting from a fundamental understanding of the nature of design practice; it is as important as research outcomes, creating massive and chaotic information and knowledge, yet through a rather non-linear and less fixed way, the process is fragmented and sometimes dissolves in research, with less significance. And then, in turn, research outcomes inspire and develop the fundamental understanding of design practice,

generating knowledge in that way reversely. The above perspectives form a core aspect of an ongoing inquiry into designerly approach to research – in design theory and practice.

CONCLUSIONS

In conclusion, this research supports the authors claim that there is a need to develop designerly approaches, not only within design research that addresses managerial topics but also within managerial academia that researches into design. Identification of the core of design theory and practice can serve as a first step in clarifying and emphasizing what designerly approaches are and should be. Doing so will no doubt enhance design management research and help it build its own fundamental theories, and specifically its impact on design management practice. It may also promote a meaningful discussion on the relevance of design management as a discipline and as a course of study. This paper has implications for the theory and practice of design management. Concerning the theory of design management, the design science perspective needs to be reconsidered. A designerly perspective will help in this by shifting the attention to what design professionals – both theorists and practitioners – think and do. For the practice of design management, this design-oriented perspective will open up more possibilities for tackling the issues it faces, related to the role of design. Finally, the identification of a designerly perspective will assist in the conceptualization of the role of design in management contexts and lead to further investigation into a strategic role and the impact of design.

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How Ideation Stars Acquire and Disseminate Customer and User Knowledge in Medtech Innovation

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One fundamental issue in innovation and design management is how companies acquire, disseminate and exploit knowledge about their customers and users in order to innovate. In this article we apply social network analysis to investigate whether differences exist between ideation stars and other actors in regard to acquiring and disseminating customer and user information. The research was conducted within a business unit in a large medical technology company. Our findings show that such differences do exist; the biggest difference seems to be that ideation stars overall have a larger number of weak ties (less frequent connections), both externally and internally. At the same time they tend to have a larger number of strong ties (more frequent connections) to spread valuable information about customers and users internally. Based on these findings we suggest managerial implications and directions for future research.

INTRODUCTION

Innovative ideas are the seeds for successful new products, and therefore is continuous generation of innovative ideas vital for companies in order to innovate (see e.g. Cooper, 1986). Yet relatively little attention has been paid to understanding idea generation in the current literature (Dahl and Moreau, 2002). To begin with, an innovative idea is an idea with potential to become successfully realized and implemented and thus creates new value for the company's customers and users. Even so, there are contradictory views in the literature on how employees' interaction and communication with and about customers and users influence their ability to generate innovative ideas. Several scholars have observed that the

involvement of users may have a positive impact on a company's idea generation efforts (see e.g. Gruner and Homburg, 2000; Kristensson et al., 2004). Direct access to customers and users could provide new and context-rich information that challenges the established assumptions regarding, for instance, customers' and users' needs (von Hippel, 1988). However, much of current research on customer and user involvement in idea generation has considered more formal methods with, for instance, lead users – i.e. users who identify market needs before the majority of users in the market place (von Hippel, 1988). Much less research has considered how the overall acquisition of customer and user information, which also includes informal connections with customers and users, influences the emergence of innovative ideas.

Kanter (1988) argues that "to produce innovation, more complexity is essential: more relationships, more sources of information, more angles on the problem, more ways to pull in human and material resources, more freedom to walk around and across the organization" (p. 178). This implies that more heterogeneous and frequent interactions with a larger number of different users and customers would be beneficial for an individual to generate innovative ideas. But previous research also indicates that too much exposure to, and focus on, customers and users may hamper the generation of innovative ideas in a company. For instance, Bennet and Cooper (1981) argued that listening to the customer's articulated wishes will mislead innovators since the customer's perception is oriented towards familiar solutions rather than innovative ideas. Especially internal information flows are more likely to mirror existing assumptions and are likely to be confined to the company's established set of customers and users (Day, 1994). Moreover, it is argued that customers and users neither know what is technologically possible, nor are they adequately informed about the latest market trends to support the generation of innovative ideas (see e.g. Hamal and Prahalad, 1994). Also cognitive limits may restrict the amount of information that individuals can process (Simon, 1976). Too much information may simply overload innovators. In line with these findings, Veryzer (2005) argues that more discontinuous ideas often emerge in R&D laboratories that are isolated from market information and are thus technology-driven rather than market-driven. These results suggest that companies should restrain their interaction with customers and users in order to generate innovative ideas. At the same time, if company employees fail to interpret customers' and users' needs and requirements when developing new products, this often leads to failure in commercializing (see e.g. Cooper, 1986).

One set of important actors in the company's exploitation of user and customer knowledge are ideation stars, i.e. individuals within the company who continuously generate innovative ideas that become valuable to the company. These actors are particularly interesting since previous research reveals that effective use of market information is just as important as the sharing of information (Ottum and Moore, 1997). They demonstrate that the gathering and sharing of information is only found to be important if the information is used effectively. Ideation stars by definition create value, either as an effective response to market information or as a consequence of being isolated from the information. Previous research also points out

that individuals, who are highly linked to the internal organization as well as customers, so-called boundary spanners, are useful for generating critical ideas and input (see e.g. Allen, 1977). However, the opposite has not yet been established in research, i.e. to what extent ideation stars are boundary spanners of customer and user information. Therefore, increased understanding of how ideation stars acquire and spread customer and user information in comparison to less innovative individuals is needed.

Summarizing the above, we note that the current literature is inconclusive regarding whether and to what extent highly innovative individuals handle customer and user information differently from less innovative individuals. In this article we intend to clarify this question by exploring how ideation stars within an innovative medical technology company, acting in a B2B context, acquire and disseminate information about users and customers in their external and internal networks. In the next section we provide a short introduction to the medical technology industry and its specific contextual conditions for customer and user involvement relevant for this article. After that, we further present relevant theory and the methods used in our study, followed by empirical results, analysis and discussion, and conclusions.

Users and Customers in Medical Technology Innovation

The user group of medical technology is composed of healthcare professionals, patients and carers, as well as professionals allied with healthcare – all with different needs and requirements (Shah and Robinson, 2006). All these different actors often play an important role in the development of innovative medical technology (see e.g. Biemans, 1991). In the development of new products the user is mainly concerned with clinical performance, patient safety, usability and compatibility with current equipment. However, many medical technology companies are acting in a B2B context where they also have to consider the needs and requirements of the customer. In most cases, the customer will be either the head of a clinical department or a centrally located procurer at a hospital or a regional department. Previous research indicates that the requirements and priorities of customers often differ from those of users (Gummesson, 2008). The customer will consider not only clinical benefits but also the health economic aspects related to a new product as well as the overall service provided by the manufacturer. Thus, it could be assumed that information from users and customers differs and influences the emergence of innovation in different ways. Hence we examine both these streams of information in this article. Although collaboration between medical technology company employees and healthcare professionals is fundamental in medical technology innovation, there are several barriers to this collaboration. These barriers are, for instance, a lack of resources in healthcare, patient safety regulation, and careful attitudes influenced by commercial law. An even more obvious barrier is the physical distance between industry and healthcare. For these reasons medical technology companies hire and incorporate healthcare professionals to better access their perspective and improve innovation performance (see e.g. Chatterji et al., 2008; Wadell et al., 2011). Previous research shows that incorporated users typically are not seen as ideation stars. However, they

contribute significantly to innovation by providing valuable feedback on others' ideas (Wadell et al., 2011). Therefore, we also investigate how ideation stars acquire information from incorporated users in comparison to non-ideation stars.

THEORETICAL EXPOSITION

As presented in the introduction, there is incompleteness in the current literature considering how the sharing of external and internal information regarding customers and users influences the emergence of innovative ideas. Since ideation stars by definition create value out of the market information they acquire or as a consequence of being isolated from this information, we want to investigate how these actors handle customer and user information in comparison to non-ideation stars. The aim of the theoretical exposition is to elaborate on the definition of ideation stars and why these individuals matter in an innovating company. We also introduce social network theory which provides us with a framework to further understand the structural patterns of information acquisition and dissemination in organizations, and how these patterns may influence the performance of idea-generation stars.

Ideation stars

Idea generation is a key process in the front end of innovation and is one of the highest leverage points for a company. Thus, it can be assumed that so-called ideation stars who continuously generate innovative ideas that become valuable to the firm are key actors in the innovation process. In fact, idea generation always takes place within the brains of individuals, and has been described as the output from a new intersection of already existing knowledge, plans or assumptions (Koestler, 1989). A large body of the existing theory on collaborative idea generation has focused on formal idea generation methods within groups, such as six thinking hats (De Bono, 1999), and lead-user workshops, as well as expert workshop creativity techniques such as trend cards (Arnold et al., 2010). Yet previous research highlights the innovation potential that is embedded in the informal structures of an organization (Nonaka, 1994). Studies have indicated that social interaction and information sharing between individuals is highly important for the creation and development of ideas (Nonaka, 1994; Leonard and Sensiper, 1998). Björk and Magnusson (2009) observed that the number of persons with whom a person has worked actively when creating ideas positively influences the quality of the ideas created. As previous research provides us with ambiguous views regarding how the overall exposure to customer and user information influences the emergence of innovative ideas, we want to investigate whether ideation stars handle this information differently from non-ideation stars. Social network theory provides theoretical models that we can apply in order to get a more detailed picture of the handling of user and customer information by ideation stars and other actors, and thereby be able to analyze the extent to which these differences can explain variation in idea-generation performance.

Social Network Theory

As suggested above, information sharing between individuals is important for the generation of innovative ideas. The social network perspective on the organization allows us to view the organization as a network built up by relationship (ties), which facilitates information flows between individuals. By investigating these relationships and information flows we have an opportunity to further understand organizational performance (Wasserman and Galaskiewicz, 1994). This approach especially allows us to review the more informal organizational structures that innovators use to find and access information necessary to innovate (Kanter, 1988). Given this, a social network perspective seems suitable for exploring how ideation stars acquire and disseminate customer- and user information, as compared to non-ideation stars.

How, then, can we analyse and understand these highly innovative individuals' location in the flow of customer and user information? It is almost self-evident that individuals with many links to other individuals have more possibilities to access information and resources than do individuals with fewer connections. Therefore, highly connected individuals have an information advantage that positively influences innovation and organizational performance (see e.g. Cross and Cummings, 2004). However, previous research also suggests that different network structures provide different benefits. Granovetter (1973) argues that weak ties between individuals are beneficial for certain tasks since these ties are more likely to hold non-redundant information and knowledge than strong ties. It is argued that weak ties between individuals generally facilitate creativity and that strong ties are not associated with creativity (Perry-Smith, 2006).

An individual who holds a position with several non-redundant connections is located in a structural hole (Burt, 1992). Individuals occupying structural holes may use this diverse input for the creation of innovative ideas (Burt, 2004). It is thus suggested that the most beneficial network in the early stages of innovation is a "non-redundant, heterogeneous network with many weak ties", but it is also stressed that common knowledge and mutual understanding are important (Kijkuit and Van Den Ende, 2007, p. 874). This creates a paradox since closed networks are characterized by high levels of trust, shared identity, and shared norms (Coleman, 1988), which facilitate information flows, open exchange of knowledge, and collaboration. Hence, dense network structures facilitate the transformation of complex knowledge and can thereby promote innovation activities (see e.g. Ahuja, 2000). It is thus suggested that the source of value might be created by brokering across structural holes, while denser structures might be necessary to realize this potential value (Burt, 2001). These contradictory views become even more interesting when the transferred information, in our case customer and user information, has an ambiguous influence on the emergence of innovative ideas. Hence our intention to investigate whether there are any differences between ideation stars and non-ideation stars in the way they acquire and share information regarding customers and users. In particular we focus on the number of different sources for

customer and user information, as well as the use of weak and strong ties for information transformation. We formulate the following specific research questions for our study:

RQ1: Does the overall external interaction with customers and users differ between ideation stars and non-ideation stars?

RQ2: Does the overall internal sharing of customer and user information differ between ideation stars and non-ideation stars?

APPLIED METHODS

In order to answer the stated research questions an empirical study was performed within a business unit of a large medical technology company. The company has a long tradition of developing high-technology products for intensive-care units, and has been one of two market leaders over the last decades within its product segment. Moreover, at the time of the study the business unit had four full-time employed incorporated users that participated in the innovation work. A questionnaire was designed in order to identify ideation stars and collect data on external interaction with customers and users as well as internal flows of user and customer information. A paper form questionnaire was handed out to the 116 employees within the business unit and it was returned completed by 86 employees (response rate 75%).

In addition to the questionnaire, 11 interviews were conducted with 2 identified ideation stars as well as 9 non-ideation stars. The aim of the interviews was to further understand the context, confirm the results from the questionnaire and further understand how ideation stars handle customer and user information in comparison to non ideation stars. The company had also been involved in a long-term action research project with the researchers. Thus, there had been an ongoing discussion between the researchers and the managers in research and development regarding the company's innovation activities.

In order to identify ideation stars each respondent was handed a list of all colleagues in the business unit and was asked to nominate three colleagues who continuously had contributed with innovative ideas that had become valuable to the company during the last three years. To avoid the bias of colleagues only nominating their friends, an ideation star had to collect at least two nominations in order to be treated as an ideation star. To collect the employees' interaction with external customers and users, the key groups of users and customers were identified together with the marketing department. The customers that were identified were national and international purchasers and heads of clinical departments. The user groups were national and international physicians, nurses, clinical researchers, bio-engineers, and family members. The respondents were asked to indicate how frequently, on average, they had been in contact with actors in these groups over the last three years. The frequency measures applied were "Never", "Once a year", "Once a month", "Once a week", "A few times a week", "On a daily basis" and "Don´t know". Frequency of interaction is a commonly used measure to capture strong and weak ties (McEvily and Zaheer, 1999). In this case we asserted that interaction which had occurred less frequently than once a week was considered as a

weak tie. Interaction that on average had occurred once a week or more frequently was interpreted as a strong tie.

We applied a similar approach to capture the internal information flows. Each respondent was handed lists of their colleagues and asked to indicate how frequently, on average, they had received valuable information regarding users and customers (two separate questions). We also provided a definition of valuable customer/user information – as information that improves one's knowledge and understanding of the user's/customer's needs, incentives to use/buy the product, attitudes, values and ideas. The frequency measures applied were "A few times a year", "A few times a month", "A few times a week", and "On a daily basis". The respondents were asked to leave a blank if they had not received valuable information from a colleague. There had been very little employee turnover within the business unit during these three years. To further ensure the validity of the questions, a pre-test and evaluation of the questionnaire was carried out with five participants. The data processing and analysis were done in three steps: (1) ideation stars were defined; (2) each person's internal and external network with respect to users and customers was computed; (3) the means of ideation stars and non-ideation stars were compared in a t-test. In order to collect relevant control variables the respondents were also asked to indicate age, education length, and tenureship. The nomination of ideation stars resulted in 16 ideation stars (19% of all respondents). The ideation stars received between 2 and 22 nominations. Another 9 employees received 1 nomination. The majority of the ideation stars were located in the research department and the development department, but also within aftermarket, marketing, and operations (see Table 1).

Table 1 – Number of ideation stars per group

Group	Number of group members	Number of ideation stars	Ideation stars calculated as a % of the total number of group members
Aftermarket	4	1	25
Finance	2	0	0
Marketing	6	2	33
Operations	4	1	25
Research	6	5	83
Incorporated users	4	0	0
Quality and Environment	3	0	0
Sales	5	0	0
Product Development	51	7	14

In the second step, the heterogeneity of external interaction and internal information flows was calculated. This was performed for both customer and user interaction as well as for internal customer and user information flows. Strong ties were considered as interaction or information acquisition that on average occurred more frequently than on a monthly basis. The external interactions were computed by hand, summarizing each individual's total number of strong and weak ties to users and customers in Excel. The internal information flows were computed using UCINET social network analysis software v. 6.286 (Borgatti, Everett, Freeman, 2002). In UCINET we developed dichotomized matrices with strong and weak ties and applied the Degree Centrality function. This function provided us with both an OutDegree measure (i.e. how many colleagues ego receives information from) and an InDegree measure (i.e. how many colleagues that receive information from ego). Thus, for incorporated users we only computed OutDegree Centrality. In the third step, we compared the ideation stars' average interaction with customers and users, as well as their internal information handling regarding customer and user information, with those of non-ideation stars. For this purpose we applied a t-test. The t-test assesses whether the means of two groups are *statistically* different from each other. An independent sample t-test was computed using the statistical software PASW Statistics 18 (SPSS, 2009).

EMPIRICAL RESULTS

Considering the external interaction with customers, the results show that the ideation stars overall had contact with a larger number of different customers through weak ties than non-ideation stars had (1.88 compared to 0.61; $p < .001$) (see Appendix A). The same pattern was displayed for users, where ideation stars had a mean of 6.38 and non-ideation stars 2.60 ($p < .001$). No ideation stars, and only a small number of non-ideation stars, experienced that they had had strong ties to customers and users during the time period. A similar pattern also counts for the ideation stars' acquisition of valuable user information through their internal network. The mean number of weak ties from which ideation stars acquire valuable user information was almost twice as high as for non-ideation stars (14.19 compared to 7.94; $p < .01$). No significant results were obtained for strong ties regarding valuable user information. Moreover, no significant differences were observed for ideation stars' acquisition of valuable customer information in their internal network. However, the group of ideation stars acquired, on average, user information from a larger number of incorporated users through weak ties than did non-ideation stars (3.44 compared to 2.04; $p < .01$). Also for incorporated users no significant differences were encountered for strong ties regarding valuable user information. Considering the dissemination of valuable user information, there were significant differences in mean values between ideation stars and non-ideation stars for both strong ties (3.50 compared to 1.54; $p < .05$) and weak ties (16.81 compared to 8.36; $p < .05$). Ideation stars also disseminated valuable customer information to a larger number of colleagues through strong ties than did non-ideation stars (0.38 compared to 0.11; $p < .05$). However, there were no significant differences in mean regarding the dissemination of

valuable customer information through weak ties. Considering the control variables, ideation stars had a significantly higher mean on education and tenureship but not age.

DISCUSSION AND CONCLUSSIONS

The results demonstrate that there are differences between ideation stars and non-ideation stars in the way they interact with users and customers and the way they handle information regarding these actors internally. On average, ideation stars had more than twice the number of weak ties to different user and customer groups compared to non-ideation stars. The weak ties stand out as even more important since the ideation stars unanimously indicate that they had no strong ties to customers and users during the time period. In the group of non-ideation stars there were a small number of individuals with strong ties to customer and user groups. Thus, in line with Kijkuit and Van Den Ende (2007) we argue that less frequent contacts with a large number of different customers and users are beneficial from an idea-generation perspective. Moreover, strong ties to a large number of customers and users do not seem to be associated with the generation of innovative ideas. Much of previous research argues that companies should focus their user involvement activities on identifying so-called lead users in the market place in order to generate innovative ideas (see e.g. von Hippel, 1988). Our results provide a complementary view, arguing that providing innovative individuals with the right conditions to interact with different types of customers and users might be fruitful for a company's idea generation efforts.

Moreover, our results indicate that ideation stars acquire valuable user information internally through a larger number of weak ties than do non-ideation stars. This is somewhat surprising since previous research (Day, 1994) shows that internal information flows tend to mirror existing assumptions regarding customers and users and thus should have a modest influence on idea-generation performance. This pattern also accounts for the information acquisition from incorporated users. These results are in line with Burt (2004) and suggest that individuals in so-called structural holes with a large number of weak and non-redundant connections are in a beneficial position to generate innovative ideas. Until now this has not been established for customer and user information. Moreover, our results indicate that ideation stars overall spread valuable customer and user information to a larger number of colleagues than non-ideation stars. However, as already mentioned, we know that non-ideation stars also span customer and user information (for instance incorporated users). Allen (1977) argued that boundary spanners of customer and user information often become ideation stars. Yet we find the converse – that ideation stars tend to be boundary spanners of customer and user information. Interestingly, ideation stars share information to colleagues through a larger number of strong ties than do non-ideation stars. Our results also reveal that ideation stars handles internal customer and user information in different ways. On the whole, ideation stars tend to be more actively involved in the acquisition and dissemination of internal user information rather than customer information.

Then, what managerial implications do these results encounter? Managers must pay attention to the interaction with customers and users as well as the internal information sharing regarding customers and users. They must be able to employ appointed methods and approaches, such as lead-user approaches or internal brainstorming sessions, but must subsequently promote more informal interaction with different types of customers and users. However, it is questionable whether these more free interaction patterns should be applied to the entire organization or specifically to those who display an innovating talent? Managers can try to identify ideation stars within the organization and provide them with even better conditions to interact with customers and users. Another strategy would be to teach all employees to adopt the behaviour of ideation stars. Perhaps there is a potential in both these paths in order to increase idea-generation performance. Still, adopting the behaviour of ideation stars is certainly not simply about copying their frequency of interaction with customers and users. It will also be important to consider how these highly innovative individuals actually interact and communicate with customers and users, the content of these interactions, and how they make sense of this information and transform it into innovative ideas. Other ways to support the emergence of innovative ideas could be to create arenas and meeting points with users and customers in healthcare where information and knowledge can be exchanged more freely. This includes creating and supporting communities for interaction within healthcare, using collaborative idea-generation techniques with healthcare professionals, to increase formal communication with users and customers but also the communication regarding customers and users between individuals from different departments.

LIMITATIONS AND FUTURE RESEARCH

One limitation of single case studies is certainly the difficulties of generalization. We cannot say whether our findings count for other types of companies in other contexts. Moreover, we have taken reasonable precautions to protect the validity and reliability of our data, but we must reiterate that some error or bias may be present. This could influence the results. To rule out this potential confound, future studies should attempt to gather real-time longitudinal data on interaction and information sharing. Furthermore, future research could include other data collecting methods like for instance evaluation of idea databases or patent applications in order to identify ideation stars. Such research approach could provide the possibilities to ensure the validity of the dependent variable in a more comprehensive manner. Based on the results we see several interesting directions for future research. Since innovative ideas often emerge in the intersection between customer/user needs and technological opportunities it would be interesting to also map how ideation stars are located in the flow of technological information as compared to non ideation stars. Furthermore, it would be interesting to investigate more in detail how the differences in handling customer and user information actually influence the emergence of innovative ideas. Finally, our results indicate that ideation stars benefit from being in a structural hole position in the acquisition of customer and user information. At the same time they seem to limit the opportunities of their peers to

occupy this position since they disseminate this type of information through a large number of strong ties. Further research should investigate this phenomenon and how it influences idea generation performance.

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Appendix A – Independent t-test sample results						
Variables	**Role**	**N**	**Mean**	**Std. Deviation**	**Std. Error mean**	**Sig. (2-tailed)**
Education	Stars	16	1.6250	.61914	.15478	.014*
	Non Stars	70	1.9429	.41304	.04937	
Age	Stars	16	3.1875	.65511	.16378	.097
	Non Stars	70	2.8571	.83901	.10028	
Tenureship	Stars	16	4.9375	1.18145	.29536	.001***
	Non Stars	70	2.6857	1.60202	.19148	
Number_of_weak_ties_to_external_customers	Stars	16	1.8750	1.70783	.42696	.001***
	Non Stars	70	.6143	1.24287	.14855	
Number_of_strong_ties_to_external_customers	Stars	16	.0000	.00000	.00000	.321
	Non Stars	70	.0143	.11952	.01429	
Number_of_weak_ties_to_external_users	Stars	16	6.38	3.181	.795	.000***
	Non Stars	70	2.60	2.705	.323	
Number_of_strong_ties_to_external_users	Stars	16	.0000	.00000	.00000	.223
	Non Stars	70	.2429	.78824	.09421	
Number_of_weak_ties_to_incorporated_users	Stars	16	3.4375	1.59034	.39758	.002**
	Non Stars	70	2.0429	1.60105	.19136	
Number_of_strong_ties_to_incorporated_users	Stars	16	.5625	1.26326	.31582	.432
	Non Stars	70	.3571	.85186	.10182	
Number_of_weak_ties_internal_userinfo_indegree	Stars	16	16.812	11.07682	2.76920	.011*
	Non Stars	70	8.3571	10.17675	1.21635	
Number_of_strong_ties_internal_userinfo_indegree	Stars	16	3.5000	2.78089	.69522	.017*
	Non Stars	70	1.5429	2.45354	.29325	
Number_of_weak_ties_internal_userinfo_outdegree	Stars	16	14.187	7.79931	1.94983	.008**
	Non Stars	70	7.9429	6.61111	.79018	
Number_of_strong_ties_internal_userinfo_outdegree	Stars	16	1.8750	2.57876	.64469	.660
	Non Stars	70	1.5571	2.52314	.30157	
Number_of_weak_ties_internal_customerinfo_indegree	Stars	16	5.5625	7.86527	1.96632	.171
	Non Stars	70	3.5714	4.42513	.52890	
Number_of_strong_ties_internal_customerinfo_indegree	Stars	16	.3750	.50000	.12500	.05*
	Non Stars	70	.1143	.46758	.05589	
Number_of_weak_ties_internal_customerinfo_outdegree	Stars	16	4.6875	5.83916	1.45979	.079
	Non Stars	70	2.5571	3.91813	.46831	
Number_of_strong_ties_internal_customerinfo_outdegree	Stars	16	.3750	1.25831	.31458	.170
	Non Stars	70	.1143	.46758	.05589	

* p < .05; ** p < .01; *** p < .001

Strategic Use of Design in the Process of Becoming a Global Brand: The Case of Vitra Bath, a Leading Sanitary Ware Manufacturer from Turkey

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This paper aims to provide a closer look at the strategic role of design for businesses, using a longitudinal case study on the evolution of industrial design, from a minor operational tool to a strategic business resource, in a leading sanitary ware manufacturer, from Turkey. The study analyzes the process of realization to design's strategic role for the company, and tries to identify major concerns and problems faced throughout the organization, when attempting to move design from the stage of its operational use to the stage of its strategic use.

1. INTRODUCTION

There is rising emphasis on design as a major driver of innovation and business performance. Many studies have identified and underlined the role of industrial design in increasing competitiveness (Rothwell, 1984; Ughanwa and Baker, 1989; Roy, 1990; Walsh et al. 1992; Roy and Riedel, 1997; Hertenstein et al. 2005) and in fostering innovation (Thackara, 1997; Bertola and Teixeira, 2003; Verganti, 2009). These studies raised attention to and intensified research on the acquisition and development of industrial design capabilities, and contributed to the growing recognition of design as a strategic business resource for the generation of product, process and business innovations (Borja de Mozota, 2003; Utterback et al., 2006; Verganti, 2009).

This paper aims to provide a closer look at the strategic role of design for businesses, using a longitudinal case study on the evolution of industrial design, from a minor operational tool to a strategic business resource, in a leading sanitary ware manufacturer, from Turkey. The company in focus is a Turkish sanitary ware manufacturer that achieved a remarkable success in several spheres, firstly, by being one of the few companies in Turkey - a late industrialized economy - which has managed to upgrade and establish itself in the global value chain with its own brand name. Again, it is one of the quite few Turkish companies, which has

recognized design's strategic role - relatively in advance -, and has been working consistently on the integration of design into the company's overall strategy and business processes since the last decade. Using VitrA Bath's case study, the paper aims to inform two main issues:

1. The evolution of industrial design capabilities in a large manufacturer company from a newly industrialized economy (NIE);
2. Major concerns and problems faced throughout the organization when attempting to move design from the stage of its operational use to the stage of its strategic use - hence during its management and its integration and coordination with business strategies and overall business functions.

After providing a conceptual background and the methodology used in data collection, the paper first presents a review of the acquisition and development of industrial design capabilities in VitrA Bath. This provides information and insights on the gradual process of building awareness about the strategic potential of industrial design (besides its solely operational function), and the process of realization to its strategic role in business transformation and brand strengthening. The paper then focuses on the current practices and policies in the utilization of design, complementary to company's corporate strategies, and specifically complementary to its major long term goal of establishing VitrA as a global brand.

In order to understand design's current utilization in the company, a wide array of issues are analyzed like: how design is integrated into company's global brand strategy and corporate planning, its position inside the organizational structure, how it is integrated with other business functions and current tools and models employed in utilizing design knowledge and capabilities. Besides examining the current use of design, the paper also aims to identify and analyze major issues and problems related to the organization and management of design when trying to establish and use it as a major strategic resource. The central questions raised throughout the study are: what are the initial steps towards the strategic use of design, what kind of problems has the organization confronted when attempting to pass to the stage of strategic use of design, and what have been the critical steps in the successful establishment of design as a strategic tool?

2. CONCEPTUAL BACKGROUND

Design has been recognized as a major source of competitive advantage through its critical impact on both price and non-price dimensions of competition, by determining product attributes which have a positive relationship with a firm's innovative and commercial performance (Walsh et al. 1992). Reviewing existing literature, Trueman and Jobber (1998) have categorized different levels that design contributes to the performance of a firm and its products, on 4 levels as: value, image, process and production. At the value level (product level) design increases customer's perceived value by determining the product's appearance, ergonomics, functionality, quality, ease of use, performance, eco-efficiency; at the image level (strategic level) design improves company image, and is central in the process of building and establishing brand image; at the process level, it can increase the efficiency of the product development process, reducing time to market; and at the production level, it can determine the ease of manufacture, reducing production times and costs. Besides design's relatively more recognized contributions at the product, process and production levels, its role at the strategic level, in improving company image, brand building, establishing corporate identity and developing a corporate design culture, has been emphasized by many scholars (Southgate, 1984; Fairhead, 1988, Borja de Mozota, 2003).

Together with an expanding number of studies (Rothwell, 1984; Ughanwa and Baker, 1989; Roy, 1990; Walsh et al. 1992; Roy and Riedel, 1997; Gemser and Leenders, 2001; Hertenstein et al. 2005, Tether, 2005) which provide strong evidence and detailed accounts on the role that design has in increasing competitiveness, research has intensified on the links between design and business strategies, integration of design with corporate goals and with corporate innovation strategies (Thackara, 1997; Borja de Mozota, 2003; Utterback et al., 2006; Verganti, 2003, 2009).

In addition to academics from marketing literature (Kotler and Rath, 1984; Lorenz 1994), particularly design management literature stresses that design participates in the strategic positioning of a firm, and on the processes of innovating and creating unique value through the integration of design with corporate strategies (Borja de Mozota, 1998, 2002; Bruce and Bessant, 2002; Francis 2002), and positions "the management of design [as] a vital aspect of corporate strategy" (Walsh, 1995, p.509). On his article "What is strategy?" Porter (1996) expresses that the "essence of strategy is choosing to perform activities differently than rivals do" (p. 64) and emphasizes that strategic positions can only be sustained through the continuous orchestration of business activities with each other and with the overall business strategy. Similarly, a review of literature indicates that one of the major determinants for the successful utilization of design as a strategic business resource is its coherent integration with corporate strategy on all levels, and the integration and coordination of design with all the other business functions.

An integrated and coordinated use of design necessitates a successful management of the design process. Consequently, another major determinant for the use of design as a strategic resource is the effective management of design (Dumas and Mintzberg, 1989; Topalian; 1990; Blaich, 1993; Bruce and Bessant, 2002; Lavasi and Lojacono 2005; Chiva and Alegre, 2009). In addition to major theoretical papers on the importance of design management skills for design's strategic use, in a recent empirical research, Chiva and Alegre (2009) have analyzed the effect of design investment on firm performance and how this relationship is mediated by design management skills. The results of their empirical study suggest that design management improves firm performance, investment in design is positively related to design management, and that design management has an important role in determining how design investment affects firm performance. Both theoretical and empirical research suggests the intervening role of effective design management on the success of design projects and on linking design investment with firm performance.

3. METHODOLOGY

The information presented in this paper is based on a longitudinal case study, which spans a period of 5 years, beginning in 2006. It is conducted according to the case study methodology, which allows the researcher to make in depth exploration about the subject under study (Yin, 1994). For the purposes of triangulation of the information gathered, and to be able to allow for different perspectives, the data is collected through many different sources such as organizational documents, interviews with in-house designers and design managers, newspaper articles and press bulletins, in addition to several field trips that are conducted to VitrA's Kartal plant and managerial offices in Istanbul. The field trips allowed the making of direct observations about the company, its industrial design activities, organizational culture and manufacturing operations. Several semi-structured interviews had been carried out with the past and current industrial design managers and the product development manager in different time periods, in order to collect data concerning VitrA

Bath's past and current industrial design activities, and design management organization and processes.

Additionally, in the scope of this case study a design audit was undertaken in 2006, using the Design Atlas Framework, which is prepared by the Design Council, UK, as a tool for auditing the design capability of organizations. The design audit and the framework guided a structured analysis of design capabilities, processes and planning within the company, and facilitated the identification of major problems and shortcomings throughout the organization, related to both the management, and the strategic use of design.

4. THE CASE OF VITRA BATH

4.1 Company Background

VitrA is the brand name for the range of products like ceramic sanitary ware, ceramic tiles, acrylic bathtubs, bathroom furniture and accessories produced by several companies under the roof of the Eczacibasi Group - a leading manufacturer in Turkey. The group is also involved in pharmaceuticals, building materials and consumer products in addition to operations in finance, information technology and welding technology. Eczacibasi Group began the production of sanitary ware in 1958, with the establishment of first national large-scale plant for sanitary ware in Kartal. It adopted the brand name VitrA to represent the full range of sanitary products from a series of sister companies that were established in the following years. These companies are currently combined under the name Eczacıbaşı Building Products (VitrA Bath) and a large part of the production is carried out in VitrA Bath's mega complex in Bozuyük. The ceramic sanitary ware includes products like ceramic washbasin, toilet, bidet, toilet pedestal, cistern, and urinal. The brand also includes acrylic bathtubs and shower trays, bathroom furniture and accessories produced by different companies under Vitra Bath. Vitra Bath additionally produces brassware products like faucets, showerheads and complementary water management systems, which are marketed under the brand name Artema in the national market. However in the international markets, these products are also marketed under the brand name VitrA.

Besides having established itself as the market leader in the domestic market, VitrA is one of the few brands in the Turkish market, which differentiates itself distinctively with a clear focus on design. In the last decade, VitrA took important steps towards using design strategically in accordance with its long term objective of establishing VitrA as a global brand. These steps began to be more discernible especially in the last 5 years. However, these developments towards design's integration with corporate strategy were the result of a long process of accumulation and development of industrial design capabilities, and the corresponding evolution in the nature and role of industrial design activities throughout different stages of development of the company.

4.2 Evolution of Industrial Design Capabilities in VitrA Bath

4.2.1 Design as Product Modification

A thorough analysis of the accumulation and evolution of industrial design capabilities in VitrA Bath requires its consideration in the light of many important subjects that pertain to the technological learning processes of newly industrialized economies (NIEs), and particularly the process of technology transfer in late industrialization. Newly industrialized economies have the common characteristic of going through industrialization based on borrowing foreign technologies, instead of focusing on innovation and the local generation of

new products and processes (Amsden, 1989). As Viotti (2002) identifies: "the dynamic engine of late industrialization is technological learning rather than innovation" (p. 658). This characteristic is important in the context of the development of industrial design capabilities in NIEs, since several studies have identified that the process of technology transfer also affects the extent and role of design activities (Kim, 1989; Er, 1994, 1997a; Er and Akay, 2001).

Being a late industrialized economy, in Turkey industrialization took place based on technology transfer and technological learning. At the time in Turkish industry, foreign technology was acquired mainly through license agreements and joint-venture projects (Kepenek, 1990). Likewise, VitrA Bath began the production of ceramic sanitary ware through license and know-how agreements with the German manufacturer of sanitary ceramics, Keramag. The large scale production plant was established in Kartal in 1958, based on the technological knowledge and production experience of Keramag. In order to learn the production processes for ceramic sanitary ware, VitrA Bath's employees were trained in Keramag's plant in Germany, Keramag acting as a training school for VitrA Bath. Studying the process of technological learning in East Asian countries Hobday (1995; 1997) has also identified a similar pattern revealing that during the establishment phase, foreign companies transferred technological and management skills to latecomer firms through training their local engineers and employees.

Naturally, in this first start up phase in the development of the company, VitrA Bath concentrated on acquiring routine production and plant operation capabilities, where the first products were bathroom suites designed by Keramag. Together with the transfer of technology, product designs created for the German market were transferred to the Turkish market. Having purchased the production rights for these designs, the nature of industrial design activities was limited to very basic operations such as making slight product modifications in the designs to adapt them to the requirements and needs of the Turkish market. For VitrA Bath the importation of product designs together with technology transfer is observed to delay the need for the creation of totally new products, and therefore the acquisition and development of industrial design capabilities.

However in time, the need for the generation of new products began to appear, mostly to satisfy the need for the redesign of some traditional products, such as squatting type toilets, and water storage units used in Turkish baths, whose designs were not available from the foreign firm. A department was established under the name "Form Searching Unit" that was responsible for making product modifications, preparing prototypes and redesigning the mentioned traditional products to suit the production processes of ceramic sanitary ware. But the redesign projects were rather sporadic and for a long period up until the 1980s, industrial design capabilities did not advance further than slight modification and redesign activities. Similarly, exploring the emergence and development patterns of product design in NIEs, Er (1997a) has identified that the main role of product design in its emergence phase in NIEs is 'imitative' product modification rather than new product creation.

4.2.2 Design as a New Product Development Process

In the 1980s, slow but significant developments are observed towards the building of design capabilities in VitrA Bath. Together with the 1980s, Turkish industrial and market structure began to go through major changes, as a result of the liberalization of trade and investment policy regimes and the removal of foreign exchange controls. Turkey abandoned its domestic market oriented industrialization strategy and the new economic regime concentrated on exports. The government started to provide incentives in order to increase export amounts

throughout all industries, and initiatives to support private investment. These developments modified the industrial structure and market conditions with new enterprises being established, creating and increasing competition in all sectors. Additionally, the protected domestic market was now open to foreign competition. These changes in the economic and industrial policy, and correspondingly in the market environment is observed to bring about the necessity to acquire more advanced capabilities (mainly in process, product and quality engineering domains) in order to exist in the newly appearing competitive market environment. These changes are also observed to induce the initiation of a period in which VitrA Bath gradually developed its design capabilities.

In order to compete in new export markets and to protect its position in the domestic market, VitrA Bath found that it was necessary to develop brand new, attractive product ranges. The in-house design staff had to begin gaining advanced design capabilities. The lack of design skills were resolved by the commissioning of German and Italian designers, both to create new product ranges, but more critically to provide observation and training opportunities for the in-house design team. The in-house staff visited their offices and observed the methods used in design and presentation. Beginning with exports to Germany, VitrA Bath gradually increased its export amounts, while the design capabilities also developed steadily. This period of production for export, and the increasing competitive environment served to establish VitrA Bath's perception of design as a significant tool to increase competitiveness.

In 1990s, the in-house design team focused increasingly on the generation of new product ranges and the further development of design skills and experience. "Form Searching Unit" changed to "VitrA Design Department", headed by a design manager, and design activities began to gain a wider attention throughout the organization. In addition to the in-house design team, VitrA Bath continued to utilize external design consultancy, especially for projects that required advanced capabilities. Besides using design for product differentiation, towards the end of 1990s, VitrA Bath for the first time began to concentrate on the creation of advanced design and product development projects that focus on the special needs of specific user groups such as disabled, children and the elderly.

In the 1990s, another area of improvement was the coordination of design with product development and production processes. One of the interviewees indicated that the beginning of the implementation of Total Quality Management (TQM) in 1993 facilitated significant improvements in defining business processes and company's future strategies, increasing business performance and competitiveness. This in turn helped VitrA to increase its share in international markets and had a positive effect on the development of design capabilities and the design approach of the company. Concentrating strongly on product quality improvement, and continually increasing its corporate management skills, the company won TÜSİAD KalDer National Quality Award in 1998, and the European Foundation for Quality Management (EFQM) Quality Prize in 2000.

Throughout the 1980s and 1990s, the utilization of external design expertise is observed to serve as a major tool in the progress of in-house design capabilities. It is seen that gradually, the extent of design activities expanded, and the main function of industrial design moved from product modification to the development of new design concepts, and the systematic creation of new product ranges. A major observation concerning this phase in VitrA Bath is that industrial design capabilities advanced simultaneously with the acquisition of advanced capabilities in other levels such as management, production, organization, distribution and marketing.

4.2.3 Design as a Strategic Process

Together with the 2000s, VitrA bath is observed to enter a new stage in the company's corporate development pattern. Having acquired advanced capabilities at all corporate levels, the company began to operate more strategically. Until this period, the progress of design and design management capabilities was noticed to occur as a result of a reaction to changing external conditions (such as the market environment, industrial policies) and not as part of a long term analysis, planning and an integrated strategy towards brand building. However starting with the 2000s, it is seen that design moves from being an operational tool to being a major constituent of VitrA Bath's corporate strategy. Setting its long term goal as to establish VitrA as a global brand, design was set to become one of the foremost strategic resources that VitrA Bath employs in order to move towards this long term goal.

Protecting its leadership in the domestic market, the company aims to enhance its recognition and reputation in international markets by creating a global brand image based on high design competence, creativity and product innovation. Consequently, for the first time in this period, industrial design had been included in strategic planning, with yearly plans for the product ranges that will be developed in the light of corporate strategies. There is methodical emphasis on the selection and planning of design projects to be integrated with long term corporate goals, and complementary to company's strategic moves in international markets.

Again in this period, the budgets for new product development and design were increased considerably. As the company focused on establishing VitrA as a global brand, VitrA Bath increasingly preferred the use of external design consultancy, especially in projects targeted at international markets, and the upper and upper-mid segments. In 1990s, VitrA Bath had worked with many external design consultancies like Pilots Design, NOA, and Turkish industrial designers based in Italy (İnci Mutlu and Defne Koz). But in this period, with increased focus on innovation and strategic design solutions, they began collaborating with more prominent names such as Ross Lovegrove and Matteo Thun.

Additionally, VitrA Bath started to use design as the keyword in its marketing campaigns and press bulletins, highlighting the importance of design and innovation in all PR mediums. Design should be coordinated with marketing and communication activities of a company; otherwise it would be an unproductive utilization of a strategic tool (Walsh et al., 1992). VitrA Bath utilizes many regional and international marketing and consumer campaigns that underline its design commitment, and to increase its sales by establishing a stronger brand identity in these markets. We see that the passage from operational use of design to its strategic use resulted in a combined emphasis on design in different business functions such as marketing and communication.

Besides the company's focus on innovation by design, in this period, we also observe several technical innovations taking place, such as toilet reservoirs that reduce water consumption, development of non splatter surfaces for use in urinals, and innovations concerning surface and material technologies which prevent the accumulation of bacteria and dirt on ceramic surfaces, and that provide ease of cleaning.

4.3 Current Use of Industrial Design in VitrA Bath

4.3.1 Design Philosophy, Processes and Tools

Pavitt (1984) identifies that paths to innovation differ according to the nature of the industry. Ceramic sanitary ware sector is a mature sector in which radical innovations are much rare; therefore the competition is mostly dependent on incremental innovations, product differentiation and effective marketing. In mature industries where there are relatively few

technological innovations, the companies utilize design for making improvements in established products and for strengthening company image, therefore design is a vital component of their competitive strategy (Walsh et al., 1992). Similarly, in VitrA Bath industrial design is observed to be the key factor in the company's competitive strategy and innovation policy, and the most important tool assisting the establishment of a strong brand image both in the national and international markets.

VitrA aims to create value through product differentiation and through focusing its products to the needs of specific market segments. In achieving these objectives, it utilizes a strategy that can be characterized as "the positioning approach", which can be explained as determining in advance where the firm wants to be in defined markets and gaining the necessary competences to get there (Francis, 2002). Eczacıbaşı VitrA has many offices in major markets throughout the world (like VitrA UK, VitrA USA, VitrA Italy, VitrA Russia, etc.) and these offices collect information regarding their local markets, consumer tastes, trends, desires and transfer this information to the main office in Turkey through well defined and systematic processes. The design process starts with a demand from a VitrA sales office for the creation of a product range, which is targeted at the particular market segment that the sales office has detected as the focus market and industrial design is employed in order to develop products that will create competitive advantage in selected market segments.

VitrA Bath currently defines its design philosophy as to transform bathrooms into complete and satisfying living spaces, and to do so the company focuses on the creation of "enjoyable experiences" and on "changing user's perception of and interaction with the bathroom". Besides market research done internally by VitrA Bath, the company also takes service from market research and trend research companies to inform the design processes. Additionally, to be able to get in contact with users and to get inspired by user experiences and thoughts, the company uses a systematic process they call "Blue Ocean Strategy", throughout which they collect information from users with surveys and interviews. Using the outcomes from this research, they develop design concepts and present them in company visual fairs. Potential concepts are then selected for further development.

4.3.2 Linking Strategy with the Use of External Design Consultancy

Although in VitrA Bath, there is an in-house design team, external design expertise is employed more often than in-house design activities in the creation of new products, especially for the projects targeted at the upper and upper-mid markets. Several studies point out the advantages of using external design consultancy with main reasons being listed as; a general lack of skill, lack of particular skill, or a company strategy in order to continue the flow of new ideas (Walsh et al., 1992). Other important motives are professionalism, creativity, objectivity, flexibility, efficiency, economy and reliability (Chung, 1989). Furthermore, Bertola and Teixeira (2003) point out that although firms have internal capabilities for innovation, they still use external design consultants to stimulate new knowledge and expertise inside the company. Analyzing the evolution of design capabilities in VitrA Bath reveals that external design consultancy had been utilized in the past, due to lack of skill and experience, and for specialist know-how in technical product development projects. However since 1990s, the reasons for the utilization of design consultancy is seen to shift from a focus on gaining design capabilities and technical know-how, to a focus on creativity, innovation, and the flow of new ideas.

Additionally, VitrA Bath is seen to make use of external designers more strategically in combination with its marketing efforts. The commissioning of a reputed designer or a design company as a marketing tool is emphasized in literature as one of the reasons of using

consultancy. Design consultants are used as "marketing agents" to receive critical information on target markets and following that, to ease the acceptance of brand names when a manufacturing company from developing countries like Turkey want to export own brand products to advanced markets (Er, 1995, 1997b). Currently, VitrA Bath's utilization of design consultancy is parallel to this approach. In fact, we see that commissioning of Ross Lovegrove functioned as a strong advertising tool intended to reflect that VitrA Bath is aware of the strategic importance of design and is willing to allocate huge financial resources in order to transform itself into a design oriented global brand. (174 new products, launched under the name "Istanbul Collection" designed by Ross Lovegrove included a broad range of products from sanitary ware to water management systems, and complementary products like bathroom furniture and accessories.) VitrA has recently received considerable international attention and three important design awards by the "Istanbul Collection" designed by Ross Lovegrove: Wallpaper Design Award for Best Bathroom, a Good Design Award and a Red Dot Design Award. Istanbul Collection contributed extensively to VitrA's recognition in international markets. Since 2004, VitrA Bath has been continuing its collaboration with the designer, and has launched 3 collections by Ross Lovegrove: Istanbul, Mod, and Freedom.

On the other hand, it is observed that the commissioning of such a reputed designer was targeted at making a rapid leap in VitrA's brand image. Observing VitrA's procession in the use of external design expertise, and company's image among consumers before they started the collaboration with Ross Lovegrove, it is seen that such a move was fairly unexpected. Borja de Mozota (2003) mentions that a credibility gap may arise if the designed product is markedly different from the image of the firm. Similarly, it may be possible that the phenomenon identified as the credibility gap in the literature (Er, 1995; Von Stamm, 1998) might have created an obstacle for VitrA to exploit the outcome of this collaboration fully. But several interviewees have mentioned that Istanbul Collection had commercial returns that exceeded their expectations, and since the company's major objective was increasing VitrA's global recognition, they are quite satisfied with the outcome.

Another strategy that the company follows in using external design consultancy is treasuring long-term familiarity when commissioning external design expertise, and keeping on working with these designers on a long-term basis. Nevertheless VitrA Bath is still quite open to collaboration with new designers, which better suit the varying objectives of the design projects. Currently, the collaboration with Ross Lovegrove is still continuing, in addition to projects carried out with other design consultancies.

4.3.3 Design Management at Different Levels

Although having taken important steps in the strategic use of design, the company is observed to face several problems and shortcomings in its attempts to integrate design with its corporate strategies and other business functions. The major problems were identified as finding the right place for the design department in the organization, and the establishment of an integrated design management system with defined processes, tools and responsibilities.

Design management can be classified into several levels. Topalian (1980) groups the management of design into two levels: the corporate level and the project level. Whereas Chung (1998) proposes three levels for design management: the corporate level (strategic), the design organization level (tactical) and the design project team level (operational). Corporate design management is concerned with the strategic management of design with a long-term perspective, and the contribution the design activities generate at the corporate level. It entails the coordination of design activities and resources with corporate goals and strategies by determining corporate design policies, design resource budgeting and

establishing and maintaining corporate design standards. Project design management is the management of activities related to the short term administration of design projects such as planning, scheduling, monitoring and documentation. In Chung's 3-level model, the middle stage, namely design organization management is responsible for the implementation of corporate design strategy and involves activities such as structuring the design organization, choosing design teams, nurturing design skills through training and development programs.

Before 2006, VitrA Bath's in-house design team was named the VitrA Design Department. It was headed by the design manager, who was directly connected to the general manager, and was responsible solely for the ceramic sanitary ware product range. The designers for other product groups such as the brassware and bathroom furniture were located under the product development departments of the corresponding plants, and worked in isolation from the ceramic sanitary ware design team and from each other. Additionally, the responsibility of the design manager was solely at the design project management level, whereas design responsibility at the corporate level was dispersed among the marketing department and senior management, with no formal and structured processes to integrate these dispersed responsibilities. Naturally, this detached organizational structure was observed to hinder the execution of an integrated design strategy, made the management of design difficult, and inhibited the strategic use of design.

In August 2006, the company underwent an organizational restructuring and united the design and product development operations of all product groups (ceramic sanitary ware, armatures and water management systems, acrylic bathtubs and shower trays, and bathroom furniture and accessories) under the roof of the product development department. At the organizational level, VitrA Bath's in-house design team was placed under the product development department with the intention to integrate design more effectively with product development processes. The product development department was composed of 25 employees, among which there were product designers, mechanical and electronic engineers, technical drawing specialists and several technicians. The department was headed by the product development manager who controlled, scheduled and reported the product development projects. There were 6 product designers in the department, 4 working for VitrA in the development of ceramic sanitary ware and bathroom furniture, and 2 working for Artema (the brand name for armatures and water management systems). The design team was in interaction with marketing but it was also headed by the product development manager.

However, the design audit, which was conducted in November 2006, (using the Design Atlas Framework proposed by the Design Council, UK,) had revealed major inadequacies in this organizational system; particularly concerning the design management processes both in the corporate and project management levels. When design management in VitrA Bath was examined at the corporate level, the most striking observation was that although top management was observed to have a high level of interest and commitment to design, and was continuously taking steps towards its strategic use, until the mid 2000s, there was no apparent formal executive responsibility for design at the corporate level. Design management activities at this level (such as design strategy formation, design planning, budgeting, administration, monitoring and evaluation) were dispersed among the marketing manager, the design manager (who was responsible for design management at the project level) and the top management without clear definitions on their respective responsibilities. Probably due to the absence of a formal corporate management of design, in mid 2000s, the company had formed an executive design board. It is comprised of the general manager of Eczacıbaşı Building Materials Group, marketing manager, product development manager, and members from the media consultancy firm that provides service to VitrA Bath. This

commission administered various activities that are defined under corporate management of design like shaping strategic decisions regarding design and their budgeting in the light of long-term corporate objectives, in addition to some of the activities that are defined under design organization management, like the selection of designers for specific design projects. Design reference groups and collective board responsibility for design can be highly effective as a supportive tool complementing executive responsibility (Topalian, 1990) and is utilized by some design conscious firms such as Bang and Olufsen (Palshøj, 1990). However, in the case of VitrA Bath, this model was observed to be inadequate when employed to substitute formal executive responsibility for design.

Coming to design project management, in the organizational structure, established in August 2006, the responsibility for the management of both design and product development activities at project level had been given to the product development manager. This structure was explained by the then product development manager as being part of the expansion of the scope and influence of industrial design activities. According to him the positioning of in house design team under the product development department enabled efficiency and superiority in the total product development process and allowed in-house industrial designers greater control in its various phases. However the in-house designers did not agree that the organizational structure resulted in a superior approach to design project management.

As a result of the design audit, it was concluded that although there is a strong culture for design and a high level of design commitment in the company, its design organization and design management processes were not effective in supporting an integrated and holistic use of design. Other important findings were the lack of clear process maps/definitions and design process tools to support design and design management at all levels, and the absence of mechanisms to nurture the internal design skills and creativity of the in-house design team. On the basis of these findings, it was suggested that in order manage the strategic use of design and its effective integration with other business functions, VitrA Bath had to restructure its internal design organization and design management processes, beginning with the assignment of an executive responsibility for design.

Since the beginning of 2011, major transformations in design organization and design management have taken place. The organizational structure has been updated, and the in-house design team is now placed under the marketing department, together with the assignment of an executive responsibility for design. The design team is headed by an industrial design manager, who has responsibilities related to the management of design in all levels: the project, the organizational and the corporate level. The design board which was previously more active in decisions regarding the management of design at the corporate level is now observed to act more as an assessment and feedback board that examines the management of design, whereas the design management responsibilities mostly at the organizational and project level are carried out by the industrial design manager and the marketing manager, who are also active and influential in the formulation of corporate design strategies, and decisions regarding design's contribution at the corporate level.

Another important development is the integration of design and design management activities for all product groups under the roof of a single department. In addition to ceramic sanitary ware, the design team is now responsible for all products defining a bathroom: ceramic sanitary ware, armatures and complementary accessories, bathroom furniture, acrylic bathtubs and shower trays. This development is expected to result in a more integrated design functioning, and is in line with VitrA Bath's expression of its current design strategy "to redesign the overall bathroom experience".

In order to improve the integration of design with other business functions and especially, marketing, R&D and product development, the company has been working on a special ERP (enterprise resource planning) system which is expected to become active by the end of 2011. Additionally, the company has recently defined its corporate design strategies, philosophies and policies by a framework named the "design DNA". The framework facilitates the establishment and maintaining of corporate design standards, by providing guidance for the selection, assignment, execution and evaluation of design projects according to VitrA Bath's design strategies and corporate objectives.

5. CONCLUSIONS

The paper examined the evolution of industrial design in the history of a Turkish sanitary ware manufacturing company, starting from its emergence and development as a routine business function to its current utilization as a strategic resource. Together with an analysis of its current place within the organization, the study aimed to identify major problems faced in the organization when trying to move design from the stage of its operational use to the stage of its strategic use.

The evolution of industrial design in VitrA Bath is observed to take place in 3 major phases which were characterized as 'design as product modification', 'design as a new product development process' and finally 'design as a strategic process'. The dynamics of this evolution in the utilization of design by the company is observed to be influenced by many factors, such as the progression of industrialization in Turkey, the process of technology transfer, the development pattern of the company, prevailing structure and changing competitive conditions both in the domestic and the global markets, and the development of organizational capabilities in other business functions.

These phases in the development of design capabilities in VitrA Bath are observed to show a similar pattern with the phases in the "the design ladder"[1] developed by the Danish Design Center (DDC), with some alterations. The DDC characterizes 4 phases of design maturity in firms as:"non-design", "design as styling", "design as process" and "design as innovation". In VitrA Bath's case the non-design phase was instead a period of slight product modifications and small experimentations with form giving. The period reviewed under "design as a new product development process' was the period of accumulation and development of design capabilities, in which design was seen as a business process and was used as an operational tool. But this period of accumulation of design capabilities was critical in the recognition of design as a competitive tool and played an important role in the identification of design's strategic potential, especially in business transformation and brand strengthening. An analysis of this phase also underlined the role of opening to export markets and increased competition in the acquisition of advanced design capabilities. Additionally, in this phase, the utilization of external design expertise is noticed to serve as a major learning tool for the advancement of in-house design skills.

The last phase "design as a strategic process" shows a major equivalence to the last phase in the "design ladder", where the design function is integrated with corporate strategies and

[1] The Danish Design Center's report on the Economic Effects of Design proposes a design ladder to assess the design maturity of firms. The Danish design Ladder Model is a 4 step model for classifying companies' design maturity on the basis of their attitudes towards design. The higher a company is on the design ladder, the greater the strategic performance design will play.

visions. Major drivers for the development of capabilities for the strategic use of design are identified to be the inclusion of design as part of corporate strategy, in addition to the commitment of senior management.

However, VitrA Bath's case also indicated that the passage from operational use of design ("design as a process") to the stage of its strategic use ("design as strategy") is gradual and demanding, as have been indicated both in the literature of development economics and design management. Although having taken important steps in the strategic use of design, the company is observed to face several problems and challenges in the ongoing process of integrating design with its corporate strategies and with other business functions. One of the major challenges was observed to be the organization of in-house design function. The in-house design organization is seen to have changed 3 times in the last decade, indicating that finding the right place for the design department in order to optimize its management and integration with other business functions can be a main challenge in the process of organizing for design's strategic use. Another key undertaking that the company is still implementing in this period is the establishment of an integrated design management system with defined processes, tools and responsibilities. In order for the effective use of design as a strategic resource, VitrA Bath is attentively working on the establishment and improvement of its design management processes and tools, both in the corporate and project management levels.

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Business Model Innovation through Design Led Innovation: An Experience from the Machinery Industry

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The interest for disruptive change as a source of competitive advantage has recently brought the attention of researchers and practitioners to the business model as a key element of the innovation process. In order to generate new and alternative visions on the business model and the value proposition companies should rely on a set of models and tools that allow employees to "see" the present challenges differently and then design possible alternatives. The set of techniques and models that seems to offer a new span of innovation relies in the design practice and in its integration with business model functioning and structure. The experience of a machinery manufacturer in Italy offered the opportunity to test a set of tools for business model design and innovation and verify the quality of the output through a set of innovation workshops that involved over 150 employees in the process of shaping possible scenarios and designing new service based business models for the company.

The evolving nature of the business model construct

In a similar way to many other managerial constructs, such as strategy (Mintzberg, Ahlstrand and Lampel, 1988), business model is not defined in a consistent way in managerial literature. This potential confusion is increased by the misuse of business construct in business community. As recently stated by Rajale (2009): "The current semantic confusion related to business models is complicated by consultants and practitioners who use the term business model to describe any unique aspect of a particular business venture". Business model definitions, in the last forty years, has evolved following the evolution of managerial studies and the new forms of organisations, enriching the scope of the construct as well as its

key aspects. Early works defined business models as models for organisational effectiveness, concentrating on computerised models in which a simple modelling of business functions was seen as a necessary aid in managing company's processes and routines. In this definition business models are very much like the architecture supporting processes and enabling routines.

A decade later, the interest of researches moved to considering business models as the layer between strategy and operations (Mintzberg, 1987). Business models were described as tools to support strategic decision through the representation of the overall impact of managerial decisions on the corporate structure and components. Business models could also support decisions taken into specific functions of the organisations thus supporting sales efficiency and operational excellence. Following the shift from value chains (Porter, 1987) to value networks (Normann and Ramirez,1994) as key sources of competitive advantage in strategy literature, business models were described as models to support inter-organisational strategies (Hamel, 2002) especially in digital environments (Hanson,2000; Magretta, 2002; Lee and Vonortas, 2004). Business models were used as support to the optimisation of the whole supply chain or as the map to support reengineering processes. In digital environments business models were used to depict the way by which companies aimed at delivering value to the market and the underlaying revenue model in new and uncertain markets.

In recent years, the business model construct has been progressively enriched, becoming a fundamental part of business innovation and a source of new value creation. In particular, a strong emphasis has been given to the business models as the tools to transform into value the outcomes of open innovation and collaborative environments (Onetti e Capobianco, 2005; Mitchel and Coles, 2003; Chesbrough, 2004; Chesbrough and Appleyard, 2007).

Despite these evolutions and modifications of business model construct, there seems to be some common background to what a business model stands for: business models are the structures through which companies perform the two crucial macro processes of value creation and delivery and value capture from the market (Rajala, 2009). In this sense, the construct evolution follows the evolution of the sources of value creation and the way through which companies turn market opportunities into desired performance outcomes. In this sense, following the definition of Osterwalder and Pigneur (2009), business models are the missing link between strategy and business processes and describe the rationale of how an organisation creates, delivers and captures value. Hamel (2002), though sharing the same vision about the functions of business models (i.e. creating and capturing value in a very unique and hard to imitate way), encloses strategy (mission, scope of business and basis for differentiation) in the components of business models. In this sense, business models do not bridge between strategies and processes but represent the essence of differentiation, from strategy formulation to the assets and resources, internal and external, needed to support the strategy and turn it into operational processes. If strategies become a part of business models the construct will be less perceived as an architecture sustaining processes and receiving its

shape from strategic decisions and more than the essence of business itself, a sort of corporate DNA, enclosing in itself the whole potential for innovation.

The components of business model

There are many different representations of business model structure in managerial literature, from very simplified ones to rich and articulated. Despite this diversity it is possible to find some common features in many of these representations. Such features could be summarised in the following way:

The offering or value proposition. This represents "anything offered to the market that might satisfy a want or need of the targeted customers" (Chesbrough, 2007). In addition to this definition, the value proposition should also show the reasons for differentiation and explain why the offering itself is a better solution than the other ones available on the market. In many business models representations, such as the business model canvas (Osterwalder and Pigneur, 2009) which has gained large popularity among practitioners, the competitive dimensions of the offering is not particularly stressed in favour of a deep analysis of customers needs and wants. The misperception of the relevance of differentiation among the dimensions of value proposition might implicitly risk to produce offerings that lack of distinctiveness or are particularly weak when compared to existing solutions.

The customer segments. It is implicit in the definition of value proposition to have a clear perception of the receivers of the value created for the marketplace. A description of the targeted customers should not only focus on descriptive variable such as lifestyle or demographics, but should have present a deep understanding of the behaviours of customers and the kind of activities they perform under the scope of the value proposition.

The revenue model. It explains the way through which the company extracts value from the market and is related to revenue sources, pricing policies and strategies, transaction models and margins and volume policies. Even though some authors (Morris et al., 2005) include the cost structure in this part of the business model, it might be argued that costs should be more related to key processes, procurement and distribution structure and policies and value chain activities and be taken only as an input for the determination of the revenue model.

The internal resources and assets. These elements might be perceived as the internal building blocks that allow to develop and implement the business model. They are related to both tangible and intangible assets, as well as knowledge and relationship resources that support the value proposition and generate, through their combination in processes and value chains, a sustainable competitive advantage.

The network of suppliers and distributors. These subjects are the external part of the business model and they contribute to the creation of the value and its delivery to the final customers. The external network is composed by primary and secondary stakeholders (like debtors, public institutions, etc.) that might affect company's performance.

The key processes and value chain. This part of the model shows how the company performs its key activities utilising key resources and assets and integrating with the external network (Ankenbrand, 2011). This component of the business model bridges all the other parts and shows the different kind of relationships between all of them.

Together with these elements it might be appropriate to take into consideration the organisational culture and its values and beliefs. These aspects play a crucial role in shaping the business model and giving it consistency over time (Bateson, 1955). This "soft" element is also the glue that virtually keeps the business model together by generation a common set of frames, perceptions and values among the employees.

Business Model Innovation

The interest for disruptive change as a source of competitive advantage (Chirstensen and Raynor, 2003) brought the attention of researchers and practitioners to the business model as a key element of the innovation process. Managerial literature on the topic has been focusing very much on the role of innovators, enlightened CEOs and other revolutionary characters as the cornerstones of any radical change in the organisation. Most of the effort in the organisations is then focused on finding these actors of change and promote their views to redesign the business model. This approach to disruptive change shows some limitations on the following aspects: In organisations with a strong culture it is very hard to grow or even detect innovators as most of the people share the same view and beliefs about what is the value proposition and how to sustain it. Innovators might find it difficult to "sell" their vision internally and draw company attention on their ideas. In fact their new ideas of value have an impact on all the layers of an organisation: the strategic context, the organisational context and the emotional context, too (Doz and Thanheiser, 1996). In these conditions resistances from the established culture might be overwhelming. As stated by Mintzberg et al. (1998) quoting Hurst: "Changes in destination might be made by the captain even less frequently, for they require a total value change in the organisation. And discoverers may find a new world only once in a lifetime". In this sense, the faith in innovators as the only visionaries and responsible for change in the company might limit the chances to catch up with the rate of change required by the external context.

In order to generate new and alternative visions on the business model and the value proposition companies should rely more on a set of models and tools that allow employees to "see" the present challenges differently and then design possible alternatives. This requires a set of tools that helps organisations in:

-Overcoming their organisational and cultural dogmas and beliefs;

-Seeing the big picture and discovering new customers' insights and latent needs;

-Visualising alternative value propositions and business models;

-Designing innovative business models with a clear perception of the changes required and the constraints to overcome.

The set of techniques and models that seems to offer a new span of innovation relies in the design practice and in its integration with business model functioning and structure(Bucolo, 2011). The work of Schön (1983), Polyanyi (1998) and Ehn has formed the foundation of the Design Led Innovation model which has been developed. Central to this approach is the ability of the designer to construct and visualise multiple futures of an unknown complexity, which are then deconstructed to reveal needs and opportunities.

Business Model Innovation through workshop based process: the case of an Italian manufacturing company

The experience of a machinery manufacturer in Italy offered the opportunity to test a set of tools for business model design and innovation and verify the quality of the output. The company faced in recent years a consistent decline in sales of machinery due to global competition and market conditions and it was forced to re-thing its strategy and business model. The fundamental challenge was the one of developing a consistent line of business through services. One of the most critical aspect in designing this change was in the strong manufacturing culture of the company and the fundamentally technical and mechanical background of most of the employees. These aspects made it very difficult for the company to “see” a different future and a different way to make its earnings.

The solution that the company decided to choose to overcome these difficulties was based on the massive involvement of a large part of the employees (150 people) in a series of ten innovation workshop, designed and facilitated by the author and a team of four consultants, aimed at designing possible business models for new services. These workshops have been managed through the support of facilitators familiar with the Design Led Innovation approach and have been structured around two phases: (i) Overcoming organisational dogmas and envisioning the future; (ii) Designing a possible business model for the service business. The techniques that have been adopted in the different phases are related to: scenario building and storytelling in the first part to generate insights related to the needs and expectations of customers and overcome dogmas limiting the ability to see customers and their needs under a different perspective; business model definition through the use of the model proposed by Oserwalder and Pigneur (2009).

The results could be evaluated under different aspects:

-All participants were able to define their limits in looking at customer needs and reconstructed the whole customer experience identifying new needs and insights;

-The needs identified in the first part of the workshops led to a very rich variety of business models to support the service offering. Each workshop produced three different business

models. Business model formulation contained: value propostion; customer segments; channel definition; customer relationship model; sources of revenues and revenue models; key activities; assets needed; partners need to create and deliver the service. All this led to the evaluation of possible revenues and the cost structure needed to create it.

The company was then able to review all the business models proposed, the need categories detected and draw a new possible line of business overcoming the constraints that did not allow management to clearly see the market for services and plan an adequate offer.

The project phases

The project was composed of several phases that involved various subjects within the organisation and generated different results.

Setting the agenda for change

The first step was the definition of the overall goal of the innovation process and the expected impact of the ideas generated on the whole company performance. This part of the project consisted in a series of meetings with company's top management to establish a proper agenda to foster innovation, gain a clear vision of company markets, structure and present business model an commit top managers to the final outcome of the project. The goal of these meeting was to: i) identify the lines of business development depending on the amount of resources available and the overall corporate strategy for the years to come (which markets to address; which product lines to launch; how many economic and knowledge resources could be acquired); ii) select an area of development that could be addressed through innovation workshops. In this case, the launch of service to couple with the existing product lines was considered critical since it presented a high potential in terms of new sources of revenues and differentiation but it was somehow very difficult to develop depending on the strong mechanic and product related culture of the company and its employees; iii) establish a goal for the innovation teams that might be at the same time challenging and yet accessible. In this case, top managers decided to attribute to the different teams the same goal: i.e. to increase revenues by 10% in the next three years through the introduction of new services and without affecting present product lines. It was agreed with company management to involve a large portion of the employees (150 individuals, as stated before in this work) in the innovation process with the aim to: i) offer a signal of radical change of present organisational culture based on product centricity and functional fragmentation; ii) work with teams composed of subjects coming from all the functions and staffs of the company to acquire different and sometimes conflicting points of view and cross-fertilise workshop participants. The use of mixed teams was functional to the goal defined: since the notion of services as separate line of business and source of revenues was very far away from company perception at that time, there was a need to collect diverging opinions and points of view on customer value

perceptions. With the use of intact teams it would have been more difficult to overcome dogmas and cultural limitations since all participants' perceptions would have been aligned on pre built ideas influenced by their functional role.

Configuring and managing innovation workshops

Every single innovation workshop was designed to last two days and aimed at generating new insights for the service business and propose alternative business models that could help the company reach their goals in terms of economic growth. Since the number of people involved was very high and the time span was somehow short (the whole project should take no more than ten months), it was agreed to compress the time for each workshop to only two days. The fact that, working for a medium size company, most of the people already knew each other really helped a lot in speeding up workshops and having people working together without too many frictions and misunderstanding right from the start.

Each workshop was divided into four separate parts, strictly connected between them. The different phases were designed to help people overcome organisational and industry dogmas that might limit their ability to foresee areas on innovation and new business, reshuffle their present knowledge about products, customers and markets and define new possible scenarios for their offer to add value to customers, generate new ideas and eventually structure them in adequate business models. The need to force people to formalise not only service ideas but also the business model to support them was originated by the belief, shared with managers, that in many cases even existing services, already offered by different players in the marketplace, could be innovated through a radically new business model to deliver them.

Each module lasted for two to four hours hours and generated a specific output that was functional to the success of the following parts of the workshop. The different module structures and the techniques adopted could be described as follow:

Overcoming organisational dogma

This was the first module for the participants after a short introduction on the workshop goals and agenda and some definition of services and business model. The group was exposed to some dogmas that in the past limited many companies in "seeing" the future and was then invited to discuss in sub groups the different dogmas that exist in the company. In this stage, participants were asked to generate an adequate amount of company and market perceptions that they perceive as possible dogmas limiting their ability to innovate and then report them on post-its and stick them on the wall of the room randomly. After this part had been completed, with the help of a facilitator, dogmas were clustered together in macro groups depending on their content: for example there might be managerial dogmas ("we have no time to plan long term activities"; "new ideas cost a lot of money", etc.); market dogmas

("our customers are very traditional and do not like new ideas"; "there is no future in serving small business", etc.); competitive dogmas ("we have to follow market leaders"; "we cannot compete on costs"; etc.) or organisational ones ("careers are made in functions"; "it is difficult to integrate people coming from different sectors in out company"). The explicitation of dogmas allowed participants to discuss about them and develop a more open minded approach to observation and perception of external menaces and opportunities. A particular attention was given to the discussion of market and customer dogmas, since participants tended to follow the beaten path on this subject, representing their customers in a traditional and over simplified way and showing a lot of resistance to question the elements of value that customers might like to receive a part from the product.

After the clustering is done participants are invited to attribute a level of danger for the success of their company for the different dogmas and clusters and represent them in a matrix as the one presented in Fig.2.

The "dogma wall" was then part of the following process as participants could refer to it when developing new scenarios or insight or new ideas to verify if they tend to fall into some kind of "dogma trap" or to subvert them as source of inspiration.

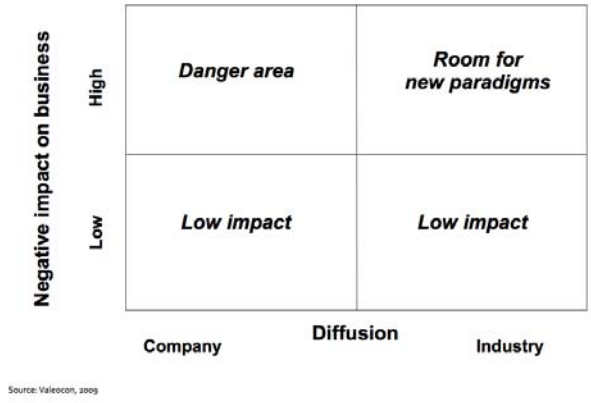

Fig. 1: a matrix for the evaluation of the impact of dogmas on performance

Scenario building and knowledge generation

Following the dogma explicitation, participants were asked to depict a possible scenario for the next three years for the final markets and sectors of their customers. The technique used was the billboard one. In a first stage participants, divided in sub groups and using photos, images and drawings were asked to represent the major changes that would take place in the

different macro environmental categories (political, economic, social, technological, etc.) in the near future. A second activity, with the same tool, is devoted to the representation of the micro environment, taking into consideration the evolution of competition, demand and distribution for the company clients. In this second case, a set of researches and other sources of professional informations were prepared and presented in order to support the participants with some quantitative background on the subject.

Billboards are then presented to all the groups and discussed in a plenary session. After the description of the possible trends in all the different aspects of the external environment, groups are asked to put all these information together creating story with a dominant theme that has their customers as main characters using storytelling techniques as the backbone of this activity. The story could be represented through drawings or simply text but it has to contain all the dimensions of the macro scenario and to represent the customer and its organisation as the main character. Some groups, for example, depicted scenarios dominated by the theme of resource scarsity and the need to increase the rate of savings in transformation processes due to increase in all company costs, while others focused on environmental issues, de-localisation of small business or digitalisation of retail and distribution.

Insights identification

On the base of the different stories presented, participants, always divided into small groups, defined the insights related to the main concern and interests of the characters previously depicted. The tool that has been adopted was the empathy map of Xplane (Fig.3) (Osterwalder and Pigneur, op.cit.). This map has forced participants to act and think like the customer they had described imaging, on the basis of the environmental dimensions they used to tell the different stories, what he sees, feels, hears, thinks, which are the main activities he/she undergoes. On the basis of these perceptions participants were able to identity the pains and the gains that their customers want to avoid and achieve. As a result of this process the various groups were able to identify latent needs and wants of their potential customers overcoming their product based corporate culture and have a clear vision their effective needs that appeared to be not linked to the usage of machineries but to the future of their companies, digitalisation of marketplaces, environmental concerns and lack of skilled labour force.

Service idea generation

Using the Empathy map as a starting point, participants generated ideas of possible services that might help their customers satisfy their emerging needs and avoid their major threats about the future scenario. In this phase of the workshop, people found useful to return to the dogma wall to subvert dogmas as a trigger for more creative thinking. During the different workshops different creativity techniques have been adopted (visual thinking, storytelling and

prototyping) providing on the whole vey similar results. The idea generation stage was divided into two different parts: i) in the first, part participants generated a huge amount of ideas related to the needs identified having as a goal to create the highest number of ideas as possible; ii) in the second part of this activity the ideas generated were clustered in families and used to develop "second level" ideas that might then be selected by the group following a grid of evaluation that helped to rank the ideas in terms of innovativeness, scalability, differentiation, new value for the market and time to imitation from competitors.

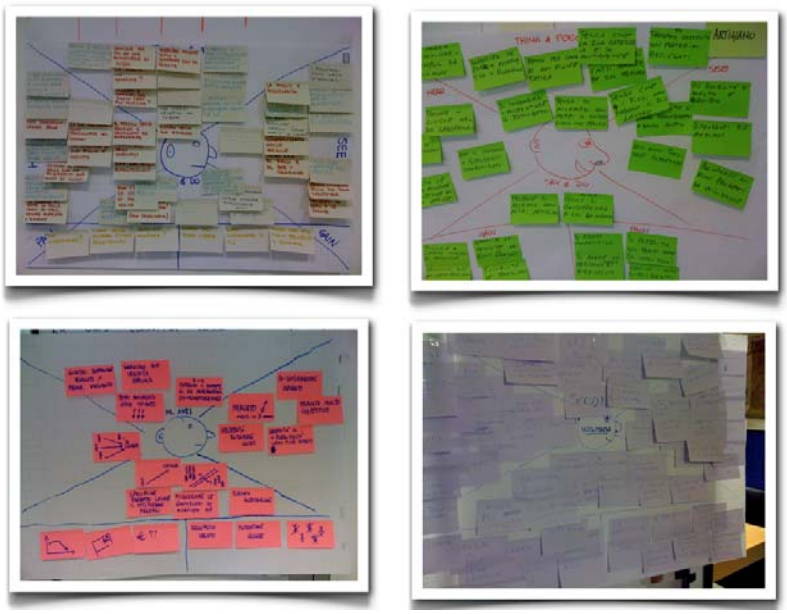

Fig. 2: some examples of the insight map

Business model design

The Business Model Canvas is strategic management tool, which allows to develop and sketch out new or existing business models. It is a visual template pre-formatted with the nine blocks of a business model. The Business Model Canvas was initially proposed by Alexander Osterwalder (2009) based on his earlier work on Business Model Ontology. Formal descriptions of the business become the building blocks for its activities. On the set of ideas selected participants were asked to draw the possible business model to support their service and turn it into a business system capable of generating the expected increase in revenues (Fig. 3). After the fast prototyping of the business model the groups presented it each other and opened a discussion on areas of amelioration or improvement.

Workshop results and managerial implications

On the whole the projected produced 30 different business model prototypes related to services and capable to sustain the expected increases in sales given by top managers as an overall goal for the project. Business model canvases have been collected and clustered in families and were presented to top management for further implementation. Business models dealt with the creation of new services for different customer segments: i) large global companies; ii) small business and industrial districts; iii) retailers and distributors. The different clusters of business models have been created grouping together services that were similar in the concept, served a similar segment of customers or displayed some similarities in the value proposition and revenue models. The most promising areas of innovation are related to small business and retail. The small business cluster of services is focused on the idea of "mobile open workshops" allowing artisans and small producers to access machineries and assistance without having to buy a machinery that could be used only for a specific production or a small lot. Company would provide technical assistance, machinery set up and run a reservation system on line where customers could ask for consulting on the specific set of machineries needed to perform a specific task. The revenue stream is guaranteed through a pay per use billing model. The service idea generated on the insight that most artisans feel a strong uncertainty about the future and are not willing to invest in new machineries or develop new skills focusing, on the contrary, on day to day activities. This set of services aimed at helping customers create new value for their company, try and experiment new techniques and by doing so help their company to develop a more positive stance towards innovation and production flexibility.

As for as retailers are concerned, the dominant idea was the one of reducing their need of stock and inventory through the digitalisation of their outlet and the digitalisation of many customer relationship processes. The service offered should be the one of an open platform where dealers and retailers could configure their virtual shop and optimise customer services and spare parts assistance. The service designed would work not only for the products of the company but should run as a sort of digital wholesaler or e-commerce platform allowing all products and suppliers to be managed. The revenue model is linked to the site management, consulting and platform promotion and is based on a service fee plus extra price for custom fit services.

In general terms, the results of the workshops were satisfactory providing top managers with not only a set of new ideas but also with different business models to browse providing different options in terms of assets needed, key processes, cost structures, channels of distribution and relationship and revenue models. The future challenge is to reward the work of all the people that took part to these initiatives in order to create a positive environment for future innovation activities. From a corporate culture perspective, the workshops helped the different groups of participants to gain a wider vision of the different roles and functions within the company and to overcome some well rooted dogmas that strongly limited their ability to see an alternative future for the company itself.

Fig. 3: business model prototypes

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A Three-Dimensional Typology for Strategic Decisions on Brand Styles

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Styling is a basic, important activity undertaken by industrial designers. It is also one of the most elusive design activities to manage strategically. What are the main styling strategies companies can follow in styling new products? When are different styling strategies more or less relevant? In this paper, we outline a three-dimensional typology to support design managers in taking strategic decisions on the styling of their products. Based on an empirical investigation on styling of passenger cars in the German market, we identify four different types of styling strategies pursued by automotive brands. We also relate the different types of styling strategies to the business strategies of these brands. The results suggest that different styling strategies are relevant under different environmental conditions, and that the styling effort of automotive brands is related to their broader business strategy.

INTRODUCTION

Styling – roughly defined as providing products with a particular look and feel – has long been recognized as one of the most basic activities undertaken by industrial designers (see e.g. Pulos, 1986). Many investments in industrial design begin as investments in styling (Nielsén, 2008). Strategies for design typically include styling, and in many cases styling is found vital for brand development, and critical in making or breaking new products (Ravasi & Lojacono, 2005). A classic case is Apple, who through the introduction of the rounded iMac in the 1990s re-established its position in the computer industry (Chong, 2004). As a style leader, the look and feel of Apple products, such as the iPod, the Macbook, and the first generation iPhone, has played an important role in showcasing the company's skill in making user-friendly products.

In spite of the critical importance of styling activities, how to strategically manage these design activities remains a puzzle for many companies. Design managers report problems in addressing designers throughout the styling process, and in giving styling sufficient priority when delineating a strategy for the brand (Bangle, 2001). Styling often appears an unmanageable, sometimes mystifying task, based on the "soft" creative capabilities of designers (Kotler & Rath, 1984). The results of styling are seen to depend on the skills and intuition of individual designers (Verganti, 2006), and its success on the market on erratic fluctuations in taste and fashion (Moulson & Sproles, 2000). At the same time, it is problematic to leave designers and the styling process outside the strategic scope of companies. Many styling decisions are entwined with decisions about the brand, the product line and the product's position in relation to the competition. However, fundamental questions about the strategic management of styling activities remain unanswered. What constitute the main styling strategies companies can follow in styling new products? When are different styling strategies more or less advisable?

In this paper, we address the gap of research noted above by outlining a three-dimensional typology for strategic styling decisions on brand styles. Based on an empirical investigation on styling in the German passenger car market, we identify four different types (clusters) of styling strategies pursued by automotive brands. We also relate the different types of styling strategies to the business strategies of these brands. Since the early days of General Motors, styling fulfills an undisputed role in the automotive industry (Gartman, 2006). Car manufacturers invest major resources in planning and conducting research on styling (Moulson & Sproles, 2000). Several research studies address how automotive brands profit from styling (see e.g. Millner & Hoffer, 1993; Sherman & Hoffer, 1971). Moreover, several design methods have been introduced to support designers in styling cars (Grondelle & Dijk, 2004; McCormack, Cagan, & Vogel, 2004; Warell, 2011). However, only a few empirical studies (or methods) focus on when to opt for one styling strategy over another, and even fewer have related styling strategies to the broader business strategy of a brand.

STRATEGIC STYLING DECISIONS ON BRAND STYLES

Designers often fulfill an important role in creating the look and feel of new products in accordance with a brand's design philosophy (Karjalainen, 2004; Ravasi & Lojacono, 2005). In delineating a strategy for this work, the literature on the management of design (Karjalainen, 2007; Karjalainen & Warell, 2005; McCormack et al., 2004; Warell, 2001) often focuses on the implementation of a consistent and distinct style for the products of a particular brand. This styling strategy is suggested (1) to facilitate recognition and (2) to transfer beliefs that consumers have concerning one product to other products falling under the same brand name. For example, by giving a hand-held device a glossy dark front and metallic details, we might recognize it as (or at least think it is) a part of Apple's iPod/iPhone-family. Furthermore, by recognizing the device as such, we might also think it is a trendy lifestyle accessory that is easy to use.

Companies can also pursue other styling strategies. In the early 00s, Nokia nurtured a multitude of design styles in its product portfolio to cater for differences in taste across market segments (Karjalainen & Snelders, 2010). Several studies also indicate that automotive companies profit from changing the brand style over model generations (see e.g. Millner & Hoffer, 1993; Sherman & Hoffer, 1971). In the case of Buick, McCormack, Cagan and Vogel (2004) note that the Buick style can be broken down into a number of periods, each with its own expression. The transition from one style to another they attribute to changes in technology, design philosophy, studio leadership and control of the company. Finally, companies do not always pursue to implement a brand style that is distinctly different from the competition. In fact, there are a number of benefits of styling products to look similar to the competition. Consumers might mistake the 'look-a-like' products for those of a stronger competitor (Miaoulis & Damato, 1978), and even when consumers are aware that they are from another company they may still assume that the products share similar attributes as the original (Kapferer, 1995). As a result, in developing a styling strategy, design managers face a strategic choice between pursuing a consist brand style for the products falling under the same brand or deviating from this endeavor in breaking with such a style or in pursuing a multitude of styles over its product portfolio (Khermouch, Thompson, & Benezra, 1997; Schoormans & Robben, 1997). Similar, they also need to choose between developing a distinct style from the competition and adhering to an existing style in the market.

In developing our typology, we depart from a model for design by the Swedish designer and design theorist Rune Monö (1997) that takes the above-mentioned complexity into account. Monö proposed that many decisions in design are about the possibility for differentiation of a new product. He identified three dimensions on which a new product could be compared to (and possibly be differentiated from) existing products: (1) between a new product and products in the current product portfolio of a company, (2) between a new product and the products from previous product generations and (3) between a new product and the products of competitors (similar dimensions have been proposed by Baxter, (1995); Van Grondelle & Van Dijk (2004).

Applying Monö´s model to the management of design, Warell (2001) suggests that the three dimensions capture a product's position on the market. Research studies also suggest that managers and designers seek different value contribution on these dimension in styling new products (Person, Snelders, Karjalainen, & Schoormans, 2007), and display stable decision patterns (i.e. 'styling strategies') in how they situate the expression of new designs on them (Person, Schoormans, Snelders, & Karjalainen, 2008). Moreover, a long tradition of studies on the financial impact of styling decisions in the automotive industries cover decisions on brand styles on one or two of Monö's dimensions (Millner & Hoffer, 1993; Pauwels, Silva-Risso, Srinivasan, & Hanssens, 2004; Sherman & Hoffer, 1971; Talke, Salomo, Wieringa, & Lutz, 2009). As a result, the three dimensions provide a foundation for mapping strategic styling decisions on brand styles.

However, in delineating a typology for the strategic management of styling activities, the question remains how styling decisions unfold over Monö´s dimensions. Specifically, in locating the main types of styling strategies companies can follow, how do the styling decisions of companies organize themselves (cluster) over these dimensions? In addition, in supporting managers in selecting an appropriate styling strategy for their brand, how do the different styling strategy types (clusters) relate to the broader business strategies of these companies? These two questions will be addressed in the study reported here.

METHOD

In developing our typology, we began by compiling a list of 39 automotive brands operating in the German passenger car market by reviewing Ward's World Motor Vehicle Data 2009 and new car registration data from the European Automobile Manufacturers' Association (see Table 1). Our focus on the German market follows the lead of an earlier study on styling in the automotive industry (Talke et al., 2009). A number of characteristics of this market add to the reliability of the study. Germany constitutes the largest, and perhaps most competitive car market in Europe. Most major car brands are present in the market. As a result, it provides a diverse stylistic scenery, grounded in the actions of multiple brands, many important OEMs, and followed by a large number of experts who monitor the competitive position of different brand and models.

The data collection consisted of two parts, to avoid common source bias. First, automotive design students assessed the styling strategies of the brands. Second, industry experts assessed the business strategies of the brands. Domain experts hold extensive up-to-date knowledge and pride themselves in staying informed about developments in their field of expertise (Shanteau, 1988). With a comparative view on the market, external experts are suited for identifying the realized strategies of companies (Smith & Grimm, 1987). Hence, our automotive design students and industry experts provided in-depth knowledge on automotive styling and the automotive industry in general, and this allowed us to acquire a valid assessment of the brands' styling strategies and general business strategies.

Alfa Romeo	*Ford*	*Mazda*	*Seat*
Audi	*Honda*	*Mercedes-Benz*	*Skoda*
BMW	*Hyundai*	*Mini*	*Smart*
Chevrolet	*Jaguar*	*Mitsubishi*	*SSangYong*
Chrysler	*Jeep*	*Nissan*	*Subaru*
Citroën	*Kia*	*Opel/Vauxhall*	*Suzuki*
Dacia	*Lada*	*Peugeot*	*Toyota*
Daihatsu	*Lancia*	*Porsche*	*Volkswagen*
Dodge	*Land Rover*	*Renault*	*Volvo*
Fiat	*Lexus*	*Saab*	

Table 1. Studied automotive brands

Styling strategy assessment of models

15 Automotive designs students assessed the styling strategies of the brands. The students were recruited from a Master program in Automotive design and were paid 20 Euros for their

participation. In preparation for the assessment of the brands' styling strategies, we began by selecting a representative set of car models for each brand. We visited the German websites of all the brands to list available models. To avoid an overestimation of coherence within a brand, we excluded versions that were presented as separate models, but that in reality had only limited (or no) difference to other versions in terms of their exterior styling (such as the Mini Cooper next to the Mini One). For the same reason, we also included one version of models that were sold as hatchback, sedan (saloon) or station wagon (estate) versions of the same model – and we always selected the hatchback over the sedan (for small cars), and the sedan over the station wagon (for larger cars). Among this initial set of cars, we selected the top five selling models for each brand by reviewing the new passenger car registrations from 2007 to 2009. Pictures of the selected models were acquired from public sources on the Internet (e.g. Wiki Commons), gray-scaled with the background digitally removed to standardize the comparisons. All pictures show the models slightly rotated, from a high front/left-side angle, which is the most commonly used perspective in the automotive industry. The final outcome of this procedure was an initial set of 173 pictures of car models available on the German market in 2009. Some brands (e.g. Jaguar and Smart) had less than five different models available on the German market in 2009 and were, accordingly, represented by all their different models.

The styling strategy decisions underlying each model were estimated as the degree in which it looked similar to, or different from a) other models within the present portfolio of the brand, b) the previous generation of the models, and c) competing models from different brands. To this end, the students were asked to make visual comparisons for each model on each of the three dimensions. The styling strategy of a model was estimated as the average score of students on each dimension.

The basis of comparison differed depending on the dimension (see Figure 1). With respect to the present product portfolio dimension, students evaluated how much each model per brand looked like the other models in the portfolio of the same brand ('How much does the car on the left look like the cars on the right?', 1:'it looks very different' to 7:'it looks very similar'). With respect to the succession of product generation dimension, we checked the German version of Wikipedia and found that 126 of the 173 models had a predecessor. For these models, we prepared pictures, and asked students to evaluate how much a model of a brand (shown on the left of the page) looked like its predecessor (on the right of the page) ('How much does the car on the left look like the car on the right?', 1:'it looks very different' to 7:'it looks very similar'). Finally, with respect to competing product dimensions, we established the main competitors for each model by going over car reviews in the three influential German car magazines: Auto Motor und Sport, Auto Bild and Auto Woche. In specific, we selected those models of other brands that were most frequently mentioned in direct comparison tests between models (Vergleichtests). We limited our study to up to four competitors for each model. Following this procedure, we established competitors for 156 out of the 173 models, again preparing additional pictures. For these models, students evaluated

how much each model looked like its main competitors from other brands ('How much does the car on the left look like the cars on the right?', 1:'it looks very different' to 7:'it looks very similar').

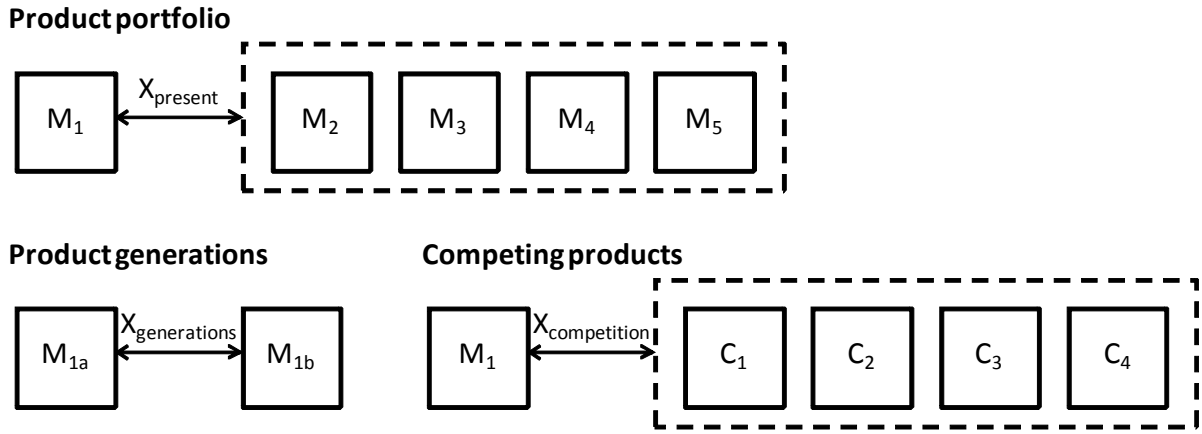

Figure 1. Types of visual comparisons over Monö's three dimensions

Each student received an A4 booklet in which they had to rate one model of each brand on each dimension. Five separate booklets were created, each incorporating one model per brand, and thus a maximum of 39 comparisons per booklet. With 15 students participating in the task, three students evaluated each of the five different booklets. Before evaluating the cars, students were first trained by performing the same task on a small set of other products (bags). Between performing the comparisons on each dimension, we scheduled small brakes to reduce fatigue.

The styling strategy for each model was calculated as the mean score on each dimension. Prior to averaging the scores on each dimension over the booklets, we calculated the intraclass correlation coefficient (ICC) for each booklet to assess the inter-rater reliability between the students. On each dimension, the inter-rater reliability averaged over the booklets was assessed, and ranged from moderate for the competing products dimension (ICC=0.63), to very high for the present product portfolio dimension (ICC=0.81), and the succession of product generations dimension (ICC=0.89). The scores allowed us to average the scores on each dimensions as an estimate of the styling strategies employed for the different models (following Dunn, 1989).

Business strategy assessment of brands

12 Industry experts assessed the brands' business strategies in terms of (1) pricing, (2) quality (reliability), (3) technological innovativeness and (4) market innovativeness. They also assessed the brands in terms of (5) overall performance and (6) brand strength. In a questionnaire survey, the assessments were made with respect to six statements summarizing each business strategy and performance measure. For each statement, the experts indicated the degree they found it representative for the brands actions (1:'Strongly disagree' to 5:'Strongly agree').

All industry experts had several years of experience in the automotive industry from working in areas such as R&D, marketing, sales and design and/or educational institutes in automotive design. We used a 'snowball' (chain referral) technique in sampling the experts where four independently approached experts recommended other suitable experts for our study. As a result, we not only reached experts known to us, but also people recognized for their industry expertise among their peers.

The brands' business strategies and performance were calculated as the mean score with respect to each statement. Prior to averaging the brand strategy and performance scores, we calculated ICC for each assessment to assess inter-rater reliability. The inter-rater reliability for all the assessments were almost perfect (Dunn, 1989), ranging from 0.91 to 0.96.

RESULTS

Standardized styling strategy scores were subjected to cluster analysis to reduce the styling strategies over the 173 models to a smaller number of styling strategy types (groups). Similar to Calantone & Di Benedetto (2007), we used the SPSS based K-means clustering procedure to group the models' styling strategies scores over Monö's three dimensions. Cluster analysis does not hold a statistical test for accepting one solution over another. We therefore explored multiple cluster solutions before settling on a final solution that was (1) mutually exclusive over the styling strategy scores and (2) revealed relevant differences in terms of business strategy and performance.

As shown in Table 2, four distinct clusters emerged from the K-means clustering procedure incorporating all the 173 models. The four clusters contained 54, 34, 59 and 26 models. In Cluster 1 ('Mass-appeal'), the models looked similar to other models on all of Monö's three dimensions. In Cluster 2 ('Experimentation), the models looked different from the other models on all three dimensions. In Cluster 3 ('Follower'), the models looked different from the models in the present product portfolio and the succession of product generation dimensions and similar to competing models. In Cluster 4 ('Nurturing') the models looked similar to the models on the present product portfolio and the succession of product generations dimensions and different from competing models.

In investigating the relevance of the different styling strategy types, we mapped the brands' business strategy and performance scores over the four clusters (see Table 2). Using the same brand score for all the models falling under a brand, we divided the different models in three categories to classify the degree they were representative of the different statements (since we did not split up models of the same brand, groups with low, medium and high scores can slightly differ in size). The results suggest that different styling strategy types are more common for certain business strategies. They also suggest that some strategies are more successful than others. We briefly elaborate on these conclusions below:

Cluster 1: ‘Mass-appeal’

The overall performance is highest for the brands with models in this cluster. As the second largest cluster, this suggests that this styling strategy is not only common but also potentially profitable to follow.

The models in the cluster score consistently high in terms of (premium)-pricing, quality, market innovativeness and technology innovativeness. To this end, this type of styling strategy seems relevant for strong brands that have the possibility to charge a premium price and the resources available to develop innovative products of high quality. The relatively high scores in terms of brand strength support this conclusion.

In contrast to past claims in the literature (see e.g. Warell, 2001), the models in this cluster display similarity with competing models rather than differentiation. To this end, the models in this clusters seem more to follow a ‘mass-appeal’ strategy by following-up on the current (stylistic) trends in the market, and not by forging a unique identity (which seems to be more the case in Cluster 4).

Cluster 2: ‘Experimentation’

The overall performance and brand strength were among the lowest for this cluster – suggesting that total differentiation (experimentation) from existing models is a risky strategy for brands.

The models in the cluster consistently score low in terms of pricing, quality, technology innovativeness and market innovativeness. This suggests that this styling strategy typically is associated with (weaker) brands that seek low-cost positioning and/or do not have resources to develop innovative products of high quality. In support for this claim, the models in this group also score low in terms of brand strength.

This said, a smaller number of models originate from successful strong brands, suggesting that this strategy may also be used for other purposes than maintaining a low-cost positioning, for instance, as a means to create a distance between the mainstream models of a strong brand and their more experimental models, without changing the brand name.

Cluster 3: ‘Follower’

The brand strength is not substantially higher for the models in this cluster in comparison to Cluster 2. However, the brands with models in this cluster score higher in terms of overall performance. This suggests that seeking similarity with the competition is less risky when simultaneously styling products to look different from other models falling under the same brand name.

Similar to Cluster 2, the models in the cluster score low in terms of pricing, quality, technology innovativeness and market innovativeness. However, the somewhat higher scores suggest that the brands pursuing this styling strategy were somewhat more successful. Finally, a number of models from high-performing brands from Cluster 1 are found in this

cluster, suggesting that these strong performers will sometimes follow competition, even when it forces them to deviate from other models in their current portfolio or previous generations.

Cluster 4: 'Nurturing'

In many ways, the brands with models in this cluster score similar to the brands with models in Cluster 1 in terms of pricing, quality, technological innovativeness and market innovativeness – making it a viable alternative to a 'mass-appeal' strategy. The models in this cluster score highest in terms of pricing and brand strength, suggesting that this strategy may fulfill an important role in cultivating brand equity. However, the lower overall performance suggests that it is a riskier strategy. In fact, the models in the cluster score similar to the riskier 'experimentation' strategy (Cluster 2).

	Overall N=173	**Cluster 1 'Mass-appeal'** N=54	**Cluster 2 'Experimentation'** N=34	**Cluster 3 'Follower'** N=59	**Cluster 4 'Nurturing'** N=26
Styling strategy					
Present product portfolio	0.00	0.56	-0.64	-0.60	1.09
Succession of product generations	0.00	0.73	-1.06	-0.49	0.79
Competing products	0.00	0.82	-1.31	0.34	-0.95
Brand strategy[a]					
Pricing					
High	33% (58)	57% (31)	15% (5)	10% (6)	62% (16)
Medium	32% (55)	35% (19)	21% (7)	37% (22)	27% (7)
Low	35% (60)	7% (4)	65% (22)	53% (31)	11% (3)
Quality (Reliability)					
High	33% (57)	50% (27)	12% (4)	22% (13)	50% (13)
Medium	33% (58)	28% (15)	32% (11)	39% (23)	35% (9)
Low	33% (58)	22% (12)	56% (19)	39% (23)	15% (4)
Technological innovativeness					
High	32% (55)	50% (27)	15% (5)	20% (12)	42% (11)
Medium	35% (61)	33% (18)	35% (12)	37% (22)	35% (9)
Low	33% (57)	17% (9)	50% (17)	42% (25)	23% (6)
Market innovativeness					
High	33% (58)	46% (25)	18% (6)	24% (14)	50% (13)
Medium	32% (56)	33% (18)	29% (10)	37% (22)	23% (6)
Low	34% (59)	20% (11)	53% (18)	39% (23)	27% (7)
Performance[a]					
Overall performance					
High	35% (60)	41% (22)	24% (8)	29% (17)	23% (8)
Medium	33% (58)	39% (21)	26% (9)	35% (21)	27% (9)
Low	32% (55)	20% (11)	50% (17)	35% (21)	50% (17)
Brand strength					
High	32% (55)	50% (27)	15% (5)	12% (7)	62% (16)
Medium	36% (63)	35% (19)	35% (12)	48% (28)	15% (4)
Low	32% (55)	15% (8)	50% (17)	41% (24)	23% (6)

Table 2. Cluster overview ([a] Separate one-way ANOVA tests on the average scores on each measure for brand strategy and performance revealed that for each measure differences between clusters were significant at $p < .01$)

DISCUSSION

In this paper, based on a cluster analysis of 173 car models, we present a three-dimensional styling typology on brand styles incorporating four mutually exclusive clusters of styling decisions. While a wealth of studies have investigated the aesthetic and symbolic outcome of industrial design (for a review see e.g. Veryzer, 2000), comparatively few (empirical) studies have addressed the styling activities by which such effects are formed by designers and the companies they work for. Specifically, our typology describes four main strategies for styling that design managers can depart from in selecting an appropriate strategy for their brand.

Furthermore, while a number of different styling strategies are mentioned in the literature, few studies address the issue of when to opt for one strategy over another. To this end, our typology answers calls for more research on the management of styling activities (Creusen, 2011) as well as on the relation between design and strategy (Hertenstein & Platt, 1997) to help companies manage design more effectively. Here, we investigated how models in the different clusters relate to business strategies of automotive brands. The results suggest that there might be a business logic underlying each strategic direction. In addition, our results suggest that a brand's basic strategy for its models should always be based on a strategy of 'limited' differentiation (i.e. never based on all three styling dimensions). In our study, experimentation (i.e. differentiation on all three dimensions) was only a viable styling strategy if applied to a few exceptional models of a strong brand.

Limitations and Future research

In developing our typology, we studied styling in the automotive industry. This is an industry where styling has long held center stage, and where style directions have a strong influence on products in other industries. As such, many of the strategies employed for the style of cars may also be relevant for other products. However, the extensive use of styling in the automotive industry is not necessarily found back in other industries. In extending the findings, future studies should address strategic styling decisions in other industries in order to provide managers with more actionable results for the effective management of styling activities.

We relied on Monö's three dimensions model to provide a foundation for our typology, employing two types of comparisons to assess styling strategies. First, students performed pair-wise model comparisons of past and present models of each brand to assess the styling strategy over model generations. Second, they performed model-group comparisons where each model was compared to (1) four other models in the product portfolio and (2) four models of the competition. These procedures allowed us to acquire an in-depth assessment of the brands' styling strategies for the creation of our typology. It also allowed us to account for an important peculiarity associated with assessments of style. Assessments of style are complicated in the sense that different (reoccurring) features of a design may be more or less relevant in determining the style of an object (Person & Snelders, 2010). We accounted for this effect by focusing on the overall similarity between different models rather than on

counting the reoccurrences over models. A focus on overall similarity is also found in other studies on styling strategies (see e.g. Person et al., 2008; Snelders, Morel, & Havermans, 2011). However, it has not been addressed in earlier studies how these 'holistic' comparative measures relate to more feature-based measures of styling strategies (see e.g. McCormack et al., 2004). Future studies should therefore be targeted at evaluating different measures of styling strategies in order to resolve the benefits and challenges associated with 'holistic' and 'analytical' measures of styling strategies.

Implications for the management of design

Numerous studies have shown how companies reap the benefits from investing in industrial design. This is particularly true for companies that are early users of industrial design in their industry, because their investments give them an edge on the competition. However, while investments in design activities such as styling may pay off, how the investment is used is probably more important.

Departing from the work of Monö (1997), the typology presented in this article provides managers with an overview of the main strategic paths that automotive companies follow in styling new products. Our central argument is that styling activities are manageable and that companies can profit from them by making more strategic decisions on the style of their products. To this end, by linking the different styling strategies to business strategies, we also provide managers with guidance in selecting which path to follow for their brand. Our results show that styling strategies relate to broader business strategies. In addition, our results also indicate that some strategies are more risky than others. In the literature on the management of design, managers are advocated to promote a coherent and distinct look over their products in order to develop brand equity. Indeed, our results show that pursuing similarity over the model portfolio and over model generations often is associated with a strong brand. However, departing from the common view in the literature, differentiation from the competition (especially if combined with differentiation from the present portfolio and previous generations) was found to be a risky strategy, with a number of low performing, weak brands pursuing this styling strategy. Furthermore, our results also indicate that companies can pursue success by pursuing a multitude of styles in their product portfolio and changing styles over model generations.

This said, a quantitative study on the use of styling in the automotive industry cannot provide all the answers. In taking a more strategic approach to managing the style of their products, managers should not forget the importance of tailoring their styling activities to their organizational and competitive environment. How they manage this endeavour will determine the success of their styling efforts.

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An Integrative Framework as Contribution to the Understanding of Decision-Making in Design

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The present research places in perspective two of the most important concepts of the Lean Management philosophy as dimensions for research of critical situations in design and derive from such approach implications for decision-making across different design disciplines. Findings aim to improve the knowledge and understanding of design processes across disciplines. Such results contribute to an integrative framework of value delivery and decision-making across design disciplines.

INTRODUCTION

On daily basis designers' have the chore to keep one's countenance facing complex and uncertain situations with the consequence of severe drawbacks, delays and conflicts. Though designers might be experienced they are not always prepared to cope with these kind of situations in an appropriate manner. Designers miss their orientation, what finally might lead to less efficient and less effective performance. Inherent to the occurrence of downside effects of crucial situations is a risk to diminish the designers' input of value for the creation of design results. Designers play an important role in the creation of value in the objects, products, systems and surroundings of everyday life to be left without awareness regarding crucial situations. Little attention has been placed to such design management issues on an empirical basis. The present research analyses the influence of the two dimensions of LT – MUDA and value - on designers' behaviour and its implications for decision-making.

Transfer of Lean thinking to decision making in design

The basic idea of the present research approach is to transfer the Lean Thinking (LT, Womack, 1990, 2003) philosophy to the context of designing as activity embracing different design disciplines. As the Lean thinking approach identifies the pathologies of the processes and support to cope with its causes and effects it should be transferable to the decision-making in different disciplines. Taking such perspective it is expected to more easily derive support to help the designer in coping with the effects of these pathologies.

As a philosophy based on the manufacturing context, LT is focused on the elimination of muda (the Japanese word for waste) "specifically any human activity, which absorbs resources but creates no value" (Womack et al, 2003, p. 355). The first seven types of muda were identified by Taiichi Ohno (1979) in the context of physical production, and then further developed (Womack et al, 2003). Apart from muda, the philosophy of LT comprises the five so called Lean Principles: value, value stream, flow, pull and perfection from which value is the most important. As a philosophy of management LT is grounded in specific principles that sustain a transdisciplinary approach what might enable its application in many fields of designing as activity. But there are also obstacles to be aware of:

- LT focuses on the customer and the producer as value creator, the designer is not referred to. Though, the designer plays an important role in value definition, especially in the early phases of product development.
- The Lean terminology is related to the manufacturing environment. The direct application of LT in the design context would not be suitable as a shared language of communication.
- LT defines muda as negative phenomena. However the sources of the types of muda in LT do not always lead to negative effects. Such situations, and according to their influence on the process and designers behaviour are comparable to the notion of crucial situations, as circumstances that have a decisive importance in the success or failure of something.

Therefore, we try to adopt the LT set of principles as underlying sources for critical situations in regard to decisions. Assuming that such effects can be positive or negative depending on the context and the results this research proposes a phenomenological approach to critical situations in designing.

As consequence we propose the conversion of the concepts of LT into dimensions that are suitable to understand designers' behaviour and their design processes in different design disciplines.

In this research, value (LT principle) is seen as value delivery from the designers' point of view, in the context and interaction with other stakeholders. The situation of, Muda (LT central concept) is seen as sources of crucial situations, that can limit but can also increase

designers' behaviour and performance. Therefore, value delivery in/and critical situations are in this research the drivers for a translation of the Lean philosophy in design research.

Critical situations and design methodology

The traditional prescriptive models in design methodology such as the Basic Design Cycle (Roozenburg & Eekels, 1995) or VDI 2221 (1987) but also newer approaches such as the VIP approach (Hekkert & van Dijk, 2001) share one common goal, they all aim to support the individual designer. However, designers have to face many different crucial situations with different sources of elicitations. Thus, design models do not represent the sources and possible effects of crucial situations designers might have to cope with as well counteractions to uphold performance. Several attempts to understand the principles that governed the behaviour of designers concerning the mental and physical processes (Gero, 1995; Cross, 1996) have been critical and innumerable to improve design methodology. On the other stream, few attempts have been made to understand the sources of fruitless performance in designers' behaviour. Such contributions are sparse and focused in the downside aspects of specific and singular issues such as design fixation (Cardoso & Badke-Schaub, 2009), non-generating alternatives (Gunther & Ehrelenspiegel, 1999), stuckness (Sachs, 1999), no feeling of competence (PSI Theory, Dörner & Schaub, 1998), inappropriate focus of attention (Simon, 1995), confirmation bias (Wason, 1960), among others.

General contributions to methodology and theory in design issues such as risk management (Jerrard & Barnes, 2006, Seering & Oehmen, 2011) and Slack theory (Richtnér & Åhlström, 2006) for example, are in close proximity to the focus of this research. However such studies only represent features of a general framework that integrates the sources and drivers of crucial situations, which go beyond the phenomenological study of situations of risk and lack of activity.

Value in design

A call has been made to further study how designers deliver value in designing (Heskets, 2008). However, in design, emphasis has been placed to the study of value from a user's perspective and from that user value theories and models (Boztepe, 2007), have been developed. This is mainly true for the field of computer-human interaction design (Suchman, 1997; Friedman, 1996) and approaches to value in the building industry towards project management in architecture (Austin, 2005; Macmillan, 2006; Langford, 2007). Few authors have tried to identify value from the designers' perspective on an empirical and transdisciplinary base. Design researchers have been contributing studies on value issues such as, affect-in-cognition (Dong, Kleinsmann & Valkenburg, 2009), ethical thinking in designing (Lloyd, 2009) a plural value framework for a shared language supporting value management (Prins, 2009). Such studies report results based on the analysis of meetings or approaches to value developed from experience.

Insights from the literature on social mechanisms and patterns of discourse in value transfer

in architecture meetings (Le Dantec, & Yi-Luen Do, 2009) have provided meaningful insights however, there is still no identification of conditions and characteristics of how designers associate value to the design situation. Evidence of a core set of values in designers' behaviour was derived from experiments with architects and non-designers about how they do prioritize their decisions (Lera, 1981). In addition, an empirical study on how groups engage in a collaborative task through the analysis of the structure of their argumentation concludes general design and management tasks and forms of argumentation independent of the issues in discussion (Olson et al, 1992). More recently an empirical study based on interviews with designers from four design disciplines asserted designers' priority bases towards decision-making (Vieira et al, 2010).

The transdisciplinary study of designers' value delivery on an empirical base seems to be of importance once such priorities guide the selection of information, motivate, steer and regulate action concerning preferable modes of conduct or end-states of existence along a continuum of relative importance (Rokeach, 1968).

Decision-making in design

From studies about influences of cognitive aspects of designing, such as question asking (Eris, 2002) and decision-making it becomes obvious that most of the designers' time is occupied making decisions (Akin, 1995). Therefore it is important to describe the conditions that surround and influence these critical moments during the design process. Research in decision-making in design has been done in different disciplines such as Engineering design (Wallace, 1995), (Badke-Schaub & Gehrlicher, 2003), Architecture (Mackinder & Marvin, 1982), and Industrial design engineering (Akin, 1995). Thereby, a variety of different issues related to decision making have been addressed, such as: methods and tools for decision-making (Wallace, 1995), design decisions under uncertainty (Beheshti, 1993), (Daalhuizen, Badke-Schaub & Batill, 2009) context, task and institutional environment of decision-making (Little, 1990), patterns of decision-making in design (Badke-Schaub & Gehrlicher, 2003), comparative studies on consensus and single leader decision-making (Yang, 2010). Deductive models have been depicted such as ethical decision-making in design (D'Anjou, 2010), and also a framework of decision-making in software design (Christiaans & Almendra, 2010) has been proposed recently.

Summarizing different reported influences on decision-making we arrive at a unconnected group of factors and processes, such as: experience, use of information from previous projects, intuition, culture, personality, predicted or unforeseen elements of risk, chain of known and unknown design constraints, unknown design variables, interaction of alternative courses of action, validity of design concepts, design intentions, and further more. However, such factors of influences on decision-making in design are not interrelated and based on studies of one design discipline, and not always supported by other empirical studies. Thus, a general framework is missing which would overcome the absent integration of the various unconnected results of empirical investigations. Therefore this research chose a

transdisciplinary approach to empirically study the relevance of value towards decision-making and ask how far sources of crucial situations in different design disciplines share common and dissimilar characteristics.

RESEARCH APPROACH

A case study based approach in five design disciplines gives ground to the exploratory research on crucial situations and designers' value delivery. This complex pattern of designing can only be observed in the social context of the designing activity, with all the crucial situations of the daily life in design offices. Data were assessed through observation and interviews. One major source of data were the analysis of designers interaction with clients and other stakeholders. The design consultancies are based on the disciplines of graphic and interaction design, architecture and engineering. The fifth case study analyses a graduation project of students in Industrial design engineering. Results refer to data collected from the design processes of on-going projects and interviews.

Table 1. Overview of meetings and interviews per case during the periods of observation

Source of data	**Case study 1** **Graphic design**	**Case study 2** **Interaction design**	**Case study 3** **Architecture**	**Case study 4** **Engineering**	**Case study 5** **Industrial design**	**Total**
Interviews	9	23	9	9	5	55
Meetings	6	7 not recorded	7	8	-	21
Observation period	6 weeks	4 weeks	4 weeks	5 months	3 weeks	

The case studies

In case study 1 the project was about the development of the design of an exhibition. Meetings took in average 2 hours, with exception of two meetings of 42 min and 3h: 48 min, the later was the meeting in which the fundamental solution was presented to the client. The client's representatives were constantly present with exception for the last meeting. It was possible to follow the development of the design almost from the beginning, since the first meeting to the last in sequence. The nine interviewees are all designers with background in graphic design with nuances in visual, communication, editorial and multimedia.

In case study 2 the analysed project was the design of interactive solutions for a museum devoted to a certain topic. Due to privacy issues these meetings could not be recorded, therefore only the notes taken in the research diary can be used for analysis. Meetings took between 1 and 2 and half hours in a total of seven sequential meetings. From the 23 interviewees, 8 are non-designers with background in management, sales, research, quality, literature and environmental engineering, and 15 are designers from different backgrounds such as, graphic, industrial and multimedia design, mechanical and electronics engineer and illustration.

In case study 3 the project was the design of a train interface. Meetings took in average 2 hours, with exception of two short meeting of 37 and 45 min and 1 meeting of 3h: 32 min,

where the fundamental solution was explained to the single occasion that the client was present. The nine interviewees are all architects with special interest in the development of specific and dissimilar tasks.

In case study 4 two projects were chosen, the design of control software for specific equipment and of a robot. The meetings from the robot project were selected for analysis. Meetings took in average 1 hour, in a sequence of eight gatherings. The design team works in academic environment in a department responsible for the implementation of projects. The nine interviewees are all engineers with specific background in electronics, hardware, control, and mechanics. Four of the interviewees are master students in mechanical engineering.

In case study 5 interviews were conducted with graduation students in Industrial design engineering.

Data analysis

Data were audio and video recorded for further analysis. Iterative coding was done with the interviews transcripts in Atlas (www.atlasti.com) and with the meetings in Interact software (www.mangold-international.com). The analysis of interviews was based on the search for designers' statements on valuable issues and priorities leading to value judgment towards decision-making. Although dissimilar incidence and predominance characterized the particularities of each design discipline, invariant characteristics on value delivery and critical situations were found across the interviewees' statements further developed in the content of the Integrative Framework (see Table 2 and 3). The analysis of meetings was guided by the search for designers' and other stakeholders' issues brought into discussion, source and priority of argumentation in value judgment towards decision-making and critical situations. Instances of value judgment were mapped across the meetings (see Figure 1).

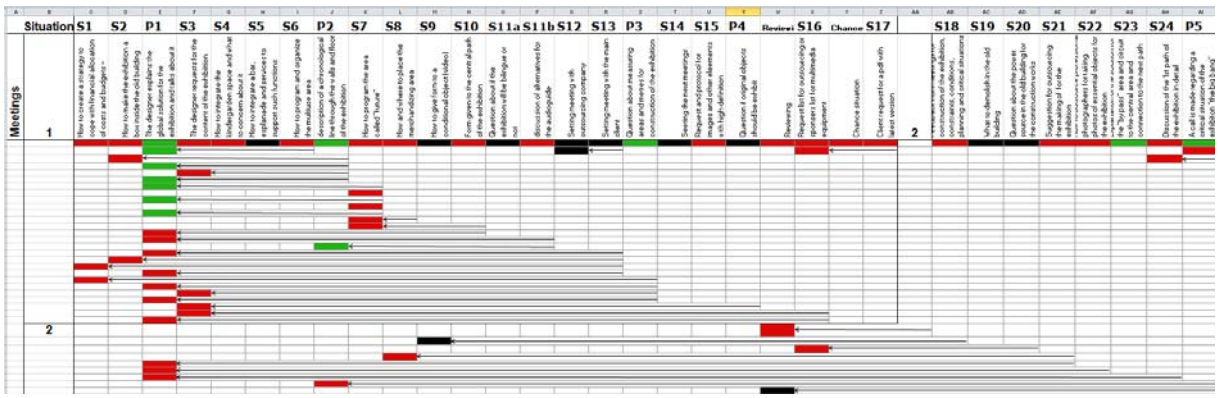

Figure 1. Example of how instances of value judgment evolve across meetings 1 and 2.

Passive *Iterative* *Definitive*

It was inferred that instances of value judgment can take three different states:

- Passive, when someone calls an issue without receiving attention.
- Iterative, when an issue is discussed still without final conclusion.

- Definitive, when a decision is assigned to an issue. Though, definitive instances can become iterative if the decision is not a final one.

Instances of decision-making were mapped across selected meetings. Specific attention was placed to causal relations and mechanisms of influence in the decision process.

Similarities were found across the meetings. From the analysis of the interviews and the analysis of meetings, influences of decision-making derive from individual, the team, the design-object and external needs and priorities (see Table 2).

Differences were also found in the processes for decision-making across the case studies. For example, architects spent more time discussing goal-based issues and one decision influences the sub-solutions of design and non-design related issues, while graphic designers spent more time discussing mean-based issues and although interdependency is evident, each issue demands particular decision. However, common sets of elements and mechanisms of influences derived from data analysis led to an integrative framework of value delivery and critical situations in designing.

ELEMENTS OF AN INTEGRATIVE FRAMEWORK

From the analysis of the interviews and meetings gathered in the five case studies an integrative framework of the main elements that assert source and priority in value judgment for decision-making as well its mechanisms is depicted. This framework integrates the sources of crucial situations and its mechanisms of influence in the decision process. In the following explanation the integrative framework related to content and process is formulated. Invariant categories across the five disciplines of sources of crucial situations and sources and priorities of values towards decision-making are depicted. The possible alternatives of interaction between these set of elements during the instances of evaluation towards decision-making that were found in the analysed meetings are considered in the integrative framework process. An integrative framework model on the influence of value and crucial situations in design is illustrated. An outline of counteractions to crucial situations is sketched.

Integrative Framework: The Content

Two main content sets of elements and its categories derived from data analysis are explained, namely, source and priority of value towards decision-making and sources of crucial situations.

Source and Priority of value towards decision

From data analysis it can be inferred that the initiator of the instance of value judgment is the individual through an individual, team, design-object or external concern. Aspects of the four main categories can be asserted as source or priority for evaluation towards decision. A two level categorization system for each one of the main sets of elements is shown in Table 2.

Table 2. Source and priority aspects of the four categories of value input towards decision-making

Source and Priority of value towards decision-making				
Value input	**Individual**	**Team**	**Design-object**	**External**
Source and Priority	Motivation Inspiration Aspiration Heuristics Gain knowledge Learning Collaboration Anticipation Application results Explicit values	Environment Teamwork Design results Management Process Performance	Emotion-based Intuitive-based Rational-based Experience-based Constraint-based	Political-based Business-based Competence-based Preference-based

The work that has been done and lies behind Table 2 is extensive and cannot be entirely explained in this piece of work. However, examples are given to illustrate the content behind these categories. For example, on the individual level, designers stated the need to have incentives and stimuli, to answer to the purpose, leave a mark and social intervention, cope with unexpected situations, break paradigms, keep external look, adopt an experimental approach, have access to information, clarify doubts, have a notion of the territory and own position, achieve change in the application results and sustainability. Such characteristics among many others were categorized as motivations, inspirations, aspirations, heuristics, gain knowledge, learning, collaboration, anticipation, application results and explicit values. On the team level, designers stated the need to have a good working place, communication flow, understand each other perspectives on the design problems, managing resources, finding strategies, and manage individual and team performance. Such concerns among others were categorized as environment, teamwork, design results, management, process and performance. On the design-object level source and priority for evaluations is given based on inputs such as, the sensations to transmit to people, feeling certainty about a choice without argument, characteristics of the design problem context, users experience, and time, client or cultural conditions. Such concerns were categorized as emotion-based, intuitive-based, rational-based, experience-based and constraint-based source and priority. Similar inputs derived from external needs, for example, a political choice from the client, a business collaboration that is included in the project, a choice based on competence for the outsourcing of services, or based on the preference for a certain style of approach that seems to be adequate for the design goal. Such concerns were categorized as political-based, business-based, competence-based and preference-based source or priority for decision-making. During the analysis of the meetings, it was found that other stakeholders also share similar concerns.

Sources of crucial situations in decision-making

From the analysis of the interviews and the meetings it can be derived that the sources of crucial situations in decision-making can be positioned into seven categories as shown in

Table 3. Aspects of the seven main categories are asserted and a positive and negative behaviour derived from these circumstances is exemplified.

Table 3. Source, challenges and examples of positive and negative behaviour in crucial situations

DECISION-MAKING			
Sources of crucial situations	**Challenges**	**Examples of observed successful behaviour**	**Examples of observed less successful behaviour**
Dosage	**Adequacy**	Look for essential criteria	Missing criteria
	Balance	Make things matching	Over dosage
Planning	**Probability**	Preparedness	No probability evaluation
	Anticipation	Foreseeing opportunities	Overestimation of predictability
Framing	**Orientation**	Reflected choice	Difficulty to choose
	Focus of attention	Convergence	Stuckness
Ambiguity	**Surprise**	Opportunistic procedure	Missing opportunities
	Unknown	Reflected analysis	Clients that do not know what they want
	Intransparency	Searching for indicators	Difficulty to grasp the features of a problem
Information Transfer	**Communication**	Transparent communication	Confirmation bias
	Exchange	Awareness of the need for sharing information	"Tunnel view"
	Documentation	Keeping record of sub-results	Not keeping record of sub-results
Interdependency	**Interfaces**	Awareness of the different interfaces involved	Acting without reference to others involved
	Suspension	Take time for decisions and keep in mind long and short term consequences	Missing feeling of competence
Envision	**Open up solutions**	Generating alternatives	Difficulty to think in the future

- Dosage - refers to the need to find adequacy and/or balance in the quantity and quality of different activities and measures, in order not to overdo or be underdone.
- Planning - refers to dynamic situations which needs an action plan for the future.
- Framing - refers to situations that need to be framed or reframed and provides reorientation and focus.
- Ambiguity - refers to situations of surprise, intransparency and unknown, which usually create a kind of ambiguity.
- Information transfer - the transference of information requires to deal with a lot of different challenges such as communication, exchange and documentation.
- Interdependency - different interdependencies make decisions vulnerable and do not intended side and long term effects.
- Envision - refers to the need of imagining future possibilities regarding the design goal.

Integrative Framework: The Process

Sources and priority of designers value systems integrate the connections in designers' thinking and acting when delivering value to design meetings and results leading to decision-making in designing. Individual, team, design-object and external concerns work as source

and priority in instances of evaluation towards decision-making and have a key role in coping with crucial situations. From the present study such connections are proposed in an Integrative Framework that contributes for the awareness of crucial situations in designing and the activation of the set of elements of designers value systems as counteractions to cope with such circumstances (see Figure 2).

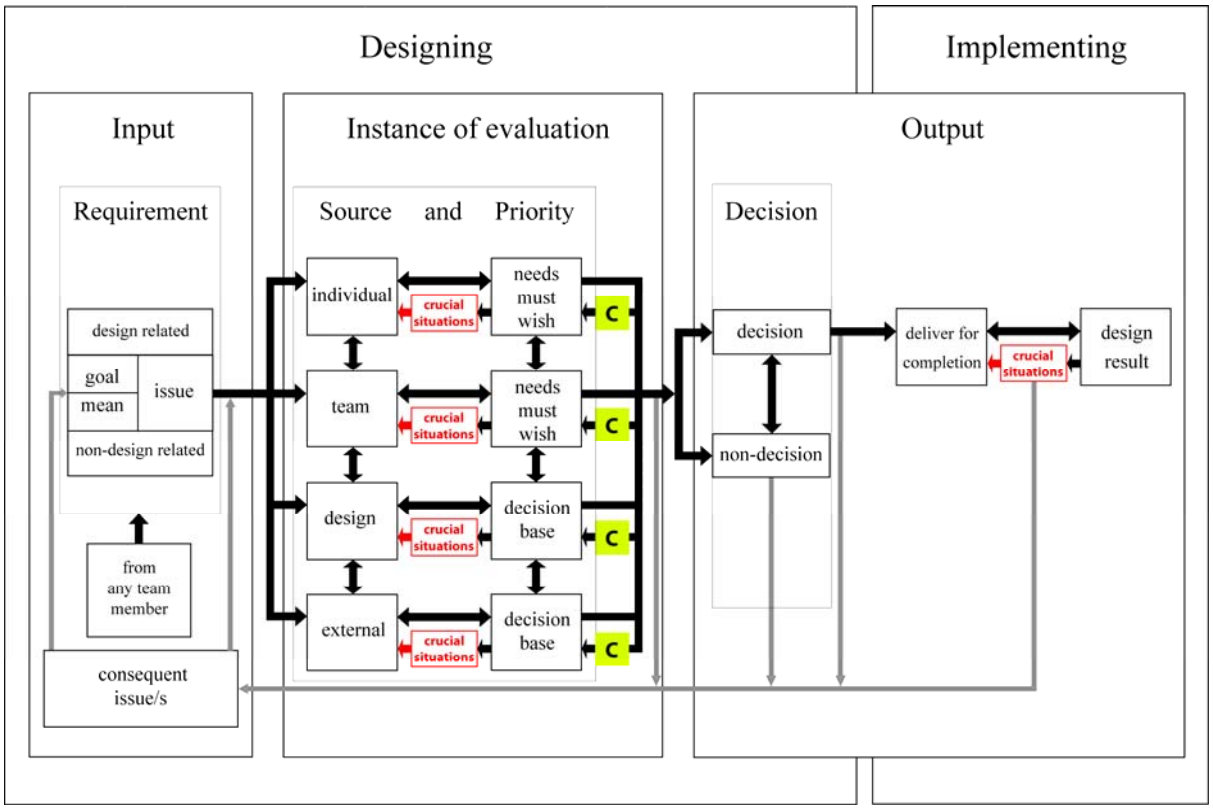

Figure 2. Integrative Framework of source and priority of value delivery in the evaluation of requirements, as counteractions to cope with possible crucial situations and the respective decision or non-decision as output.

The model covers two main stages of the design process, namely the designing and implementing stages and has three main components, namely an input, an instance of evaluation towards decision-making and an output:

- There is an input situation based on the requirement to discuss a certain issue, that can be goal or mean-based and design or non-design related. Such request is initiated by any team member, and can be consequent from the discussion of previous issues.
- There is an instance of evaluation towards decision-making that follows a pattern of connection. The issue requested for discussion can emerge from four alternative sources, namely: an individual, team, design-object or external concerns. Different combinations of these four paths of connections can be distinguished and analysed towards value judgment and decision-making (See Figure 3). The sources of crucial situations can affect the individual, team, design-object and/or the external environment.
- There is an output situation where a team-based decision is made and that bridges the designing and implementing stages. In regard to decision-making two different situations may occur: a final decision based on the agreement of a definitive solution, or a non-decision based for example on alternatives of the solution.

Decisions and non-decisions can lead to the discussion of consequent issues. Crucial situations can occur in the implementing stage.

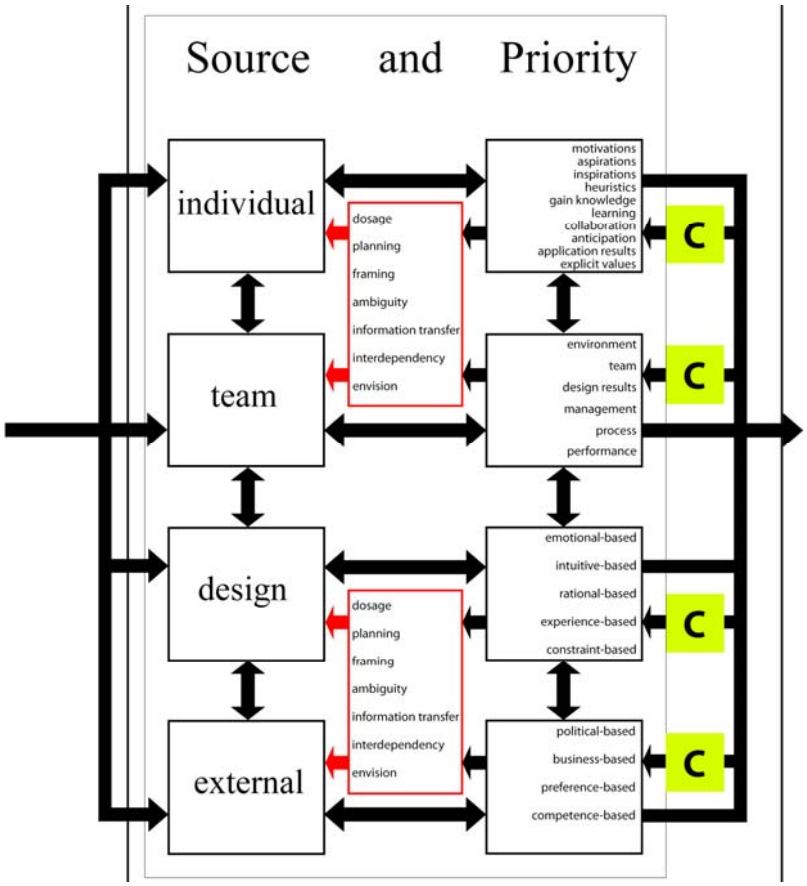

Figure 3. Integrative Framework content of the sources and priorities in instances of evaluation.

The present framework contributes to the awareness of critical situations in designing and to the activation of the system of individual, team, design and external sources of value input as counteractions (C) to cope with such circumstances.

CONCLUSIONS

This research aimed at integrating findings of the analyses of five case studies in different design disciplines focusing on sources of crucial situations, which were derived from the lean thinking philosophy. Therefore, contributes to the knowledge and management of value deliverance in designing and intends to contribute to the awareness of crucial situations to improve designers' performance and facilitate decision-making. Further empirical studies should prove the interrelations between the influence of the sources of crucial situations on the variants and invariants across disciplines.

The issues of commonalities and differences in designing across disciplines have been asserted as of a major importance to design research (Visser, 2009). The present study brings the opportunity to see more in depth and on a transdisciplinary base, how designers cradle and prioritize value and what phenomena can lead to crucial situations and its consequences.

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Sustainable Consumer Voices - User Insights as Inspirational Locomotive for Design Strategies

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Keywords: User Studies, Innovation, Technology Adoption

Aiming to explore how user driven innovation can inform high level design strategies, an in-depth empirical study was carried out, based on data from 50 observations of private vehicle users. This paper reports the resulting 5 consumer voices*: Technology Enthusiast, Environmentalist, Design Lover, Pragmatist and Status Seeker.* Expedient use of the voices in creating design strategies is discussed, thus contributing directly to the practice of high level design managers. The main academic contribution of this paper is demonstrating how applied anthropology can be used to generate insights into disruptive emergence of product service systems, where quantitative user analyses rely on historical continuation.

AIMS

The study and understanding of the emergent market of electric vehicles holds an interest for companies across the globe. Ability to frame and influence the dynamics of this potentially global market can lead to large scale success for the companies involved. In the last decade the negative impact of transport on the environment has developed into a generally accepted discourse depicting a growing concern for our environment (Van Wee 2007). With respect to the transport sector, current dominant measures to reduce the demand for car usage have concerned assessments of how to reduce *car use* rather than reducing *the environmental impact per car* (Gärling and Steg 2007). This paradigm is changing with the emergence of electrical vehicles. As awareness of sustainable design and development is growing amongst the public and policy makers, industries are undergoing increased pressure for becoming more sustainable. Changes in core automotive technologies and services surrounding them

are reflected in the emergent electric vehicle market. Shifting to more emission free technologies is an industrial change which marks a classic disruption or discontinuity in an industry (Christensen 2001). This emergent market promises a more sustainable automobile usage and appears to be a potential profitable market for the key stakeholders involved.

As an effect of these changes, the main challenge that organisations involved in this transition are facing is: How to design and align company strategies with the emergent consumers of electric vehicles? The ability to do this promises new insights and deeper theoretical understanding of how to design organisational strategies for emergent markets. In this particular context, it could prove to be a competitive advantage for companies striving to be the first to enter the emergent electrical vehicle market, as the ability to define and implement the rules by which other companies have to abide is the significant advantage in itself. Therefore, we set out to explore how user driven innovation informs creation of business strategies.

This article is organised as follows: firstly we argue for a methodological shift from a quantitative segmentation to a qualitative user behaviour analysis. Secondly, we present the case of etrans Design Collaboration and 5 consumer voices elicited, together with the desires and motivations that guide their behaviour. Thirdly, we map them out on product adoption curve for the introduction of innovative products in the market and combine them with a model of business strategies. Finally, we outline and discuss implications for the strategic design management and the need for further research.

LITERATURE REVIEW

In an emergent market the notion of creativity plays an essential role, as the shape and size of the market is not yet imaginable (Woodman, Sawyer et al. 1993; Sternberg, Ohara et al. 1997). A way of sparking organisational creativity in the hope of framing emergent markets has been the use of consumer surveys. That is, companies have sought to understand the consumers in the present in order to grasp the consumer of the future, so they might design and fit an appropriate organisational strategy (Buchanen 2001). In emerging markets where the industry architecture is at a nascent stage, each actor has a strategic interest in shaping the industry architecture favourable to their business model. Action asymmetries, i.e. who can do what and who cannot, and rules for interaction among industry actors will shape division of work, and with it render some capabilities more critical and thus more valuable than others. In order for companies to do this, and spark creativity in the form of new ideas leading to innovation, two broad methodological consumer approaches could be suggested: quantitative segmentation approach and qualitative segmentation based on user behaviour in a given context. The quantitative approach to consumer surveys, such as segmentation and forecasting, is well integrated in contemporary strategy making (Davenport 2006). However, qualitative approaches has been argued especially useful for making design strategies in situations with manifold visions and conflicting societal interests, such as development of sustainable energy systems (Jørgensen 2009).

Consumers shift social strategies and constantly 'play' with their identity, making it increasingly hard to predict behavioural patterns using the linier approach that is entailed in statistical surveys (Hacley 2002; O'Sullivan 2007). So far, the main market analysis conducted by the companies in the area of consumer understanding in the context of business strategies has been quantitative. Quantitative method seems more appropriate for testing existing products than for exploring future perceptions of an innovative concept, such as electrical vehicles and their market. As outlined by several commentators, it is becoming increasingly difficult in the Western world, defined as Europe and the US, to understand consumer behaviour and trends in emergent markets by using static categories such as e.g. price of product/income. Attitudes towards price are much more diverse and multifaceted. As such it is problematic relying for a one-to-one connection between quantitative categories such as income and the patterns of behaviour we see in emergent markets. Although quantitative segmentation approach remains the most widely used tool for companies to understand their customer base and the emergent market of electrical vehicles, we would suggest a qualitative approach as it creates possibilities for holistic understanding of the emergent consumer of electric vehicles. Thus, we call for a methodological approach that can encompass the hopes and dreams of the consumers that may not always be affected by the static categories used in statistical surveys. There has been a very limited amount of research on electric car consumption focusing on the qualitative aspects, an none has sought to combine this with business actor strategies in the emergent market (Gjøen and Hård 2002; Heffner, Kurani et al. 2007). This is what we set to do, and as such we formulate the following research question: ***How can design of business strategies, in an emergent market, be informed and driven by user insights gained through a qualitative approach?*** From this heading, a sub-question is formulated to guide this specific project: How can we combine consumer insights from etrans Design Collaboration, gained through qualitative user studies, with business actor strategies in new and meaningful way?

APPROACH

The data for this study comes from Etrans Design Collaboration. It is a three year EU-funded project, which has the purpose of *'[…]contributing to making electrical vehicles an environmental and commercial success in Denmark."*(etrans 2010). etrans Design Collaboration seeks this goal by working with key stakeholders in the emergent market of electric vehicles such as; DONG Energy, the largest energy supplier Denmark, who in collaboration with Better Place seeks to develop a vehicle to grid platform, capitalising on surplus energy from wind turbines; Peugeot, who seeks innovative strategies for implementing electric vehicles in Denmark and change the services being offered on auto repair shops accordingly; Falck, the largest road service supplier concerned with understanding the future customer base of the electric vehicles market and with education of their personnel in order to handle these new challenges; Statoil Denmark, who has interest in surveying the emergent market, and many more (etrans 2010).

Data Collection

Etrans Design Collaboration is based on a qualitative user driven innovation (UDI) approach in their effort to understand the future base of electrical vehicles consumers. As noted by Leonard-Barton (1995), an anthropological approach to UDI can be particular fruitful in cases where there is great uncertainty both regarding the market and technology, as is the case with the design and implementation of electric vehicles. In the case of Etrans Design Collaboration anthropological approach was adopted: 50 different informants, who all have in common the fact that they live in Denmark and all drive cars, were chosen and selected in order to get an equal representation of categories such as gender (male/female) and place of living (urban/suburban/country area), age, and driving experience, as seen in figure 1 below:

DISTRIBUTION OF 50 INFORMANTS BY SEGMENTS

Car users distributed by		**Electric car user's driving experience**	
Public sector	34,5%	New user	26,5%
Domestic	38,0%	Experienced user	47,0%
Business/trade	27,5%	Lead/extreme user	26,6%
Geographical distribution		**Petrol car user's driving experience**	
City	34,0%	New user	9,5%
Suburbs	34,0%	Experienced user	61,5%
Country area	32,0%	Lead/extreme user	29,0%
Age		**Electric car user's gender**	
20-35	38,0%	Male	68,0%
36-50	32,0%	Female	32,0%
51-80	30,0%	**Petrol car user's gender**	
		Male	55,0%
		Female	45,0%

Figure 1 - Distribution of 50 informants by segments, adapted from etrans (2010)

The 50 informants were each followed by a trained anthropologist who observed them in their daily doings. Focus was primarily on users' daily lives and their relationship to vehicles and transport in general, with particular attention on their unique stories and inputs for a new, first-hand understanding of car usage, driving conditions, possibilities and challenges for driving electric cars in Denmark today.

During the day several data gathering techniques were used; semi-structured interviews, participant observation and shadowing, (Adler and Adler 1994; Bernard 1995; etrans 2010).

The 50 field visits, all of which lasted between five and eight hours, were conducted in the period between 7th April and 29th May 2009.

Participant observation and shadowing were distributed across five hours with each informant. The anthropologist followed the user and paid attention to parking, charging, refuelling, driving style, needs, activities, preferences and features of the car and of other technological devices. The anthropologists' approach was inductive – focus was on what contributes to a holistic, detailed understanding of this particular user's life, everyday routine and circumstances. After the field visit, anthropologist has written field notes about the user containing a brief description of the field process, a portrait, a description of the person's driving, costs, brand and environmental awareness, an extensive collection of quotations, any interview notes and anthropologist's reflections after the meeting with the user (etrans 2010).

Semi-structured interviews were conducted at the end and after 5 hours of *participant observation and shadowing*, so the purpose of interview was summing up and rounding off. *Semi-structured interview*s were based on interview technique that includes both contrast questions (how does it differ from?), descriptive questions, scenario questions (what-if scenarios) and exploratory questions (where hypotheses are proposed and jointly examined). The semi-structured and qualitative approach to an interview has the advantage of giving the interviewer ability to go in depth and explore and hence learn what meaning the participant himself/herself ascribes to his/her life-world (etrans 2010). The interview guide comprises a number of questions which the field worker covered with each participant in the study. The interview questions were developed and tested during the first field visit. The following 7 questions are the main themes that addressed the problem areas concerning user attitudes to limitations and making changes to their consumption of electricity:

1. *Me and my car – a presentation*
2. *What do your choice of car and your use of the car say about you as a type/profession?*
3. *Before buying or acquiring the car, what did you think/consider concerning the car? Is it different now (everyday use of the car)?*
4. *What prejudices are there about electric cars and drivers of electric cars? (what is the backchatter/what do other people say?)*
5. *In your opinion, what positive arguments are there for the electric car? – what could be improved?*
6. *What disadvantages and challenges do you see with the electric car today? – what gets in the way of its popularity?*
7. *Would you be prepared to change or limit your consumption of electricity in relation to different prices of electricity at different times of the day and night?*

Semi-structured interviews and *participant observations and shadowing* were chosen as data collection methods, guided by Ahmed-Kristensen's (2007) table below, as well as practical considerations. This choice is seen as best support for this investigation, as it provides insights into process, environment, product and participants, as seen in figure 2.

Research methods	*Process*	*Environment*	*Product*	*Documentation*	*Participants*
Document analysis	✓ (across different cases)		✓ (across different projects)	✓	
Interviews	✓ (across different projects)		✓ (across different products)		✓ (knowledge and views of participants)
Discourse analysis	✓		✓		✓
Observations	✓ (a period of a process)	✓			✓ (individuals and teams)
Participant observation	✓ (a period of a process)	✓			✓ (individual and teams)
Protocol analysis	✓ (episodes of process)	✓			✓ (individual)

Figure 2 - Research methods mapped against benefit from industrial context (Ahmed-Christensen 2007)

Data Analysis

There are many ways to analyse informants' talk about their experiences (Mahrer 1988; Spradley 1979; Taylor & Bogdan 1984). All the data collected has been transcribed and coded by using qualitative coding software, Atlas.ti, in order to make cross comparison and identify behavioural consumer patterns (Spradley 1980). As of 31st May 2009, a total of 16,510 Codes have been created in Atlas.ti and 7,789 Quotations covering more than 500 pages of transcripts (etrans 2010). Since in this project we underline focus on users and their perception of reality, as opposed to fitting users in predefined theoretical models, we chose In Vivo coding for the First Coding Cycle. In Vivo's root meaning "in that which is alive," and as code refers to a word or short phrase from the actual language found in the qualitative data record, "the term is used by participants themselves" (Strauss 1987). In Vivo Codes "can provide a crucial check on whether you have grasped what is significant" to the participants and may help "crystallize and condense meanings" (Charmaz 2006). Furthermore, In Vivo Codes capture "behaviours or processes which will explain to the analyst how the basic problem of the actor is resolved or processed" (Strauss 1987) and "help us to preserve participant's meanings of their views and actions in the coding itself " (Charmaz 2006).

After First Cycle of coding was completed, Second Cycle of coding has been undertaken. As Saldana (2009) points out, primary goal during Second Cycle coding is to develop a sense of categorical, thematic, conceptual, and/or theoretical organization from the array of First Cycle codes. First Cycle codes (and their associated coded data) are reorganized,

reconfigured and categorised according to similarity, during Second Cycle coding, to eventually develop a smaller and more select list of broader categories, themes, and/or concepts (Saldana 2009). Pattern Coding was chosen for the Second Cycle of Coding, because we wanted to map out user behavioural patterns. According to Miles and Huberman (1994), pattern coding is appropriate for search for rules, and explanation in the data, examining social networks and patterns of human relationships, and development of major themes from the data. Pattern coding is a way of grouping those summaries into a smaller number of set, themes or constructs…as pattern Codes are explanatory or inferential codes, they identify an emergent theme, configuration, or explanation (Miles and Huberman 1994)

The results of Second Cycle of coding and analysis, representing emergent themes and emergent consumer voices were presented at a weeklong workshop with participation of the anthropologists involved in the data gathering, market analysts, and key personnel representing all the stakeholders and companies involved. The aim of the workshop was *consumer identification,* using the knowledge and perspectives of the organizational partners in order to identify areas that might hold future interest. This was done by dividing 30 participants into smaller groups, entailing at least an anthropologist, a representative from one of the business partners, the technical specialist within domain of electrical vehicles, and a designer. The outcome of the workshop was the development of 5 consumer voices.

KEY FINDINGS

We learn, from the 50 different informants in this field study, what it means to have a car, to drive a car, to choose a car and to switch to an electrical car. The users' perspective showed us the car as a part of the shopping, utility, maintenance and replacement scenario, but also of people's everyday lives, working lives and social lives, where it signals to those around us about the self – and shows that our relationship with the car also creates and embodies our identity. 50 different informants in this study, as customers/buyers/users of any service, product or campaign for electric vehicles, are unique, complex, contradictory, moveable, social and very different people with just as many different needs, preferences and circumstances of life (etrans 2010) As a result of analysis 5 consumer voices were identified: *Technical Enthusiast, Environmentalist, Design Lover, Pragmatist and Status Seeker.*

The Technical Enthusiast: For this consumer voice the electrical car is associated with notions such as control and exploration as an informant points out; *"Driving an electric car is all about planning and how long you've got left"*. The technical aspects of electric vehicles become a hobby that is shared with peers in various social settings, in order to demonstrate their technical abilities. *The Technical Enthusiast* has already adopted the electrical vehicle, mostly because he does not perceive the technical problems surrounding the EVs as a negative but rather as a positive challenge.

The Environmentalist: The electrical vehicle is associated with the notion of being environmentally responsible. As such the consumer is driven by a desire to make ethical and environmentally correct decisions, as stated by this informant; "*Using electric*

cars is so obvious. It ought to be a law, really." What drives the environmentalist is not a desire for technical challenge, but a social and environmental responsibility. Environmentalist is looking forward to see electrical car on the market and express a desire to be among the first ones to try it out.

The Design Lover: This consumer voice is aware that he/she should be socially and environmentally conscious in his/her consumption; *"[...] if it could be attractive and eco-friendly at the same time, that would be preferable, of course."* Faced with a direct choice, the Design Lover would choose aesthetics over environment and as such his/her consumption of electrical vehicles is hindered by the fact that he/she sees it as being a negation of design, emotion and aesthetics. As such Design Lover does not rush into electrical car purchase. He/she would embrace the electrical car choice, if the car would fulfil aesthetic and design standards, by being a design object in the first place and environmentally friendly in the second.

The Pragmatist: Whereas the *Technical Enthusiast*, *Environmentalist*, and *Design Lover* put notions such as aesthetics, technical challenges, and social and environmental responsibility over price, this is not the case for the pragmatist. As an informant says; "*I have a pragmatic relationship with transportation: reliability and common sense; perhaps a bit boring!* " This consumer voice is motivated by notions such as price and quality, and as such electrical vehicles should outperform traditional cars in terms of efficiency in order to appeal to this consumer. He/she would not be among the first electric car buyers. Rather would wait to see other people using it first, and would adopt electrical vehicle, if it proves to be safe, reliable and demonstrate that entire system surrounding and supporting electrical car is functioning well.

The Status Seeker: For this consumer voice car consumption is closely linked to the notions of noise, speed and acceleration. As such an environmentally friendly consumption should add values to these notions. As one informant says; "*If it costs a bit more, that would be a statement to the effect that things are going well."* This consumer voice is a long way from adapting electrical vehicles as it is seen as too small and too plastic looking. Furthermore, he/she would wait with electrical car purchase until it is widely adopted and part of the bigger system and at the same time perceived as a status symbol.

DISCUSSION

The following consumer voices are paired with the Rodgers adoption curve for innovative products in the emergent market of electrical vehicles leading to the following model:

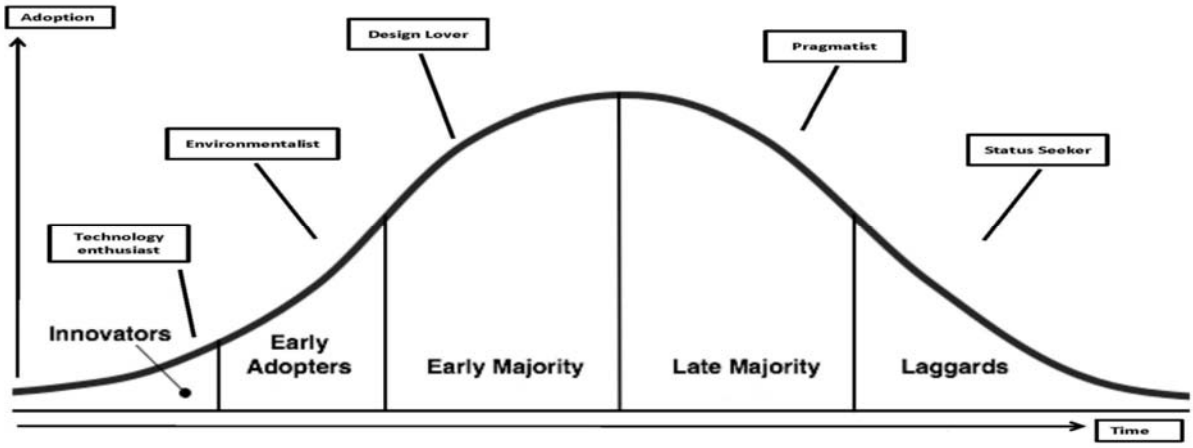

Figure 3 – adapted from Rogers, E.M. (2004) Diffusion of Innovations, NY Free Press

These consumer voices vary in the motivation that drives their consumption and behaviour, and call for different strategic approaches from key stakeholders in the emergent market of electrical vehicles. Each consumer voice in the model is related to one segment and says something about it. *Technology Enthusiast,* although the minority, represent lead users and innovators. Immediately after them *Environmentalis*t is the next in line to adopt innovation, belonging among early adopters. *Design Lover* and *Pragmatist* represent two most numerous segments. However, *Design Lover* is faster in innovation adoption being early majority. He is followed by *Pragmatist*, who represents late majority adoption. Last to adopt innovation will be *Status Seeker*, belonging among laggards.

For the purpose of structuring and understanding possible strategies that might be chosen in the future by the organisations when designing business strategies in the emergent market of electrical vehicles, we wish to include the following model allowing us to position business actor strategies with the consumer voices found in the Etrans Design Collaboration.

Integral Product Architecture	Proprietary Systems	Integrated Products
Modular Product Architecture	Open Innovation	Standard Products
	Business System Architects	***Technology Specialists***

Figure 4 – adapted from Rask, M; Andersen, P.H.; Linneberg, M.S.; Christensen, P.R. (2009) Local Design & Global Dreams – Emerging Business Models creating the Emergent Electric Vehicle Industry. Conference: Macromarketing, Kristiansand, Norway, June 2009

On the lower level of the figure 4 we see *Business System Architects* and *Technology Specialists*. An important distinction can be made between the strategies of *Technology Specialists* and those of *Business System Architects*: it is reflected principally in different managerial mind sets, business models and underlying capabilities to develop a competitive position in a fluid stage of industry architecture formation in emergent markets. *Technology Specialists* have relatively strong focus on developing one particular technology. By a

managerial mind set we refer to the mental representations of the business realities which managers use to make sense of ongoing events. These include strategic beliefs and creative processes that drive managerial decisions, including the identity of the customers, such as e.g. the qualitative consumer identification found in the etrans Design Collaboration (Weick 1995).

On the left side of the figure 4 we see *Integral Product Architecture* and *Modular Product Architecture. Integral Product Architecture* refers to industry patterns of high degrees of co-specialisation where substitution is limited, whereas *Modular Product Architecture* consists of standardised components making both substitution and a developing market for specialisation across manufacturers possible.

Figure 5 shows how we positioned consumer voices found in the Etrans Design Collaboration according to their key characteristics and main drives: *Technology Enthusiast and Environmentalist*, with their inclination towards innovative sustainable solutions, and valuing the product higher than the service, were placed within *Technology Specialists'* strategy. *Technical Enthusiast* is motivated by relative autonomy and the possibility of discussing technical aspects with peers. As such they are radical in their use of the product. *Environmentalist* is more motivated by its social and environmental responsibility, and perceives it as a guiding principal when choosing new product.

Whereas *Technology Enthusiast* and *Environmentalist* would find Business Systems architects' strategy constraining, it is a strategy well suited for *the Pragmatist* and *Status Seeker*, as both seem motivated by convenience, and to a lesser extent are interested in technological challenges. *Pragmatist and Status Seeker*, with their focus on reliability of products, were placed within *Business System Architects'* strategy. *Pragmatist* is driven by practical solutions that function well within already established large system. Although *Status Seeker* highly values social status symbol of a product, he depends on the existence of a wider system in which the product is well integrated, widely accepted and publicly recognized as valuable.

While all four of above mentioned consumer voices clearly belong to one of the strategies, *The Design Lover* is betwixt and between the Technology Specialist and Business System Architects. This consumer voice do not separate product from service and could potentially belong to both strategies.

Business System Architects	***Technology Specialists***
Pragmatist	*Technical Enthusiast*
Status Seeker	*Environmentalist*
Design Lover	

Figure 5 – Distribution of consumer voices within categories of business actor strategies

To illustrate the distribution of consumer voices, along the adoption curve, together with business actor strategies, we created the following model:

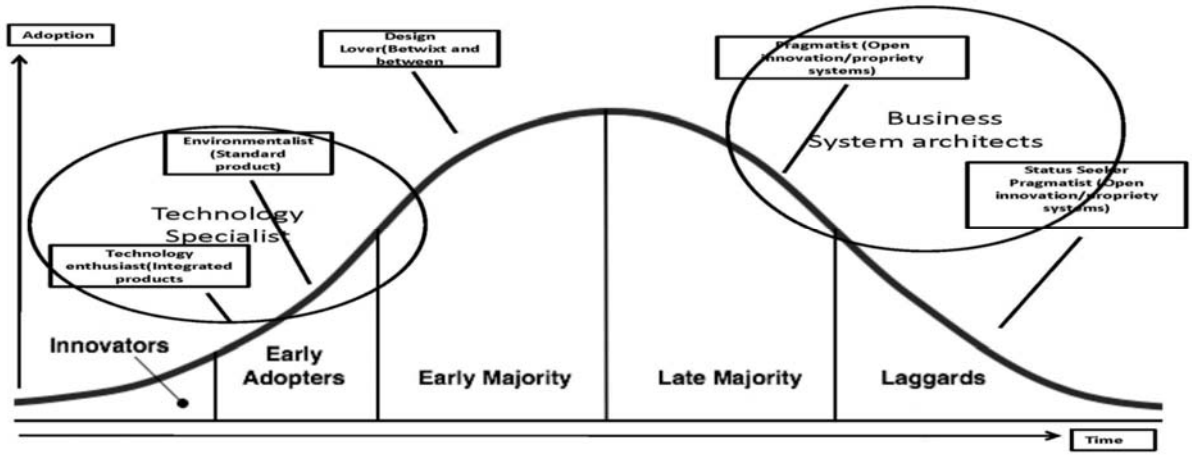

Figure 6 - adapted from Rogers, E.M. (2004) Diffusion of Innovations, NY Free Press

Technology Specialists' strategic focus is on how to progress one particular technology to be used either within one single industry architecture or across a range of industry architectures. In the case of the emergent market of electrical vehicles, this strategy targets *Technology Enthusiast* and could take advantage of the knowledge embedded in this consumer voice. *Environmentalist* could also prove to be helpful in the design of the *Technology Specialist's* business strategy. Although this consumer voice is not in the lead of technological development, it rather leads when it comes to notions such as social cooperation and environmental responsibility. Insight from this consumer voice would allow companies to gain understanding of how to design their strategies in order to accommodate the needs of this grouping. *Technology Specialists,* who develop S*tandard Products,* simultaneously seek to create network externality. Their business model will often be more incremental and focused on the innovation activities of other actors in the industry and best suited for the *Environmentalist*. On the other hand, the *Technology Specialists,* who develop *Integrated Products,* are radical in their approach to innovation in order to create new concepts and therefore do not need to create relationships with other actors, and could tab in to the knowledge of the *Technology Enthusiast* (Henderson and Clark 1990). *Design Lover* can be approached by *Technology Specialists'* strategies. Insight from this consumer voice could inform companies when designing new products, as they equally value product as well as services surrounding them.

Business System Architects design architectures that provide the contours and framework within which actors interact by creating standards and by means to coordinate economic activities (Jacobides, Knudsen et al. 2006). In the proprietary system the user is obliged to subscribe and add to a certain technology that renders the company full control of innovations in the present and the future. Opposite to such an exclusion strategy, we find *Open Innovation* (Chesbrough 2003), where the business model of the firm determines what external information to bring inside, and what internal information to take outside. The central idea behind open innovation is that firms cannot afford to rely entirely on their own

research, but should cooperate with other actors such as customers and other firms in order to create network externalities, because standards enhance compatibility or interoperability and thereby generate greater value for the actors by making the network larger (Shapiro and Varian 1998). *Business System Architects'* strategies, both within Open Innovation and Proprietary Systems directly target *Pragmatist*, as this voice shows most interest in price, quality and safety, and highly values reassurance and reliability of the system surrounding the product. *Status Seeker* could in the same way inform and drive design of *Business System Architect's* strategies, although by giving insight into scalability of the concept after market introduction. This consumer voice is interested in confortable, high performance, high quality products, operating within perfectly functioning service systems. *Design Lover*, although placed in between, can be targeted by *Business System Architects'* strategies. Although this consumer voice can be radical in their use of product, he would also have knowledge of and be interested in broader systems.

IMPLICATIONS FOR THEORY/PRACTICE

One of the focal interests with respect to disruptive change is the question of which market participants hold the largest probability of being able to define the business models of the future, or in other words which capabilities will frame the future market. In this paper we have sought an explorative approach in order to understand how one can fit qualitative consumer voices with the design of business actor strategies in the emergent market of electrical vehicles. Thus, we have argued that a business actor strategy in the emergent market of electric vehicles focusing primarily on radical innovation, and secondarily on the standardised products in product development, will have easier access to the market, thereby being able to frame it relatively earlier than businesses that set up business architecture like e.g. infrastructure in the case of electrical vehicles.

From the results of this study, design managers in the product development organisations, service development organisations and product service system (PSS) development organisations, can gain better understanding of requirements needed when defining specifications for future design strategies. Consumer voices inform them on product characteristics desired, preference of products vs. services or *vice versa*, and help them in creating and building more robust and adaptable design strategies for emerging markets.

The main academic contribution of this paper is demonstrating how applied anthropology can be used to generate insights, through qualitative inductive approach, into disruptive emergence of product service systems, where quantitative user analyses rely on historical continuation.

Although our study provides deep understanding of consumer behaviour in relation to emergent market of electrical vehicles, it is context specific and as such would require a comparative study when applied to another setting. Conclusion that product should precede the service is most probably only valid within current users and current technology, whereas it would need to be tested in another environment.

After eliciting and defining five consumer voices, further quantitative studies could prove useful, such as study of the relative frequency of the voices, in order to define business potential within each voice. Longitudinal quantitative study could further research on consumer voices by providing insights into relative stability of the consumer voices and their fluidity over a longer period of time.

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Embedding Sustainable Design-Led Innovation in SME's through Regional Business Support

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Keywords: Sustainable Innovation, SME, Business Support

Sustainable Innovation can be seen as both a means to mitigate the effects of climate change and a method by which business can adapt and prosper during societies transition towards a low carbon economy. This paper presents the progress and initial findings of the Sustainable Design-led Innovation business support program, led by Cranfield University. The initiative utilises design thinking around sustainable innovation to assist small and medium sized enterprises in the East of England in their early innovation process; enabling them to produce more sustainable / low carbon business offerings. The paper presents the dynamic and flexible methodology being adopted for the project delivery; focusing particularly on a life cycle hotspots tool developed for this program and provides insight into initial project findings surrounding sustainable innovation outcomes.

Background

Sustainable Innovation defined

Sustainable Innovation can be seen as both a means to mitigate the effects of climate change and a method by which business can adapt during societies transition to a low carbon economy. The Harvard Business Review identifies sustainability as the key driver of Innovation (Niumolu, *et. al.*, 2009), and recent research by IBM (2010) saw 1500 CEO's identify "harnessing creativity to manage increased complexity" as the most important leadership quality. These factors together suggest that business has a clear need to allow sustainable innovation to influence its offerings and practices.

Although there are many benefits for organisations, particularly small and medium sized enterprises (SMEs) to engage in sustainable innovation, the process of doing so can often be confusing and can differ depending upon the nature of the business and the approach that they adopt. This is emphasised by the range of terminology which surrounds the concept of sustainable innovation, which often serves to highlight a particular focus of the approach to be taken or the outcome to be achieved. Von Stamm (2006), for example, depicts innovation as 'creativity and commercialisation put together' highlighting its implicit economic benefit. The Eco-Innovation Laboratory (2010), however, emphasises the environmental nature of Eco-Innovation defining it as 'any innovation that reduces the use of natural resources and decreases the release of harmful substances across the whole life-cycle'.

Charter (2007) supplies a more encompassing definition to Sustainable Innovation making it more accessible and comprehensive to SME's; 'a process where sustainability considerations (environmental, social, financial) are integrated into company systems from idea generation through to research and development (R&D) and commercialisation. This applies to products, services and technologies, as well as new business and organisation models'. This definition is particularly useful as it highlights the multi-faceted and tangible benefits of sustainable innovation that can occur throughout the entirety of an organisation. Additionally, Charters definition points to a clear role for design as the creative stimulus for business to engage with sustainable innovation at all levels.

The choice of approach to innovation depends on the business strategic purposes and direction, its capability, its market understanding and the size of the risk investment available (DTI, 2006). Organisations can choose to embark on different levels of innovation depending upon the degree of change they wish to achieve. These degrees of innovation are often referred to as Incremental, Radical and Disruptive dependent on their effect on the market status quo. Additionally, as suggested in Charters definition, innovation can influence various aspects of an organisation depending upon the focus of change; Process/ Product/ Marketing/ Organisational (OECD, 2005)

Stevals (1997) broadly identifies four levels of innovation assessed by environmental improvement:

1. Incremental; improvements to existing products,
2. Re-design; re-designing present products within scope of technical feasibility,
3. Functional; providing alternative product service systems to fulfil need,
4. Systems; requiring societal behaviour change.

Hansen, *et al.*, (2002) identified that uptake of environmental innovations by SME's is highly influenced by the interplay of competencies, network relations and strategic orientation of the company. It is therefore necessary for SME's to take a holistic and broad view of their business when implementing any degree of change.

Business support for SME's in East of England

The East of England is one of three regions with the lowest proportion of innovation active enterprises in the UK, according to the National Endowment for Science, Technology and the Arts (NESTA, 2008). SME's make up 99% of all businesses (BIS, 2011) and with survey findings from the Federation of Small Businesses (2007a) showing that "92% of respondents considered their business to be socially and environmentally responsible", there is a clear desire from SME's to address sustainability issues. Early program research in 2010, to understand the business support offerings on sustainability available to SME's in the region, identified 37 support services available. Only 9% of these services supported early stage innovation, with all focused around intellectual property and providing business incubation premises. No support was focused on assisting early stage innovation and definitely not associating this with sustainability issues.

The SME has support needs specific to their characteristics and circumstance. With limited resources, financially and physically, staff often have multiple roles and lack depth of area expertise. These factors drive SME support requirements (FSB, 2007b) of; simple to understand, not demand a large amount of time and not require great expenditure. As the areas of sustainability and innovation are complex, even to the area expert, these make demanding requirements. All these factors indicate a clear need for support around sustainable innovation focused to SME's needs, within the East of England region.

Sustainable Design-led Innovation (SDI)

Details of Business Support Program

This paper focuses on the Sustainable Design-led Innovation (SDI) business support program, led by Cranfield University and part funded through low carbon European Regional Development Funding (ERDF). The SDI program is for SME's in the East of England specifically, and aids their early innovation process, helping to produce more sustainable / low carbon business offerings, through utilising design as a key enabling tool.

The aim of the SDI program is to embed Sustainable Innovation in businesses, by supporting early stage innovation, through promoting knowledge transfer to unlock academic knowledge and increase SME knowledge on sustainability. In enabling SME's to engage with innovation driven by the sustainably agenda the following business benefits are identified as goals; identify new business opportunities, strengthen their business brand, insulate a business against risks and develop innovation strategies.

There are many drivers for a business to engage with sustainability, including customer expectations, regulatory requirements and resource shortages. Engagement with sustainability can also bring opportunities; for opening up new markets, differentiating business offerings and providing customers with added value. Sustainability and the Low Carbon economy are

complex issues, which can leave SME's confused as how best to respond. The SDI program employs simple, pragmatic tools to help a business identify which actions are relevant to them, and work towards developing more sustainable, low carbon business practices and offerings.

The SDI program is enabled through working in collaboration with key regional and national business support and academic partners. The support offerings recognise the findings of Hemel and Cramer (2002) which identify internal stimuli as the greatest drivers for eco-design uptake, particularly opportunities for innovation and the potential for market opportunities, which are highlighted to business as key benefits from engaging in Sustainable Innovation, alongside gaining greater understanding of the sustainability impacts of present products and practices.

The SDI program is ongoing, at approximately midway through its three-year lifespan. It has undergone development through running pilot workshops, building program identity and the creation of networks of both academic collaborators and engaged SME's. In clarifying the program delivery and base workshops the program is moving to a phase of wider delivery across the East of England region with a developing network of SME's. Close collaboration with other regional support programs has allowed the co-promotion of support available and recommendation of suitable SME's between programs.

Theory behind business support program

The definitions of sustainable innovation, discussed in an earlier section, describe a process where sustainability considerations (environmental, social, financial) are integrated into company systems from idea generation through to research and development (R&D) and commercialisation. This applies to products, services and technologies, as well as new business and organisation models (Charter 2007). Further more it was confirmed by early stage research that SME's lack any support for the early phases of the innovation process, when they can identify opportunities for sustainable innovation around their present business activities.

Life Cycle Analysis (LCA) is a tool widely used in industry (BSI 2006) to understand sustainability impacts throughout the life cycle, but could only inform SME business support for the SDI program as strict framework adherence requires too much expert knowledge, takes too long and is too expensive. Life Cycle Thinking (LCT) is widely acknowledged as an approach supporting sustainable innovation, with both the United Nations Environment Programme (2007) and the European Commissions Institute for the Environment and Sustainability promoting LCT in their programmes aimed at helping business contribute to sustainable consumption and production. Described by UNEP (2007) as "about going beyond the traditional focus on production site and manufacturing processes so to include the environmental, social, and economic impact of a product over its entire life cycle" it was

decided that LCT would be adopted within the program to encourage SME's to consider sustainable innovation at a comprehensive and holistic scale.

The East of England's regional business sectors were analysed using data from the Office of National Statistics (2011), for number of SME's and level of turnover. Using a two digit Standard Industrial Classification (SIC) it was found that 9 of the top 10 sectors, assessed by both criteria, were service based activities. Life Cycle knowledge (BSI 2006) is framed around the manufacture and consumption of products, with a distinct lack of clarification or terminology covering the life cycle of a service. In order to develop tools flexible enough to engage the target audience of predominantly service based SME's, life cycle knowledge was captured in both product and service focused diagrams (see Fig.1). The primary differences between diagrams were in terminology and the range of activities captured within the life cycle phases.

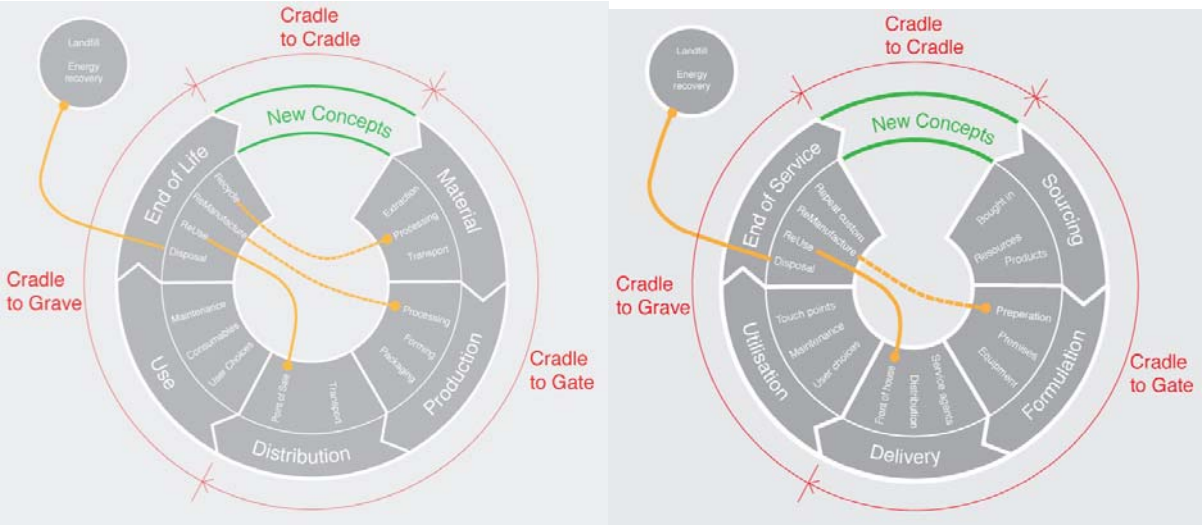

Fig.1 - Comparison of life-cycle diagrams for product (left) and service (right)

A range of complementary methodologies was considered in developing the SDI support program. Byggeth, *et al.*, (2006) have shown the effectiveness of both backcasting and a modular system of guiding questions framed around the life cycle as effective strategies for engaging business with sustainable product development. The use of backcasting was recognised as stimulating creativity in the generation of new concepts, but seen to be more suitable to business sector based workshops, and as such part of future program developments. A life cycle thinking framework was prototyped to follow the life cycle with a range of linked questions to capture a businesses knowledge around their offering, but its was found difficult to relate these answers to sustainability impacts, and the prototype developed into the life cycle hotspots tool detailed later. Providing knowledge of impacts enables a prototype card based tool (Dusch, 2010) to be used by designers in the selection of appropriate sustainable design strategies (Brezet, Hemel, 1997.,Vezzoli, Manzini, 2008), and is in development as part of a SDI workshop for product focused SME's.

The life cycle hotspots tool, described in more detail in the following sections, has been developed as an encompassing mechanism through which SME's are able to engage with varying degrees of innovation across multiple aspects of their organisation and product / service delivery. It was important to enable and encourage SME's to engage with the whole spectrum of innovation from incremental innovations (e.g. resource efficiency in processes and material re-design), through to considering a wider benefit for their business offering through disruptive innovations (e.g. new product categories, Product Service Systems).

Delivery of Business Support Program

The SDI program is delivered through a range of activities; Initial Engagement, Opportunities Workshops, Link Events, Sustainable Innovation Learning Lab and sector specific support.

Through Initial Engagement a potential SME customer for SDI program support series of diagnostic interviews and questionnaires the SDI program identifies important factors and allows them to influence the support offered to a business.

The Opportunity Workshops are the entry level activity, with separate workshops focused to both product and service orientated businesses. Using a mixture of unique tools and tested techniques the workshop helps participants identify and understand how their business activities relate to sustainability impacts, then think creatively about the innovations and opportunities that their company can realise from doing things differently.

The Link Events bring together businesses with sustainability area experts, support providers & funding organisations, in order to promote knowledge transfer, opportunity development, discussion and networking around the critical issue of sustainable innovation.

The Sustainable Innovation Learning Lab provides access to a network of expert partners from across the region, to help a business address their real learning needs. Seminars and workshops led by area experts ware organised to meet the demands of SDI supported businesses, driven by growing understanding of their needs.

Business sector specific support has been guided by the analysis of ONS data on SME's within the East of England. Tools are currently in development, through collaboration with industry experts and trade organisations, to engage with the specific needs and issues of; print, food & drink, and tourism sectors.

Of the SDI program activities the Opportunities Workshops represent novel methodology and original tools, of which a greater understanding and analysis would contribute to wider knowledge and research.

The Opportunities Workshop

Overview

The Opportunity Workshop is a 1 day workshop which has the overall goal of helping the participant businesses identify sustainable innovation opportunities specific to their business. The key activities of the workshop are employing the life-cycle hotspots tool, conducting a situational analysis and the application of creativity techniques to workshop findings.

A more detailed chronological breakdown of workshop activities follows; introduction to workshop and participating SME's; description of sustainability paradigms that are drivers for business engagement; explanation of sustainable innovation and its potential benefits using case studies; basic assessment of sustainability of business using SWOT analysis; conduct a life-cycle thinking exercise for a specific business offering (see Fig.2); highlighting of sustainability hotspots related to life-cycle phases and resource flows; conduct a situational analysis to identify the core competencies of the business; engage in guided creativity techniques around the previous workshop findings of sustainability impacts and core competencies to generate sustainable innovation opportunities specific to that business.

Fig.2 - Introduction to life cycle thinking activity in Opportunities Workshop

The 'take home' from the workshop is both the findings from the day, along with a new set of tools which can be re-used to focus on different aspects of the business, both of which inform the businesses innovation strategy and understanding of knowledge requirements. Throughout the workshop all activity outputs are captured in a handbook so that there is a

record for reference after the event and a guide for repeat use of the tool by the business.

The Opportunities Workshops have undergone development through pilot workshops, from which feedback has been very positive, informing the development and improvement of the workshop. Participating businesses have identified innovation strategies from workshops, which have focused on different areas and are at various stages of implementation. The SDI program is running Opportunities Workshops through the SDI program, to meet demand from businesses.

Life Cycle Hotspots Tool

Within the Opportunities Workshop the Life Cycle Hotspots tool is used to evaluate business activities throughout all phases of the life cycle of their business offering, appreciate what activities they can influence and highlight sustainability hotspots related to resource flows through those life cycle phases.

The first stage of the tool focuses on life cycle thinking around the product or service life cycle. This stage provides the business an opportunity to consider the wider life cycle aspects of their business offering, which are located outside their everyday activities and may not have been investigated in detail previously. The workshop group are introduced to the life cycle description used in the workshop and asked to populate a large-scale version of the tool, suggesting activities they feel appropriate for each phase (see Fig.2). This allows for discussion of the scope/appropriateness of each phase/activity and clarification of the workshop groups assumptions. Each business then works on their own specific life cycle thinking sheet (see Fig.3), starting by defining the boundaries of the life cycle, allowing businesses that provide a range of offerings to think on a manageable scale. It is advised that the boundaries should cover their business offering with most sales, as this offers the greatest potential for benefit from identified opportunities. The activities undertaken for the identified offering are then recorded for each of the life cycle phases. When completed the level of influence the business has over each of these activities in recorded.

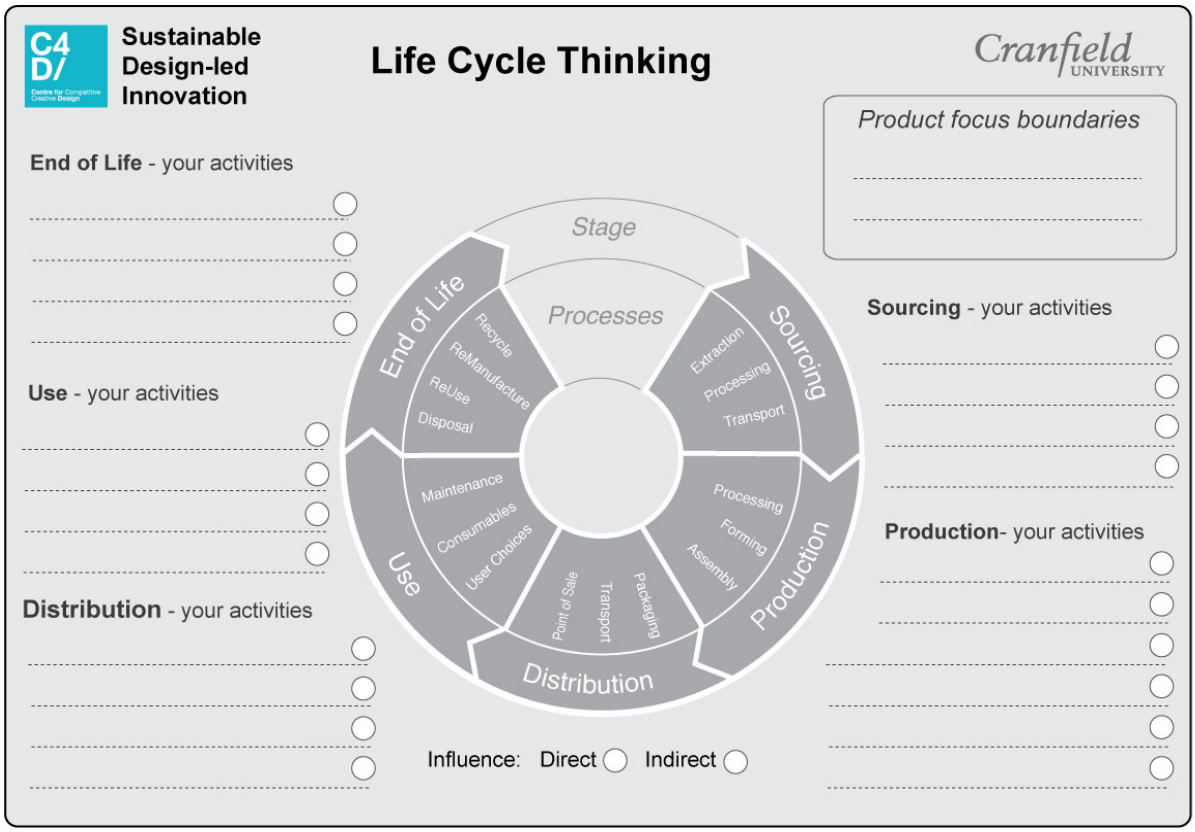

Fig.3 - Product Life-cycle thinking sheet, capturing activities and influence by phase.

The next stage of the tool, focuses on identifying the resource aspects associated to life cycle phases. As completing this stage for all lifecycle phases with in the timescale of the 1 day workshop is unrealistic, businesses are encouraged to focus initially on the phases they have identified greatest influence. Selecting the appropriate worksheet (see Fig.4) businesses identify the resource aspects used in that phase, using the stimulus questions to get them started. The resource aspects of Material, Energy and Waste are considered for any input or output flows, and the aspect of People is considered where there is influence on quality of life.

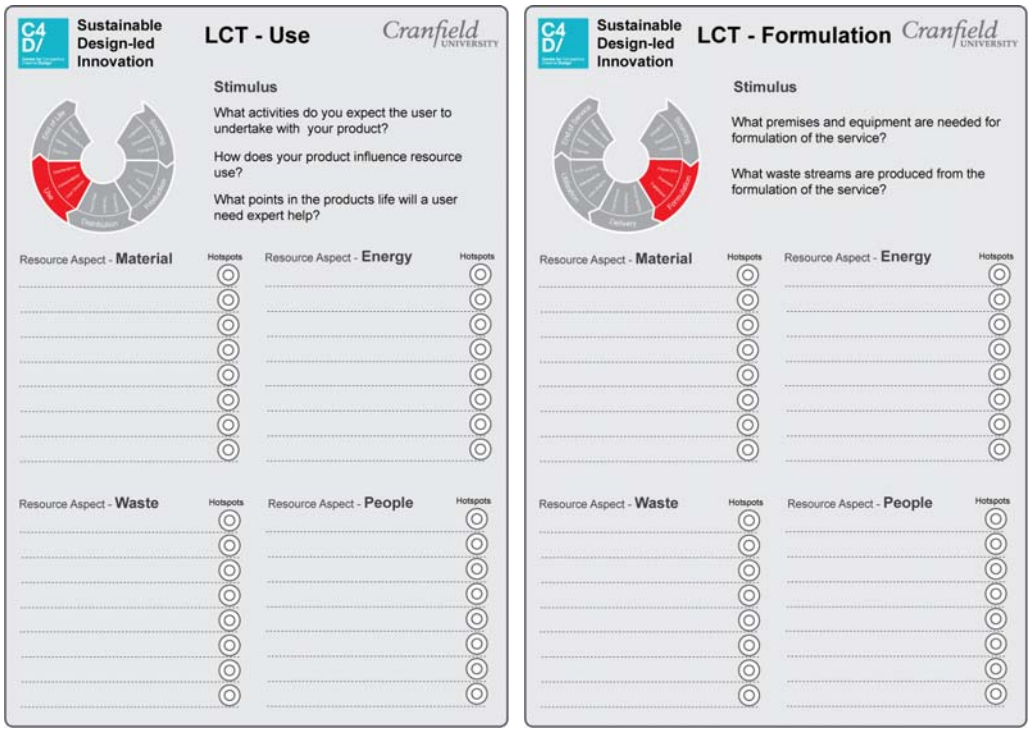

Fig.4 - Life-cycle Hotspot sheets for capturing resource use and ranking hotspots. Phase specific, with product use phase (left) and service formulation phase (right).

Once the Resource aspects are complete, the business moves on to assess the sustainability hotspots. Each of the resource aspects is ranked for sustainability impacts of 'little', 'some' and 'lots', with a corresponding marking of the hotspot circles of no marks, inner circle filled and both circles filled. In making the judgement on Hotspots the business is asked to consider the metrics of cost, quantity, associated fuel-use, toxicity and quality of life, and make a subjective decision influenced by comparison with the other resource aspects. Once sustainability hotspots have been identified they feed into the continuing Opportunities Workshop process described previously.

Discussion of Workshop Outputs

The sustainability hotspots highlighted through the workshop represent subjective judgements of the participating businesses on sustainability impacts, brought about by resource use from activities associated with the life cycle of their business offering. Whilst this method can be criticised for lack of any quantitative data to substantiate decisions on ranking, several factors work in its favour. The best people to make these subjective judgements are the practitioners taking part in the workshop, as they are deeply involved with their business activities. The findings from the life cycle hotspot tool are used to guide a creative process aimed at generating innovation relevant to a business and of a sustainable nature. The outcomes are framed as an appreciation of highlighted sustainability hotspots, describing their more ambiguous nature, in comparison to understanding identified sustainability impacts which would be provided by a Life Cycle Analysis.

At the time of writing 5 SME's, represented by 9 workshop participants, have completed pilot Opportunity Workshops. Detailed feedback questionnaires have been completed by 4 companies. The creativity sessions were identified as useful by all SME's for generating new insights, with 50% of SME's requesting increased knowledge of environmental impacts. All SME's identified at least one opportunity for innovation, these covering a range of areas including;

- policies for community engagement,
- resource efficiency measures,
- marketing strategies
- product re-design focused on materials.

A range of modifications have been implemented in light of feedback and lessons learnt in pilot workshop. The main changes focus on the life cycle hotspots tool, in providing more support for decisions on identification and ranking of sustainability hotspots, and an added emphasis on attaching metrics to hotspots in order to encourage appreciation of their sustainability impacts and the benefits from sustainable innovation opportunities that are implemented in the future.

Insights from SDI program

In developing the SDI program we have had interaction with a range of sustainability focused business support programs. This has provided insights into their problems and opportunities. Several issues are common; support programs focused around innovation have great difficulty in engaging SME's to participate and employing direct marketing techniques is common; jargon is to be avoided and ideas should be presented initially with business terminology.

Through feedback on the Opportunities Workshop the Design Management of participating SME's was examined. Those SME's providing services did not have any design management or innovation policy, while those providing products had ad-hoc systems that were driven by the founders of the business.

Whilst conducting SDI seminars and workshops several themes have been repeatedly expressed by SME's regards business support for sustainable innovation. To move from diagnosis to implementation, need simple templates that can be employed internally, alongside examples/case studies for inspiration, of exceptional people who are forging the way in areas. Collaboration within sectors on innovations was thought difficult due to perceived benefits to competitors, whilst inclusion of larger businesses could provide drive and context for sustainable innovation within supply chain SME's

On-going SDI Program Activities

The SDI program is on-going and several activities are still under development:

- Making the tools and workshops presently delivered face to face available through on-line delivery mechanisms, whilst maintaining the benefits and outcomes they provide.
- Growing the network of SME's engaged with sustainable innovation and collaborating with other organisations to delivery agents SDI program outputs across the East of England region.
- Development of future tools and workshops framed around both business sectors and supply chains.

Summary

This paper describes the Sustainable Design-led Innovation support program, its development of unique tools, research findings to date and insights into effective methods of engagement with SME's around sustainable innovation. The Opportunities Workshop and its Life Cycle Hotspots tool have been shown to effectively aid SME's in the generation of opportunities for sustainable innovation. Through the on-going development of the program these initial observations will be substantiated with the metrics of jobs created, funding acquired and innovations brought to market.

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Alex has worked on the SDI program for just over a year, where he has created the programs methodology and tools, utilising his knowledge of Sustainability and Design gained through research and practice. Previously Alex has worked for Knowledge Transfer Networks, the Ministry of Defence developing protection equipment and for a manufacturer in the automotive sector supply chain.

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Comparative Studies on Emerging Issues of National Design Policies

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Keywords: Design Policies, Design Promotion, Competitiveness, Design and development

National Design Policies is a field of emerging importance for design research. To demonstrate this, a review of available literature has been done, bringing evidence of emerging themes, authors and institutions, and providing an overview of some current trends in the field. This is achieved with the help of summarised visual representations and analyses of the information collected. This knowledge, visually depicted and examined, offers then further space for future research in the field.

Introduction

Governments are confronted today with increasingly complex demands from sectors as distinctive as urban development, energy, environmental impacts, food supply, and social care, among others. These problems need to be addressed with a new set of tools that help to break down this complexity into simple and achievable goals.

Design strategies are being considered as an alternative approach to unravel this problem. Consequently, a theme of increasing significance is that of Public Design Policies – how government sets principles to employ design to leverage social, economical, industrial, and regional development. Two aspects contribute to this interest: the exponential growth rate of Creative Industries within the past decades (UNCTAD, 2008; Velloso, 2008); and the ability of Design to be a link between technology, creativity and the user, being a potential unique tool to help innovate and foster economies (Heskett, 2009; Lee et al., 2007; Vinodrai et al., 2007).

Recognising the role that Design could play in this scenario, the European Union issued a report that emphasises the need for adequate National and Regional Design Policies to help leverage the otherwise vulnerable markets (Cunningham, 2008). Several government bodies

and international organisations have as well published reports, working papers and other documents on the same issue (Rat fur Formgebung et al., 2010; Commission of the European Communities, 2009; Design Council, 2008). Nonetheless, very little academic recognition has been given to the subject. Recent doctoral theses indicated the critical importance of producing new research-based knowledge, the generation of theories and their subsequent evidence (Choi, 2009; Raulik-Murphy, 2009). Other documents had also unfolded the quest for proper planning and assessment tools to support government management decisions (Bernatene et al., 2009; Moultrie & Livesey, 2009; Cunningham, 2008).

Within the above framework, this paper focuses on mapping how national design policies are evolving, specifically mapping the key authors (individuals and organizations) and emergent policy issues and trends within the field. This will enable future researchers and policy makers to more effectively establish benchmarks for policy development.

Methodology

This paper derives from the analysis of an original dataset of 970 documents, including papers, books, white papers and reports, collected during an empirical review of literature for an ongoing doctoral research on the subject of public design policies. Most of these documents were collected on digital format, and have been published by governments and international organizations.

From these documents, the most significant authors were chosen – either from the number of citations or from the relevance of the document. Several names appeared as authors and co-authors in many documents – in which case the most frequent name was highlighted (and usually appears followed by "& others"). One example of a document considered to be *'relevant'* despite being not very often mentioned are the proceedings of the World Design Forum "Design Policy and Global Network", promoted by ICSID and KIDP (Lee, 2002). Institutions also appear as authors, when names of authors or editors are not stated in the documents. Such is the case of the UK Design Council, with an extensive production of reports and white papers signed only by the institution.

From the selected authors (and institutions) resulted a subset of 231 documents, from which 22 themes emerged as significant – directly about or related to the field of design policies. Some themes (as well as authors) helped to establish a framework for the field, as a number of documents about "Design Definitions", or "Design History", "Economy" or "Innovation", and authors such as Michael Porter, whose models of competitiveness were adopted and cited frequently. International organizations such as the World Economic Forum, the Organisation for Economic Cooperation and Development (OECD) and the Commission for European Communities, published very significant and frequently cited documents about innovation, competitiveness and development which usually mention the role of design and design policies.

The themes were also set against a timeline of the dates of publication, allowing to visualise some clustering of themes and other behaviours along the four decades covered by the documents collected.

Visualising the data

Looking at the visual representation of publications and citations (Figure 1), some names stand out for different reasons: Michael Porter and his modelling of countries competitiveness is frequently cited and used as a reference by many authors (Porter, 1990); and authors such as Bonsiepe, Heskett, Papanek and Thackara helped to establish a basic framework for the field. Gui Bonsiepe authored several documents and working papers commissioned by United Nations in the years 1970s, grounding a discourse of design as a tool for development which he later applied during his experience in different countries in Latin America. Papanek, considered a pioneer for his writings on sustainability in the early years 1970s, took part of an ICSID working group that discussed design for development. Margolin (2007) states that Papanek's ideas, focused on indigenous skills, were opposed to Bonsiepe, who embraced science and technology as drivers of development. Sir George Cox, with his Review of Creativity in Business, commissioned by the British Chancellor in 2005, is undoubtedly the most cited author, and his ideas were used as a reference to several other recent documents. Finland was prodigal of writers on design policy – Korvenmaa, Valtonen, Hytonen, Nieminen, Saarela. Framing its own national design policy proposition from 2005, much research has been done concentrating around the Helsinki University of Art and Design (now the Aalto University) and it's Centre for Innovation in Design, Designium. Some of the authors listed (Tether, Swann, Cunningham, Cawood, Raulik-Murphy, Moultrie and others) developed research commissioned by institutions such as the UK Design Council, NESTA (National Endowment for Science, Technology and the Arts – the British innovation agency), SEE Project (Sharing Experience Europe - Policy, Innovation & Design – a network of European institutions related to design policies and promotion, based on Design Wales, Cardiff), and the Commission for the European Communities. Finally, a few academic theses have been written in the last years in UK universities: H. Alpay Er defended "The Emergence and Development Patterns of Industrial Design in Newly Industrialised Countries with particular reference to Turkey" at The Manchester Metropolitan University in 1994; Youngok Choi's "A Comparative Study of National Design Policy in the UK and South Korea" was presented at the Lancaster University in 2009; and Gisele Raulik-Murphy, a frequent author of papers and later manager of SEE Project, defended in 2010 "A Comparative Analysis of Strategies for Design Promotion in Different National Contexts" at the University of Wales. Curiously, they are all non-Europeans: Alpay Er is Turkish, Choi is Korean and Raulik-Murphy, Brazilian. It might help to understand the persistent focus of interest on design for development.

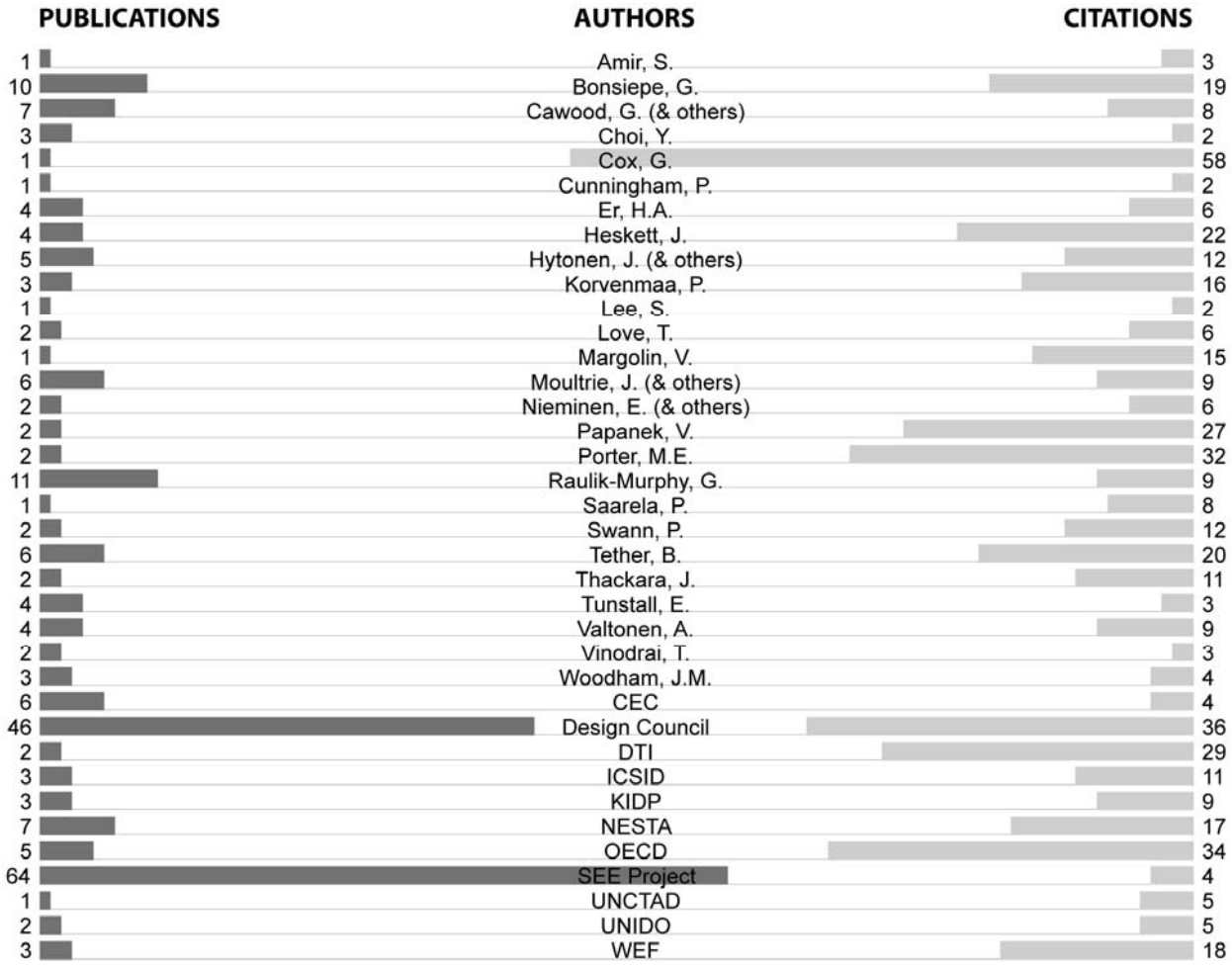

Figure 1: Design Policy - Key authors

A few conclusions could be drawn from the observation of the lower part of the authors/publications/citations graph (Figure 1): the first and obvious is the availability of publications from the UK Design Council. It still sets the ground for discussion in the field, either for being already almost seventy years old (founded in 1944) or precisely by the number of publications it produces. Important to note that several other publications of the Design Council were listed under other authors' names, since the ones listed there have only the institution as author. SEE Project is another prolific publisher, with a large number of talks, case studies and "policy booklets" available online, in addition to its bulletin. It certainly extended the centre of discussion and knowledge generation on the field of design policies to Wales – even though the search returned a low number of citations. The Department of Trade and Industry (DTI), specially with it's "Economics Paper No.15 - Creativity, Design and Business Performance" is frequently cited by other authors. The same occurs with the OECD documents "Open Innovation in Global Networks" (2008), "Science, Technology and Innovation Indicators in a Changing World" (2007), and "National Innovation Systems" (1997), frequently referred, especially when positioning design within

the innovation system framework. The World Economic Forum (WEF), besides the publication of its Global Competitiveness Reports, has also included design in the "Global Agenda Council Reports 2010". NESTA situated design within its reports on innovation and creative industries, offering support to some authors as well.

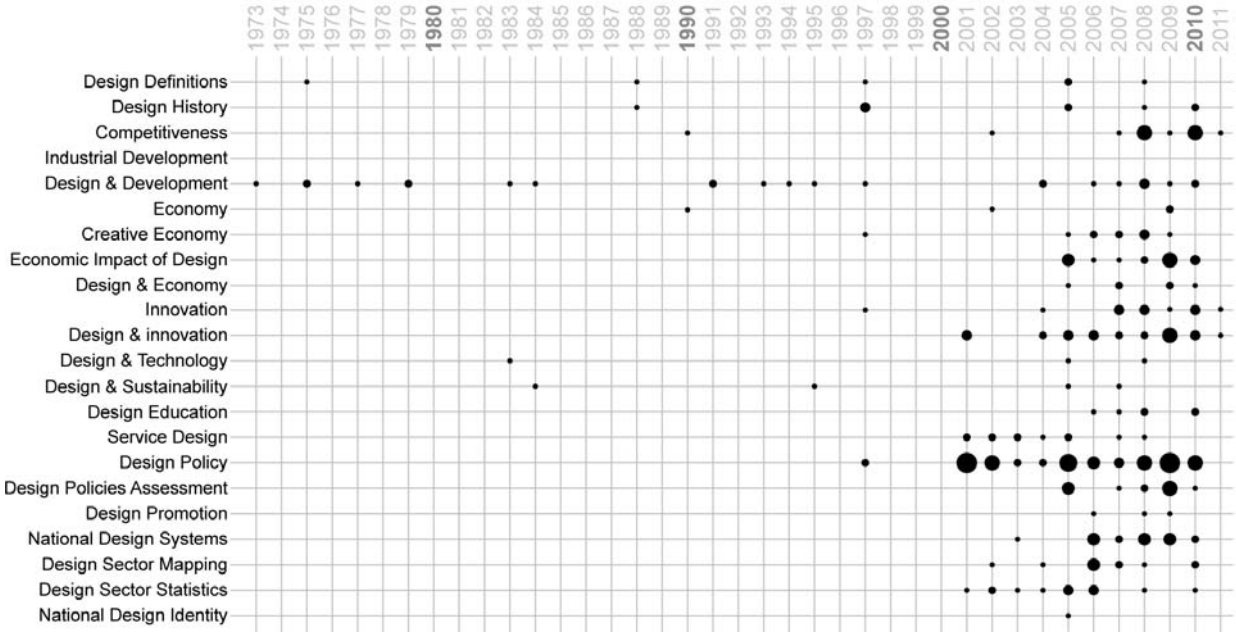

Figure 2: Design Policy - Themes over timeline

From the visual representation of occurrence of themes along the timeline (Figure 2), first it becomes clearly evident how much the discussion in the field was intensified in the years 2000s, and especially in the second half of it. The field slowly incorporated the discourse of Creative Industries / Creative Economy from the middle of the 2000s – as well as the importance of design as a driver of Innovation, and shows interest – or rather the need – for metrics, beginning with Sector Mapping and Statistics and growing towards the Economic Impact of Design and Design Policies Assessment at the end of the decade. A very consistent discourse of Design and Development permeated the four decades of documents – being Bonsiepe the most persevering author on the field.

The *Themes and authors* graph (Figure 3) brings more light to the individual interests and production, complementing the previous information. Authors such as Hytonen, Nieminen, Raulik-Murphy, Saarela, Tunstall, amont others, developed an extensive mapping of the design sector and the national design systems not only in their countries (Finland, Brazil, USA), but also from several others, as a comparative or benchmarking tool. Themes as design education or service design, despite their high relevance, had been little explored – with the exception of the Design Council. Design and sustainability, regardless of its importance, seems to be less explored in the realm of design policies as well.

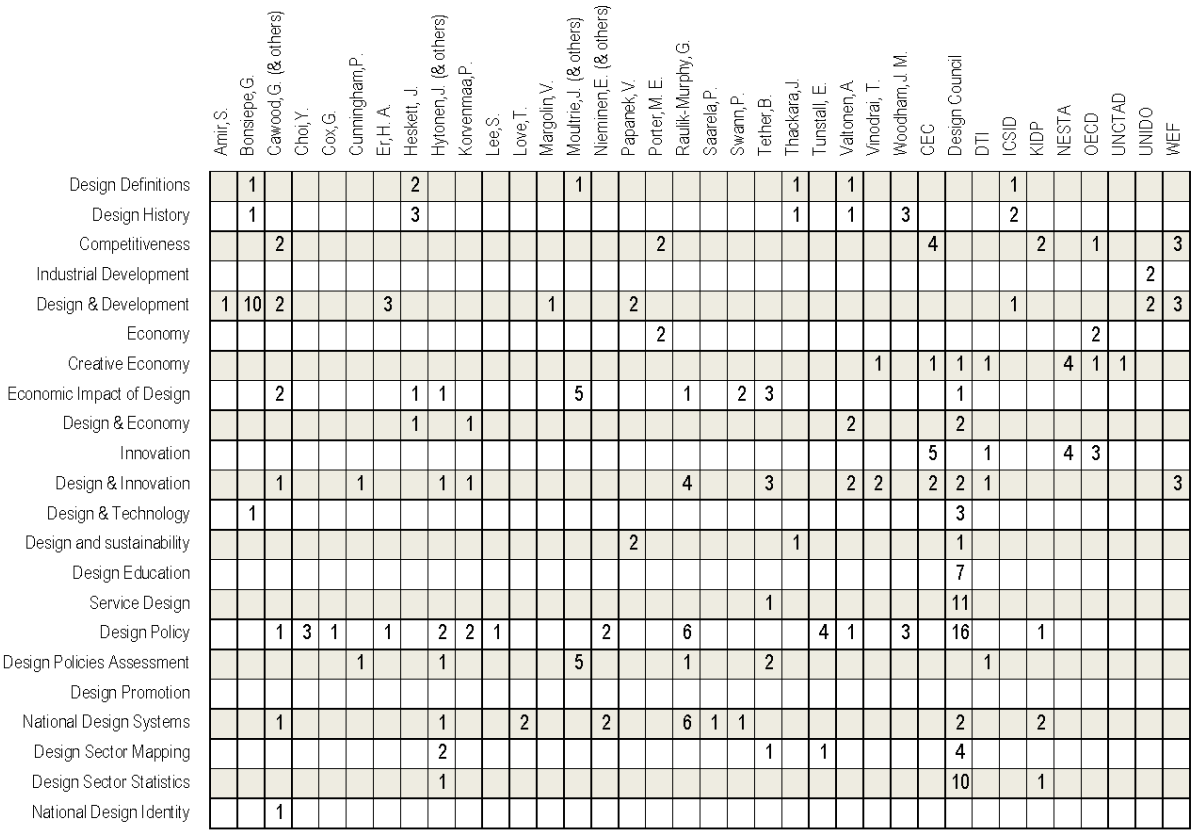

Figure 3: Design Policy - Themes and authors

Conclusion and further studies

From an original dataset of 970 documents to the selection of 231 documents from 37 authors writing on 22 themes, this paper offered strong evidence of the current significance of the subject of National Design Policies. It is present in several contexts, with authors coming from different countries and backgrounds. There is clear corroboration that the value of design is being considered by governments and international bodies as a tool to foster innovation and economic and social development.

This knowledge opens space for further studies and research on the field, such as the importance of design as a tool for growth in developing economies, or the search for effective metrics of design efficiency and of the outcomes of design policies.

This offers a clear opportunity to promote a positive change through design research.

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A graduate of the Royal College of Art, he is an international award-winning designer. His work has been exhibited in the Design Museum (London), Axis Gallery (Tokyo) and the Pompidou Centre (Paris). Professor Bolton has worked promoting the role and use of design with organisations such as the Design Council, Industrial Design Society of America, Korean International Design Promotion and the Hong Kong Design Centre.

Experiential Design Landscapes as a Design Tool for Market Research of Disruptive Intelligent Systems

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Keywords: Experiential Design Landscape, disruptive innovation, design process, infrastructure, emerging behaviour, intelligent systems, data-processing, process mining

Our society is faced with a number of major challenges. As the most significant of these include the aging society, the related challenge of increasing cost of healthcare, and attaining a sustainable level of energy consumption, in light of the available resources. In many cases these major challenges cannot be solved by incremental solutions. Disruptive innovative solutions are often needed to create sustainable growth. Looking, for example, at the field of public health, we are currently faced with a situation where, if no fundamental change takes place, an increasing number of people will have to rely on increasingly expensive healthcare paid by a decreasing number of people. Introducing new propositions that will lead to a structurally more sustainable society is not easy; in most cases changes are required in societal processes that involve a wide range of stakeholders. Due to a high degree of structural uncertainty, the outcomes of such changes are by no means easily predictable. For industry it is therefore very difficult to introduce these disruptive innovations without a solid basis of evidence. This paper describes the newly developed method of Experiential Design Landscapes (EDL): a method where an infrastructure is created that, on one hand, stimulates the creation of new, disruptive, propositions in a semi-open environment where new these new propositions are used as agents to facilitate new and emerging behaviour and that, in parallel, enables the detailed analysis of the emerging data patterns as a source of inspiration for the design of future services and products. This paper describes both the methodological basis as well as the actual experiences of EDLs using a real-life test case.

THE CHALLENGES OF DISRUPTIVE INNOVATION

Designing highly innovative or even disruptive products provides serious challenges from a design management perspective. Since users have no frame of reference it is often not possible to ask them, using traditional market research techniques, for the requirements of these future products. The actual added value of these systems becomes only clear after a certain amount of time where the users learn to see the added value of the (services provided by-) these new products. Products can be used in unforeseen manners and the users adapt in a manner where new patterns may emerge, often unpredicted, on the level of (new) market segments or even on the level of individual users. Take for example healthy living. Companies are interested in developing and deploying technologies aimed at positively influencing users' attitudes and behaviours through so-called Persuasive Technology. They are able to create new propositions using the most recent concepts of Persuasive Technology but it is difficult to predict whether these concepts will lead to sustainable behavioural change and a healthy life. Products are designed with the intention that users will change their behaviour but, at this moment, this sometimes happens in quite unpredictable manners. New patterns may (and will) emerge that may, positively or negatively, affect societal patterns.

It is obvious that it is highly relevant for companies to discover, study, anticipate and design for these emerging patterns in an early phase. However, in current industrial practice the creation of disruptive innovations is often a matter of "trial and error". In spite of considerable design efforts many products see rejection on the market either because products are not sold in the anticipated quantities or, even worse, products are sold but are not used or even brought back because the products capabilities do not match the emerging user requirements. [Koca 2008]. The strong pressure on time to market has increased this problem over the last decades. Relative to the continuously decreasing "time to market" the time to understand the product in the market has hardly been reduced [Brombacher 2005]. Due to the increasing complexity of the products and the increasing complexity of the logistics of the feedback systems [Sander 1999] designers get less detailed information on the actual performance of their products in the field after a, relatively speaking, increasing amount of time. Recently there have been numerous attempts to considerably shorten this cycle. For example, attempts were made to involve customers directly in product innovation via co-creation [Thomke 2006] and to validate products in a near-real-life environment via Living Labs [Bergvall 2009] and many of these attempts have been successful.

In spite of these successes, however, there remains a class of increasingly relevant systems where these methods have failed; the so called "Intelligent Systems". Intelligent systems have the ability to adapt to individual users, often over a longer period of time. As a consequence it is likely that also users will adapt themselves to these systems. As a second consequence the diversity of product-market combinations can grow to the level of individual user/product(system) combinations while, in the mean time, all kinds of, often unpredicted, usage patterns may emerge. Well-known examples are systems like Google, Facebook and iTunes/iPods/Ipads/iPhones. Since the mission of the department of Industrial Design at

Eindhoven University of Technology is to “Create Intelligent Systems, Products and Related Services for Social Innovation” it is evident that there is a keen interest with the authors to understand mechanisms underlying disruptive innovations and to create models and systems to support and manage the relating design processes.

EXPERIENTIAL DESIGN LANDSCAPES

As stated in [IJsselsteijn 2006] the imperative of the transformation economy is to provide meaningful context-specific propositions built with long lasting profitable, ethical and fair business based upon multiple stakeholder collaboration and value sharing. The question is how to develop such propositions when focusing on disruptive innovative intelligent system and how to manage this process?

Designers of intelligent systems need a much faster and better insight to what is happening with their designs and products with respect to new patterns of use, in an, often increasingly diverse, market. Companies managing this process successfully may become the next Google, Facebook or Apple. This requires new approaches and methods for design processes and design management since they are and currently hardly available. Instead of going through a rather linear problem solving process (see Figure 1) a reflective transformative design process (see Figure 2) is desired [Hummels 2008].

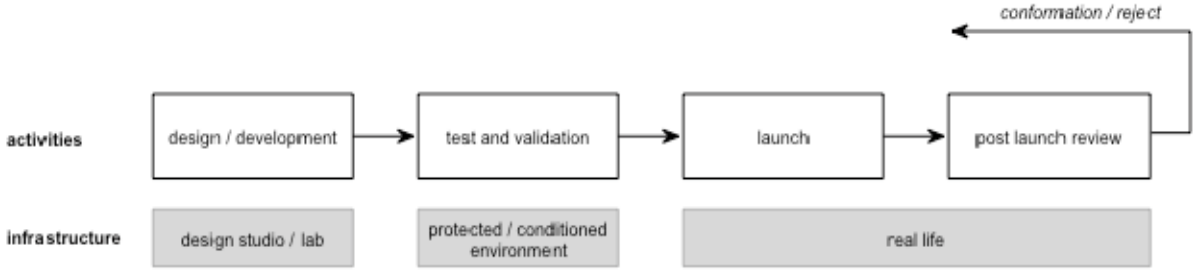

Figure 1: Traditional product development cycle

The challenge, compared to traditional market research methods, is that these emerging patterns can develop highly unpredictable with a level of diversity that can require the longitudinal study of user/system interactions at the level of unpredicted individual users. Fortunately, due to their embedded intelligence, these systems have the capability to register the emerging patterns and, if desired, communicate them to the parties involved. Such a modern infrastructure where new disruptive propositions are created and larger series of (prototypes of) intelligent systems are interacting with end-users in their (near) normal environment early on in the development process, and where in parallel the emerging patterns are studied with consent of these users and further developed, is called an “Experiential Design Landscape” (EDL). This paper describes the methodology underlying the principle of “Experiential Design Landscapes” (EDL).

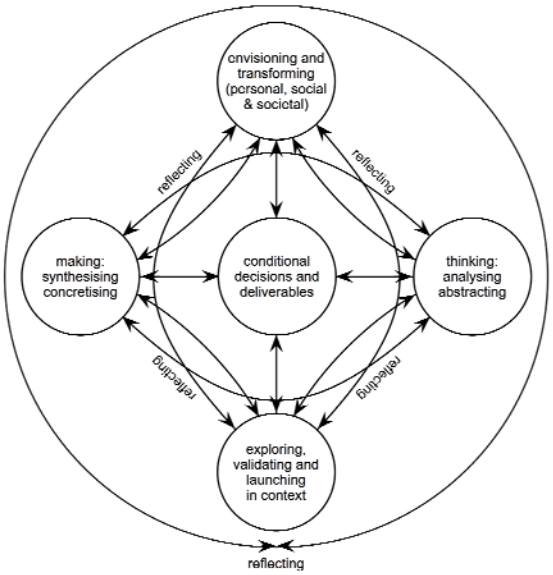

Figure 2: Reflective transformative development process

EXPERIENTIAL DESIGN LANDSCAPES; BASIC STRUCTURE

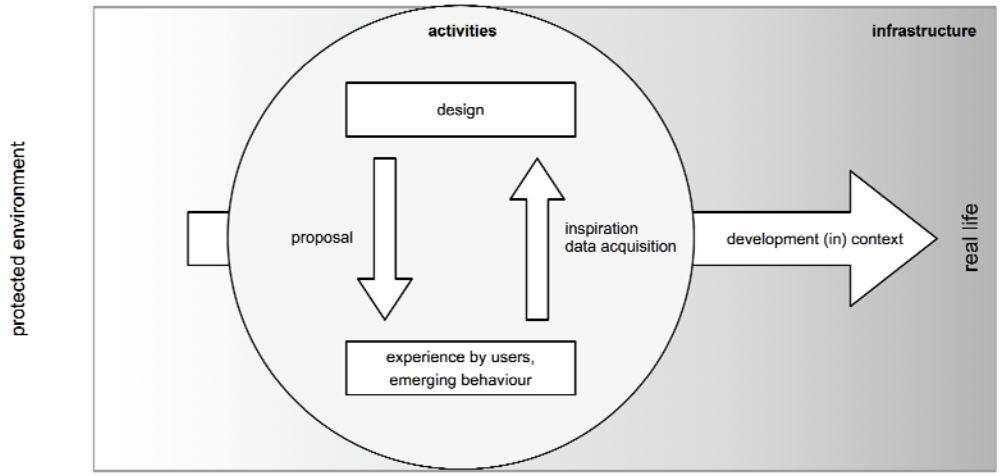

Figure 3: Experiential Design Landscape for the creation of intelligent systems

The Experiential Design Landscape is characterised by a near-real-life environment (the "outside") where a context is created in which designers (can be inspired to) create design proposals and where users have the opportunity to interact with these new concepts through experienceable prototypes, products and services for longer periods of time. The EDL consists of advanced observation equipment where the interaction between users and the design proposals in their environment can be observed via multiple modes of interaction during longer periods of time. The environment is, for the user, as close to real life as possible, but for legal and ethical reasons users are made aware that their actions are being observed for research purposes.

In this environment new “products” are designed; not only as a means to meet with a (in this case often largely unknown) user demand but especially as an agent to facilitate/enable new behaviour in interaction with the user. Since these emerging patterns can be highly unpredictable a detailed analysis is performed during the actual “product use” in order to understand and model emerging interaction patterns. Due to the, in the product, embedded intelligence the product itself plays a major role in acquiring the data and generating the models, as a kind of intelligent technology probes [Hutchinson 2003]. As a result of the fact that the products are connected to the in the EDL available infrastructure, very rich multi-modal data patterns can be generated that, after being processed into adequate formats, can serve as a strong means of inspiration for next generation designs.

The interaction is by no means restricted to interaction with individuals. If the agents, the data acquisition and the data processing are designed correctly not only “single-product-single-user” patterns can be analysed but also “multiple-products-multiple-users”. This makes an EDL highly suitable to create and analyse products that are intended (to change the behaviour of) social groups.

Due to the open structure of an EDL it is easily possible to extend the observation process outside a given physical structure. As long as it is possible to acquire the required observation data also user actions outside a given geographical structure can generate data. The only requirement is that the EDL should provide is some level of thematic coherence; if the context becomes too free it becomes difficult to interpret the emerging data.

This Reflective Transformative process is different to the existing living lab approach since “living labs” serve the purpose of analysing propositions largely known to the user in a well-defined context. In an EDL the entire design process is incorporated, from the early start when generating propositions to launching "production-ready" products and services in context. Moreover, the user is during the creation phase still unaware of what patterns will emerge in the future. Whereas in living labs users (and designers) are in most cases far more focused on what is happening in the interaction between an individual and a product.

EDL IN PRACTICE; A CASE STUDY

An EDL takes the physical form of an environment where rich interaction can take place between newly created agents (“products”) and end-users and where the (emerging) interaction of systems and users can be thoroughly observed. Due to the embedded data-gathering, data-processing and communications capabilities this does not need to take place on a centralized location and can take place during longer period of time. The data, obtained from the Landscape, is monitored and with techniques such as data-mining or, more recent, process mining [Rozinat 2010], unanticipated and emerging patterns are detected on a continuous basis. In this manner design synthesis and market analysis become one integrated highly dynamic design landscape.

The resulting information is analyzed in mixed teams of designers, social scientists, engineers and other (business) stakeholders in order to obtain new information and inspiration for subsequent design iterations. In this manner a highly dynamic system emerges where fast and very diverse iterations can be used to develop new emerging value propositions and the supporting intelligent systems in parallel.

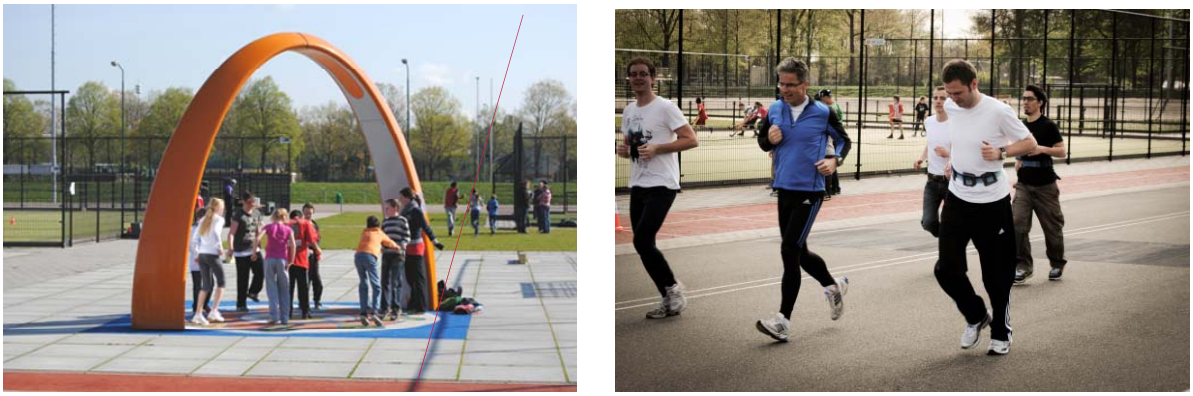

Figure 4: Part of the Experiential Design Landscape "Eindhoven Noord"[1]

The infrastrcuture of EDL "Eindhoven Noord" is designed especially to facilitate the development of new concepts in the field of "Health and Wellbeing". The EDL was created as a research vehicle on one hand and on the other hand as a means to create meaningful propositions in the context of this increasing social problem. The EDL is owned by the City of Eindhoven and is jointly operated by local government, research institutes and industrial partners. One of the main reasons to create this EDL was that the product creation model that many of the industrial partners operate, often did not result in the anticipated market success; it assumes that high-end products, developed for top sports gradually find their way to the market of "Health and Wellbeing".

The EDL "Eindhoven Noord" consists of a large sports and recreation complex, with a running track and a large space in the middle with several sports fields and playing grounds. The complex focuses on non-active people up to amateur sportsmen, and tries to encourage them to be physically more active. People can easily book specific accommodations and rent equipment like e.g. hockey sticks. The complex is often used for e.g. sports days for (school) children and company outings. But also individual people and children can make use of the freely accessible facilities.

The sports and recreation facilities of "Eindhoven Noord" are all in place, but the EDL method and infrastructure is fairly new at "Eindhoven Noord" and still under development. Most of the designing was still done at the university, although the users and their behaviour at the EDL inspired the participating designers and design students. Moreover, as a first step, we introduced for a period of almost half a year several products and prototypes in the EDL,

[1] Courtesy City of Eindhoven and Playful Interactions research from Tilde Bekker and Berry Eggen [Bekker 2009]

for example intelligent watches for high level and professional athletes, and the resulting data was analysed.

The first results show that firstly, the EDL can indeed find new behaviour. It appears that the intentions of the designers are not always fitting the ideas and creativity of the users during interaction, resulting in new behaviour. For example, during one of the studies, a group of high-level runners received a new intelligent watch for a longer period of time. Because one of the runners got injured, he gave the watch to his teenage son to encourage him to start running, which he did. Without the son knowing, at least in the beginning, the father followed him online and analysed his running behaviour. The manufacturer did not foresee these activities: the son running with the watch and the father observing and following him from a distance. The current watch and provided services could hardly adapt to this situation or anticipate it. But by incorporating this information in the design synthesis, the next version might or can.

Secondly, as expected, one can find through EDLs that people behave differently and have different desires, needs, motivation and skills. For example, to the surprise of the industrial partners, there is a clear difference between people exercising sport for performance reasons or for reasons of health and wellbeing. Certain products appreciated by one group, were not appreciated at all by other groups and also the emerging individual and social patterns showed large differences, which was not anticipated by the industrial partners, because classical survey techniques did not give them those insights.

Figure 5: Sports vs. "Health and Wellbeing"; different markets with different drivers

Thirdly, designing and building experienceable intelligent prototypes during the early phases of the design process, which are in the beginning merely 4D sketches, and which can be used for longer periods of use too, are asking for different skills and points of attention from the designer than more classical design proposals. Because users have to interact with these proposals in their near real life context, designers are facing with and have to anticipate

malfunction electronics of the interactive sketches, safety issues, prototyping drawbacks such as heavy batteries and the size of available parts, buggy software, etcetera. These issues bring us close to the legal and ethical boundaries of EDLs, which we are currently investigating. Disruptive innovation is always about exploring the unknown and since the emerging behavioural patterns can only emerge in interaction, the boundaries need to be explored, in order to have enough freedom to design but also stay within acceptable safety, financial and ethical boundaries.

Based upon these results from the EDL "Eindhoven Noord", the designers involved are currently using the obtained models and datasets to now develop products that are adapted towards the patterns that have emerged during earlier iterations. The now available data also helps the industrial partners to, on one hand, better understand the (lack of-) success of earlier products and to develop early insights into patterns that emerge in the market.

CONCLUSION AND FURTHER DEVELOPMENT

Although the concept of Experiential Design Landscapes is still under development, it already shows promising results. An EDL proves to be a valuable mechanism to enable the creation of new disruptive concepts in a market context. The combination of a reflective-transformative design process, a structural open system with strong involvement of end-users and the generation of high quality longitudinal multi-modal data is proving to be valuable not only for researchers but also for industrial partners. Although users are aware that they are involved in a design and research process, the structure of an EDL seems open enough to stimulate the emergence of unanticipated but realistic behaviour. Currently discussions are ongoing to determine, for legal and ethical reasons, what data can be gathered and which data not.

A second EDL, currently under construction, deals with the creation of outdoor Intelligent Lighting Systems in a residential area inside the city of Eindhoven. The difference between the EDL discussed in this paper and this new EDL is that, while in the first EDL, people actively enter an EDL and engage deliberately in the activities provided, in the second case people "can not escape" the EDL since it is part of the public space where the live or pass through. Initial discussions with both participants, with legal experts and with local authorities lead to a preliminary conclusion that, if the expected benefits (in this case in terms of "quality of life", "social safety" and "energy consumption") strongly outweigh the experimental nature of the EDL stakeholders support the creation and operation of an EDL in their direct environment. However, more data needs to become available before clear conclusions can be drawn in this context.

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The Role of Future-Proofing in Achieving Sustainable Building Design

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Keywords: Future-proofing, sustainability, innovation, uncertainty, low energy housing.

This paper investigates sustainable building design at a neighbourhood scale. In particular, it examines how futures thinking can be integrated at an early stage into the design and selection of solutions that influence the energy performance of housing developments over their full lifecycle. A literature review of 'future-proofing' is presented, which reveals that its key attributes are accommodating uncertainty and fostering technological innovation. In combination, these result in buildings that are resilient and adaptable to future trends (e.g. climate change), while also embracing conventional environmental design considerations (e.g. low carbon development). 'Best practice' energy-related design processes and solutions from five European housing developments have been assessed to determine the degree to which they have been 'future-proofed'. These case studies reveal progress in fostering technological innovation; however there is little evidence of efforts to accommodate uncertainty.

INTRODUCTION

The urban built environment contributes to key challenges, such as the alteration of landscapes, climate change, rising energy demand, fossil fuel price increase, resource depletion, and the urban heat island effect (Devuyst et al., 2001). Buildings are complex 'products' with significant capital and operating costs, which consume energy and water and produce waste, while indoor air quality issues and thermal comfort standards need to be achieved. The building sector has the greatest potential for delivering long-term, significant and cost-effective Greenhouse Gas (GHG) emissions compared to other major emitting sectors, such as transport and industry (IPCC, 2007). At present, however, it accounts for

around 40% of total energy consumption worldwide, which translates to about 30% of global carbon dioxide emissions (UN, 2010). Furthermore, it is estimated that 64% of the world's economic production, consumption and environmental pollution is associated with the urban built environment in developed countries, where people spend around 80-90% of their time indoors (Burnett, 2007; Devuyst et al., 2001).

Buildings have long-term impacts and the benefits of sustainability can only be realised over a period of time. Sustainable building design has emerged as an integrated approach, which aims to consider social, economic and environmental aspects surrounding the use of natural resources, energy consumption and environmental performance. This derives from the Brundtland Commission, which defines sustainable development as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (WCED, 1987). Given the poor energy performance of the building stock, both in existing and new buildings, key decisions need to be 'future-proofed' from the early lifecycle stages against long-term social, technological, economic, environmental and regulatory impacts. Examples of these impacts are changing demographics, the emergence of novel technical solutions, rising energy costs, incentivising energy efficiency and renewable energy technologies, climate change, and the introduction of new government policies (Devuyst et al., 2001).

This paper introduces the concept of 'future-proofed design' and presents its application to the energy performance of 'best practice' European housing developments. Little research has been conducted into explicitly considering the long-term implications of the energy performance during the design phase, due to the short-term mindset that prevails in much of the building and construction sectors (HCA, 2008). The paper consists of two parts. First, it introduces a conceptual framework for the 'future-proofed' design of buildings. Based on a literature review, this framework maps the relationship between low energy design processes and building solutions that promote technology innovation and accommodate uncertainty. The term 'building solutions' refers to the choice of low embodied energy materials and building components, energy efficiency measures and renewable energy generation (either on-site microgeneration or local energy networks). Second, it seeks to assess the extent to which 'best practice' European housing developments 'future-proof' their energy performance.

RESEARCH SCOPE AND METHODOLOGY

The research adopts a 'real-world' perspective to understand the opportunities, practical constraints, and trade-offs in the selection of design processes and building solutions. A literature review is undertaken focusing on the justification and conceptualisation of 'future-proofing'. A multiple case study method is employed (Yin, 1984) and 'best practice' European housing developments from 400 to 11,000 residences are selected (see Table 1). The proposed conceptual framework is illustrated via a knowledge map, which provides the axes and types for future-proofing. Table 1 provides a list of the case studies, along with a

short project description. The selected projects are expected to provide the best platform for planning and design techniques from which to develop any improvements with regard to 'future-proofing'. Case study research entails both desk-based research and fieldwork. An ongoing survey via a structured questionnaire in parallel to expert interviews and focus groups via a semi-structured questionnaire have been carried out since October 2010. The target audience includes local authorities, developers, architects and building engineers involved in these projects.

Table 1: Selected 'Best-Practice' Housing Developments in Europe.

Project		Description
Sweden	Hammarby Sjöstad, Stockholm (HCA, 2008)	The 2010 European Green Capital. A mixed-use development of 11,000 apartments with energy, waste, and water following a unique eco-cycle. The City's long-term goal is to be fossil fuel-free by 2050.
	Välle Broar, Växjö Sweden (SESAC, 2010)	A green district of around 400 dwellings demonstrating high rise timber-framed construction was developed as part of the SESAC project (European-funded programme under the CONCERTO initiative).
UK	North West Cambridge (NWC, 2008)	A new University eco-quarter of around 3,000 new homes, which will contribute to meeting the needs of the wider city community and which will embody best practice in environmental sustainability.
	Hanham Hall, Bristol (TCPA, 2009)	The first development of around 185 homes to meet zero carbon standards (Code for Sustainable Homes Level 6) in the UK.
	First wave of the Eco-town Programme UK [DCLG, 2009b; TCPA, 2009]	Four new mixed-use developments of around 5,500 zero carbon homes and 40% of affordable housing at a pre-design stage: - Whitehill Bordon, East Hampshire - China Clay Country, St.Austell, Cornwall - Rackheath, Norfolk - Northwest Bicester, Oxfordshire

Sustainable communities have emerged as an integrated approach to urban planning; the term is used to refer to eco-developments of various scales, from eco-neighbourhoods or 'green' city districts to larger schemes, such as eco-towns or eco-cities. In this study, however, this term refers to housing developments at the neighbourhood scale. Unlike individual buildings, these scales presents better economies-of-scale for novel technologies via the integration of community-scale energy, water, waste networks and communications infrastructure, driving down construction and supply chain costs (TCPA, 2009).

THE NEED FOR FUTURES THINKING IN ENERGY AND BUILDINGS

Future climate change impacts

Energy targets and building regulations have focused predominantly on climate change mitigation; i.e. reducing GHG emissions via energy efficiency measures and the use of renewable energy technologies (Pitts, 2008). However, "we are already designing and constructing buildings that use less energy and reduce carbon emissions. The challenge is to make sure our buildings are resilient and flexible to the climate change that we will see over the coming decades" (TSB, 2010). Many future impacts due to the energy consumption in buildings and other sectors are already 'locked-in', as a result of past GHG emissions. This means that even if mitigation strategies are successfully achieved, the anticipated climate impacts will affect buildings via temperature changes and extreme events, which could cause damage to the fabric. To counteract this, climate change adaptation measures are promoted to bring resilience into the building design and enhance the ability to withstand the impacts of future changes both at European and national levels (Shaw et al., 2007).

Policy trends

Futures thinking is promoted implicitly within the increasingly stringent environmental legislation, building standards and regulations at European and national levels. For instance, the revised European Performance Building Directive (EPBD) 2010/31/EU – previously EPBD 2002/91/EC – sets out a more rigorous policy framework for both new and existing buildings (EC, 2010). Furthermore, there are national programmes moving the building sector towards a zero carbon target. In the UK, all new homes should be carbon neutral by 2016 and all new buildings by 2019, followed by a binding target of an 80% carbon emissions reduction for the entire building sector by 2050 (DCLG, 2009c).

Long lifecycles of buildings

The physical fabric of neighbourhoods and city districts remains in place for a long time; a phenomenon commonly referred to as 'inertia of the built environment' (Wilkinson and Reed, 2007). The building stock has normally a design life of 40 to 100 years and its form usually has greater longevity (especially for historic structures), even if this was not explicitly the intention (Bosher et al., 2007; Malmqvist et al., 2010; Sharma et al., 2011). The slow turnover of the stock is a result of the long lifecycles of individual buildings, which is due to the: high upfront costs of refurbishment; practical difficulties associated with deconstruction and demolition; and social attachment to buildings or neighbourhoods due to historical or cultural reasons (Hacking, 2009). It is the early decisions that determine whether a project will be sustainable and future-oriented or not. Building solutions cannot be easily revised and Hawken et al. (1999) observe that "although upfront design and construction costs may represent only a fraction of the lifecycle costs, when just 1% of a project's upfront costs are spent, up to 70% of its lifecycle costs may already be committed; hence, that first 1% is critical because, as the design adage has it, all the really important mistakes are made on the

first day". It is estimated that 70% of the existing stock will be in use in 2050, thus each new building constructed in or retrofitted to an energy-wasting manner will lock us into a high carbon-footprint future (UN, 2010).

CONCEPTUAL FRAMEWORK FOR FUTURE-PROOFED DESIGN

Definition and knowledge mapping approach

Jewell *et al.* (2010) define future proofing as "designing something that can be resilient to future developments including both mitigation of negative impacts and taking advantage of future opportunities". When applied in the context of low energy buildings, it refers to a design that seeks to promote both technology innovation and to accommodate future uncertainties. It entails 'stress-testing' design solutions against a range of energy trends and drivers to ensure that they remain robust over the lifecycle. A low energy design does not necessarily constitute a future-proofed design, but does represent a point of departure from which to develop the two key axes of this concept. Figure 1 presents a two-dimensional knowledge map that yields four types of future-proofed design.

- Technology innovation for low energy solutions. This axis refers to the selection of low energy/ low environmental impact strategies, which can vary from conventional to innovative.
- Design processes and building solutions that accommodate uncertainty. This axis refers to the use of futures techniques and the criteria of lifecycle thinking, resilience and adaptability.

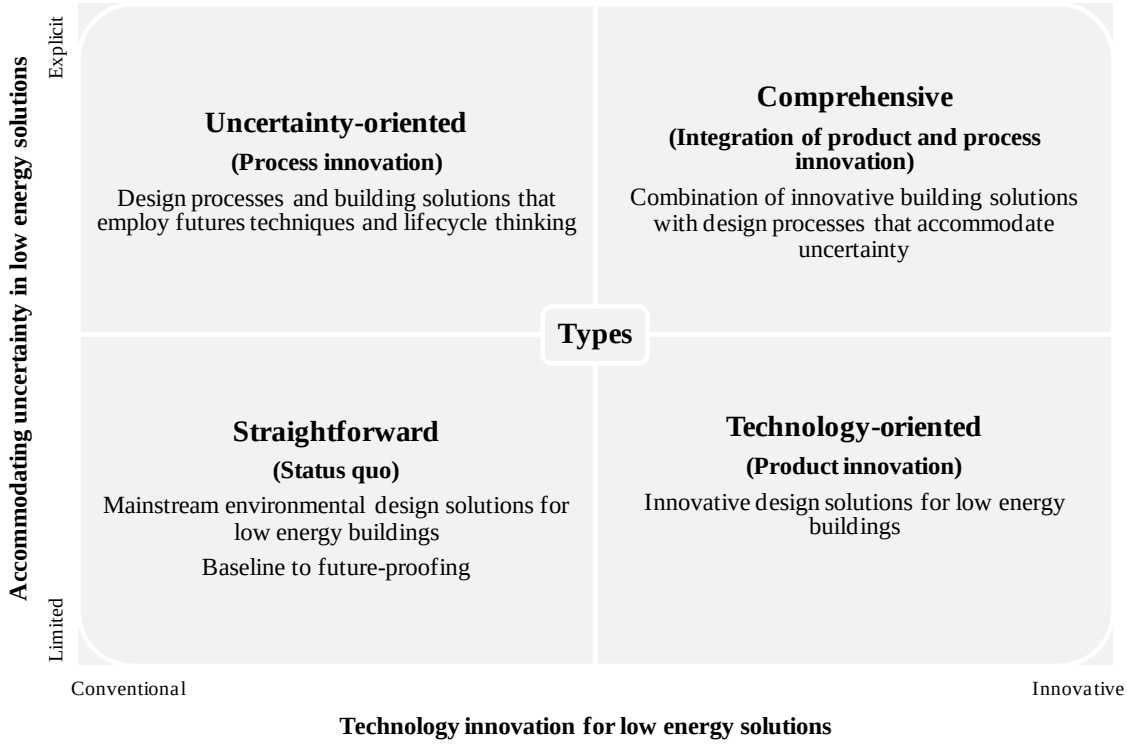

Figure 1. Knowledge mapping approach for future-proofed building design.

This map is not a 'model solution' for the building design but rather represents the spectrum of design processes and building solutions for delivering low energy buildings with varying degrees of future-proofing. The choice of materials, building components, energy systems and construction practices should be project-specific in order not to discourage innovation and creativity.

X-axis: Technology innovation for low energy solutions

This axis represents the bedrock for future-proofed design. Technology innovation in low embodied energy materials and building components, technologies and construction practices is an imperative for delivering low energy buildings. At present, decision-making on building solutions is based predominantly on the appraisal of different technology options. The literature on sustainable innovation or eco-innovation distinguishes two basic models of innovation; namely, incremental and radical (Abernathy and Clark, 1985; Clark and Staunton, 1989). Based on this categorisation, the x-axis differentiates the selection of buildings strategies between those that rely mostly on existing and proven technologies and those that are part of a demonstration project that tests pioneering and novel solutions (either incremental or radical). Nonetheless, innovation does not necessarily mean over-designed solutions, but rather ones that are technically robust, socially responsible and potentially financially viable.

Y-axis: Accommodating uncertainty in low energy solutions

This axis encompasses the degree to which design processes and building solutions accommodate uncertainty. This component aims to proactively manage both predictable and uncertain aspects. The contribution of this study is based on the introduction of the y-axis in the decision-making process on building solutions. At present, established methods for the energy assessment of buildings (modelling software or building rating tools) have predominantly used forecasts rather than a spectrum of plausible futures (Boardman, 2007; Hacking, 2009). This axis explores the use of *futures techniques* and the criteria of *lifecycle thinking*, *resilience* to climate change and *adaptability* to changing circumstances and needs of the occupants.

Futures techniques are a family of methods that were not developed with sustainability in mind; however, their orientation is of direct relevance to future-proofing. The Foresight (2008) Horizon Scanning Centre has identified a portfolio of 24 futures techniques. Scenario planning is one technique that has become increasingly dominant in business strategy and long-term planning of products, processes and industrial sectors (Bunn and Salo, 1993). This technique can help understand the nature and impact of the most significant and uncertain driving forces affecting the energy performance of buildings. It brings together different perspectives, challenges current thinking, and aids strategy formulation that will be robust in any future (Jewell et al., 2010). The knowledge map presented in Figure 1 corresponds to explorative scenarios, as this category aims to predict the future or to find the single best

answer, but rather to prepare for a set of plausible futures (Foresight, 2008; Van der Heijden, 2005).

When assessing the *lifecycle energy performance* of buildings, it is essential to consider both the embodied and operational ('in-use') energy (Boardman, 2007; DCLG, 2009a). The embodied energy is the energy used to extract, process, manufacture and transport building materials and components (Yohanis and Norton, 2002). Embodied energy constitutes around 12% of a building's lifecycle energy footprint and is often overlooked in the energy assessment (WBCSD, 2007). Furthermore, embodied energy cannot be determined accurately due to the lack of reliable and accurate data (Yohanis and Norton, 2002). Improvements in energy efficiency have led to reduced energy consumption at the operational stage; hence, the relative significance of the embodied energy over the lifecycle has increased (Boardman, 2007, Gustavsson et al., 2010). Established tools include the Lifecycle Assessment (LCA) or Lifecycle Costing (LCC), which can be used to evaluate the environmental or economic impact of a building solution from its raw materials, production, transport, installation, and service life, to its recycling and disposal (Ness et al., 2007). In practice, the LCA/LCC tools are mostly used for assessing the impact of individual building materials and components due to the lack of large data inventory (Malmqvist et al., 2010).

The need to adapt to climate change underlines the importance of *resilient* and *adaptable* building design (Mumovic and Santamouris, 2009). From an energy point of view, this means that the structure should be resistant to: climate variability; rise in average temperature; and weather extremes, such as overheating and the urban heat island effect. Furthermore, change is inevitable over a building's lifecycle due to social, economic and physical factors, which require refurbishment, deconstruction and/or demolition. Russell and Moffatt (2001) define adaptability as "the capacity of buildings to accommodate substantial change, which covers the elements of flexibility, convertibility and expandability". In practice, this means that building solutions should be able to maximise lifecycle value in both initial design choices and subsequent changes in use.

Types of future-proofed design

This section examines the four types of future-proofed design, as mapped in Figure 1.

The *'straightforward'* type describes the status quo, which is conventional design processes for the delivery of low energy buildings. This is the baseline and covers the narrowly-focused environmental design strategies that have been used to achieve good levels of energy performance. The building design relies mostly on a portfolio of conventional and economically viable solutions ('low-hanging fruit') to reduce the energy consumption. This type shows little or no integration of futures thinking into the design. The possible exception is energy efficiency measures that are used in anticipation of more stringent building regulations and higher energy costs.

The *'technology-oriented'* type of future-proofing fosters product innovation. This refers to the selection of innovative building solutions (either passive or active), such as novel

materials, building components, renewable energy technologies and methods of construction. However, similarly to the *'straightforward'* type, this category does not plan for a spectrum of plausible futures to accommodate reasonably foreseeable or unpredictable events.

An *'uncertainty-oriented'* building design utilises existing low energy solutions. Yet, it is a state that fosters process innovation rather than product innovation, as novel thinking is pursued to accommodate uncertainty. Established methods for energy assessment are refined to consider uncertain trends that could impact on the energy performance. Approaches that can accommodate uncertainty include:

- Use of futures techniques (e.g. scenario planning) to facilitate planning for a spectrum of plausible futures.
- Adoption of a lifecycle perspective for the selection of building solutions.
- Resilient and adaptable building solutions in response to climate change adaptation and the varying needs and expectations of occupants.

'Comprehensive' future-proofing aims to combine the *'technology-oriented'* and *'uncertainty*-oriented' types, thus promoting both product and process innovation. The building design demonstrates innovative building solutions and design processes that ensure optimum energy performance and accommodate uncertainty.

RESULTS FROM CASE STUDY RESEARCH

This section presents the findings of an investigation of 'best practice' housing developments. A review of design documents and consultation reports has been undertaken, along with data gathered via an ongoing survey and interviews. Results show the extent to which future-proofing is integrated into the energy design of buildings; namely, the trends and drivers that influence the decision-making of developers and local authorities and examples of future-proofed design processes and building solutions.

Trends and drivers of change by 2050

Figure 2 reveals that the selected housing developments consider predominantly five trends and drivers from a broad spectrum of issues affecting buildings by 2050. These are: i) the decarbonisation of the grid; ii) the increasingly stringent building regulations standards, iii) carbon emissions reduction due to climate change considerations, iv) economic incentives for energy efficiency and renewable energy technologies, such as the Feed-in Tariffs, and v) the launch of new materials and technologies. Higher energy prices, demographic changes that modify the housing unit and tenure types and lifestyle changes are considered to some extent. The latter refers to the energy-intensive behaviours associated with higher energy consumption, such as the purchase of more appliances, higher preferred lighting levels or room temperatures, and the occupancy of larger living spaces per person. Figure 2 shows that 'best practices' do not embrace climate change adaptation strategies, as this trend is not fully considered or even overlooked in about two thirds of the survey data.

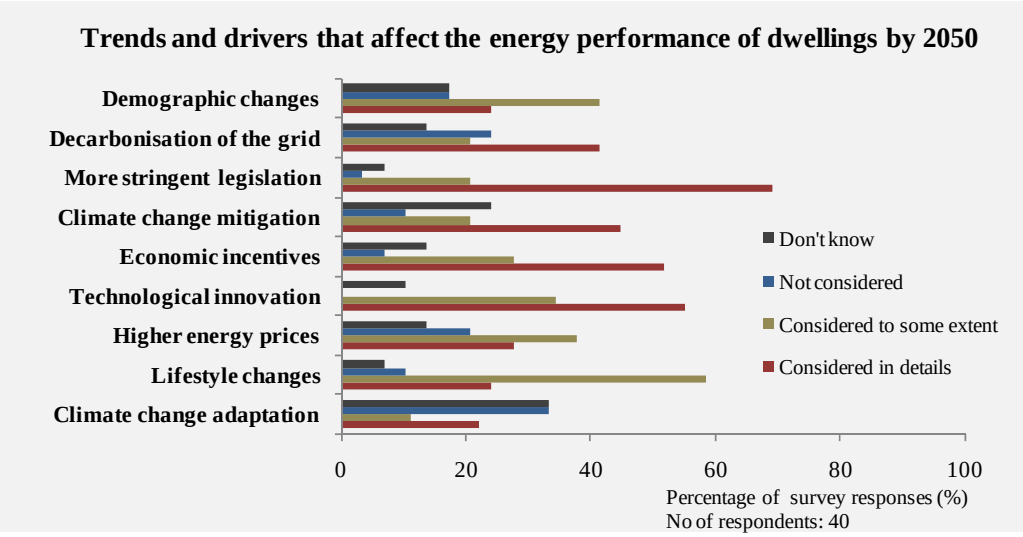

Figure 2. Trends and drivers affecting the energy performance of housing developments by 2050.

Future-proofed design processes and building solutions

Table 2 presents examples of building solutions under the four types of the knowledge map, as presented in Figure 1. These building solutions are mostly relevant to the early lifecycle stage of new buildings; however, they could be also considered during a retrofit.

Table 2: Future-proofed design process and building solutions in the selected case studies.

Straightforward
Conventional energy efficiency measures and energy systems with short payback periods: • Passive systems: site analysis of the location and orientation; natural daylighting; external shading; thermal mass; insulation, airtightness and advanced glazing; low embodied energy materials and building components; natural ventilation. • Active systems: low energy lighting; low energy appliances; and control systems, solar thermal panels, photovoltaic (PV) panels, gas-fired or biomass-fuelled Combined Heat and Power (CHP) plants for district heating and/or cooling, large wind turbines outside built-up areas.
Technology-oriented
Product innovation: • Novel timber-framed construction and passive design techniques (e.g. shutters, louvers and blinds). • Innovative mechanical ventilation systems. • Advances in microgeneration technologies, such as micro-wind, heat pumps, hydrogen fuel cell micro-CHP. • Advances in building management systems and smart metering for accurate data records, along with a portfolio of added-value services (e.g. remote disconnection, load control, price and tariff changes).

Uncertainty-oriented
Process innovation: • Visioning exercises at the early planning stages. • Step-by-step multidisciplinary collaboration between developers and local authorities. • Adoption of a lifecycle perspective: - Systematic monitoring and post-occupancy evaluation during the operational stage. • Adaptability to accommodate future change/requirements in: - New technologies, such as PV-ready roofs, energy storage systems. - Internal space flexibility for future expansion or modification.
Comprehensive
All design processes and building solutions under the 'technology-oriented' and the 'uncertainty- types, along with: • Smart facades via adaptive response systems.

Sources: From fieldwork data (October 2010 to present). Material of interviews, surveys and correspondence is available upon request.

CONCLUDING DISCUSSION

This paper aims to clarify the concept of 'future-proofed' energy design of buildings. On a theoretical basis, the proposed knowledge map provides an understanding of future-proofing, which includes the elements of technology innovation and uncertainty. Nevertheless, it is important to state that this approach does not aim to prescribe the choice of building solutions but rather to characterise the overall design process; design is project-specific and therefore there is no 'one-size-fits-all' solution. Given that future-proofing is an evolving concept, it represents a starting point for further research. The knowledge mapping approach can have wider application in the selection of building solutions, covering water and waste. It also reveals the need to refine established methods for energy assessment in order to accommodate uncertainty and become more future-oriented.

Preliminary findings from the case study research suggest that 'best practices' demonstrate good energy performance via the combination of both existing and innovative building solutions. However, there is a lack of design processes and building solutions that explicitly consider uncertainty. The following conclusions can be drawn from the case study analysis:

- At present, designers focus predominantly on 'straightforward' or 'technology-oriented' building solutions, i.e. energy efficiency measures that go hand-in-hand with the use of renewable energy technologies. However, the knowledge map identifies the need to accommodate uncertainty via the 'uncertainty-oriented' or 'comprehensive' types.
- Futures thinking should be systematically incorporated into the early design stage of buildings, thus avoiding the social, economic, and environmental costs and practical challenges associated with modifying buildings once they have been built. This, however,

requires a step change from short-term mindsets to a full lifecycle view of the development. This can be enhanced via the selection of low embodied energy materials and a strategy for deconstruction (disassembly, recycle, and reuse) since the early design stages. Although designers and developers in the selected housing developments undertake systematic monitoring and post-occupancy evaluation, they should further use the LCA/LCC tools for the commonly used building materials and components.

- Interviewees agree that there is currently no single, truly holistic technique that can integrate futures thinking into the evaluation of the energy performance. Climate change adaptation issues, such as overheating risk analysis and monitoring the urban heat island effect, are not yet a priority at the design stage, as building solutions are mainly focusing on mitigation. The case studies also reveal that futures techniques, such as scenario planning, have only been applied to a limited extent. Established design tools (e.g. energy modelling and building rating tools) should incorporate a futures perspective that extends beyond the actual years used in payback calculations and adopt criteria for resilience to climate change and adaptability to changing occupants' needs.

The building sector is in need of design strategies that will anticipate and proactively manage future trends and drivers affecting the energy performance of buildings; thus representing a shift from the current 'build-it-now and fix-it-later' philosophy. Future-proofed building strategies aim to ensure the delivery of resilient and adaptable low carbon development, which have potential for cost savings via lower running costs and added-value in the future. This requires technology innovation, along with design processes and building solutions that accommodate uncertainty. The case study research demonstrates the tendency to overlook futures thinking due to the complexity of dealing with uncertainty and the short-term mindset of the building and construction sectors.

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Use of Verbatim Customer Data in a Firm's New Product Development Process

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Keywords: Customer Insight, New Product Development, Verbatim Data

The literature suggests that designers will benefit from having access to rich customer data; in this study that rich data consists of verbatim customer comments from car clinics. This study examines a major car manufacturer's ability to use such data within the New Product Development process, and identifies generic barriers to successful use of such data.

Introduction

This paper describes the outcomes of an investigation of the use of verbatim customer data in a firm's New Product Development (NPD) process.

The literature suggests that designers will benefit from having access to rich customer data; in this study that rich data consists of verbatim customer comments from car clinics. The study uses a major car manufacturer's Premiumness Research Programme (PRP) as a case study to examine their ability to use such data, and identifies generic barriers to successful use of such data, by addressing three key aims:

- to assess how well the PRP data has been understood within the firm;
- to understand how effective the PRP dissemination process was and how it could be improved in terms of meeting stakeholder needs and providing rich, focused knowledge; and
- to evaluate the quality and format of the raw and coded PRP verbatim data in terms of its ease of use.

Literature Review

The concept of luxury has been the subject of academic debate for centuries, the literature for which has been predominantly concerned with luxury at brand level, and centred around the marketing aspects of gathering and using customer insights to direct business and marketing strategic developments (Vigneron and Johnson, 1999; Dubois et al, 2005).

The emerging field of Emotional Design (Desmet, 2004; Norman, 2004) attempts to bring this focus on voice of the customer to the product development environment, but remains centred on the marketing/design interface, neglecting the downstream engineering and manufacturing functional boundaries, and has so far failed to establish a consistent and standardised approach to gathering and using customer insight about luxury effectively in the NPD environment. Empathic Design goes some way to addressing the failings of traditional market research approaches, but can produce subjective or qualitative results which lack utility in the engineering domain (Leonard and Rayport, 1997; Burns and Evans, 2007). Existing "translation" tools and techniques, such as QFD (Burns and Evans, 2007; Akao, 1990) and Kansei Engineering (Nagamachi, 1999), either fail to consider the transfer of customer insight to the engineering domain, or enforce numerical and/or pre-determined translations (Guldbrandsen and Evans, 2004) that erode context and meaning, and lead to flawed assumptions and poor decision making.

There is therefore a gap in our understanding of how companies can capture customer thoughts about luxury during naturalistic product evaluation, and can enable that to be embedded into the NPD process without losing context or meaning.

Approach

This research was conducted with a UK premium automotive manufacturer, using a major market research programme as the basis of inquiry. The firm had conducted an extensive customer clinic (the PRP) to develop consumer insights about luxury and premium cars, and how customers evaluate them, which gathered verbatim data from 446 actual and target customers in the UK and US. This paper concerns efforts to improve the value of this rich customer data to the firm's NPD community through utility and accessibility. An action research approach was adopted, and the research was conducted during a four year period of interaction that included over 300 days spent working with the firm.

Data was collected through a multi-method combination of participant observation, unstructured and semi-structured interviews, documentary analysis, interactive meetings, focus groups and workshops. Tasks were undertaken concurrently and emerging findings were presented to key participants to enable their responses to enrich the data set.

An interventionist approach was used to probe for deep insights into how successful the firm's research and dissemination process was, to establish how designers, engineers and marketing teams interact with the data, and to develop and test new ideas and tools to

enhance the utility and accessibility of the PRP data. The interventions were centred around 3 distinct research focus areas:

Research Focus #1: Realising the Power of the Verbatim Data. How can the verbatim data be used by specific teams within the firm: what questions do they want answers to, how can the data be interrogated to provide those answers?

Research Focus #2: Deep Dive with PQ Team. How can premiumness be embedded effectively into the Perceived Quality team's work process?

Research Focus #3: New Vehicle Development Workshops. How high is participants' understanding, motivation and ability to use the rich customer research information, and how might the workshop process improve designers' understanding of the customer?

Research Focus #1: Realising the Power of the Verbatim Data

Rationale for Intervention

Traditional market research studies tend to yield rational, cognitive and numerical results. These results can be analysed in myriad ways (by age, gender, household income bracket, car driven, body style, etc), but the data are fixed: they represent the responses of the participants to each question at that time. Such studies are often conducted in clinical, non-naturalistic settings in which participants give their responses without looking at the products, so their answers are based on their memories of the whole car or the whole brand; the data can be considered a measure of their expectations, rather than an evaluation of the actual cars. Often using both attribute-based and holistic questions, these studies can also be used to signal how emotionally positive or negative the respondent feels towards that attribute - not necessarily how well an attribute has been executed. They provide a quasi-rational view of an emotional enquiry. These data provide a numerical mechanism by which vehicles can be compared using the eyes of their target customers, without introducing the bias of the engineer, designer or researcher. In this case, the numbers provide a translation from subjective customer opinion into a language with which the designers, engineers, marketers, and manufacturers are familiar. However, what this translation can not provide is an understanding of the meaning behind those numbers, nor how they can be used to improve the product. The numbers provide a target; the automatic need to improve such numbers is driven by the deeply-held, but untested, assumption that better numbers will automatically equate to an improved perception of luxury in the eyes of the consumer. Without guidance to provide meaning to that translation, it is entirely possible that efforts to improve the numbers would not improve the perception of luxury (by changing the "wrong" things, or changing the right things the wrong way); this could be especially true once the data is removed from its original context, and once assumptions are made about what motivated consumers to make particular responses in specific instances.

Customer verbatim data, on the other hand, provides a qualitative mechanism by which vehicles can be compared against their competition set using the eyes of their target

customers. It can be argued that verbatim data provides a far richer data set than the quantitative data. The verbatim data captures what the respondents wanted to talk about, not what they were asked to talk about, and reveals what excited the respondents (whether positively or negatively), what they found interesting, intriguing, frustrating or difficult to understand. It does so from a visceral level: the respondents are yielding their non-rational, emotional views of the vehicles. However, analysing this type of data is a much more labour-intensive and specialist task compared to analysing the quantitative data. In a resource-stretched, time-starved environment, this presents a significant barrier to its use. But by understanding what truly excited, pleased, intrigued or infuriated the respondents when they interacted with the cars and articulated their thoughts and feelings in their own way, it is possible to develop guidance that would ultimately support attempts to improve the traditional, rational quantitative measures.

Aim and Approach

While the value of the PRP verbatim data was recognised by the firm, the results were only shared in a high level summary format that concentrated on the numerical output of the codified verbatim data (area, theme, emotional valence). This research focus therefore looks at what specific attribute teams within the firm want from the data, what questions they want answers to, and how the data can be interrogated to provide those answers, by considering the end-to-end process of developing a detailed report about seats and seat comfort using the raw verbatim data, and highlighting the problems and difficulties that arose.

The intervention began with a critique of the data, which was stored in a number of files:

Transcripts: MS Word documents. Two documents were provided per car, one for each market (UK & US). Each document contained all the respondents' comments for that market. For each car that each respondent viewed (3 per respondent), the verbatim is presented in 5 sections: General, Exterior, Interior, Rating, Suggestions.

"Database of Answers": Excel spreadsheet, listing breakdown of each code attributed to each section of each respondent's verbatim for each car.

Demographic Listing: Excel spreadsheet, listing unique ID, country, cell viewed, age, gender, luxury level and vehicle owned.

Tabs: A3 print-outs of excel spreadsheets (hard copy only), listing code counts, cross tabulating Themes and Areas. Sheets provided for US, UK and combined UK & US results, for each emotional response (positive, negative or neutral).

A set of detailed seat and seat comfort reports were developed from this data set.

Discussion of Results

A review of the existing data presentation/format identified that the tab data was summarised at too high a level to develop useful seat/seat comfort reporting. A recode of the data was therefore deemed to be necessary to develop greater granularity.

Developing the seat reports highlighted two clear points: the verbatim data in its raw format was not easy to interrogate and the data were therefore not accessible/available to those design and engineering teams who would find it most useful. The main issues identified that made the data difficult to interrogate were:

Time: the process of re-reading and re-coding the data took several man-months, this time delay means that teams cannot get the answers they want in a reasonable time-frame and scarce resources are also tied up.

Reliability/Consistency: the perceived integrity of the PRP relies on consistency with previous report-outs and a high level of inter-rater reliability.

Expertise: a high level of understanding of how the data is stored and related is required to conduct the analyses, together with a good capability with MS Excel. Expertise is also required to be able to explain the results obtained (such as the difference between comment and respondent-based analyses, and the implications on results).

Nugatory Work: re-reading and re-coding the verbatims is a wasteful process and each repetition increases the likelihood of error in the analysis, especially if the team members continually change.

This intervention demonstrated the limitations of how the raw data was stored (separate, non-linked files), and of the level of detail nominally presented (summarised, high-level). A need was therefore identified to improve the accessibility of the data to market research team members, enabling the "experts" to optimise their time when answering requests for premiumness information. A second need was to ultimately enable NPD teams to conduct their own analyses thereby reducing the resource load on the market research team.

The raw customer verbatim data do not present a language or format with which designers, engineers, marketers, and manufacturers are familiar. There is therefore an opportunity to translate the subjective customer voice into a useful language: to increase the utility of the data. The reports generated during this intervention demonstrate some of the ways in which this could be achieved. It was proposed that a tool should be developed that would enable the verbatim data to be stored and interrogated in such a way as to increase its utility, with the ultimate aim of enabling self-analysis by non experts.

Research Focus #2: Deep Dive with PQ Team

Rationale for Intervention

Perceived Quality (PQ) is one of a number of vehicle attributes that are used to drive the firm's new product development. The PQ attribute focuses on a customer's perception of quality based on "sensory experience" and "emotional connection". This intervention therefore looks at the PQ attribute and the team that manages that attribute within the firm.

Aim and Approach

The aim of this intervention was to understand the role of the PQ team, establish how premiumness could be embedded effectively into the PQ work stream and inform the design and development of a premiumness tool, by identifying the needs and wants of the PQ team and how the data be interrogated to provide those answers. Data collection tools employed included document analysis, interviews and development of PQ premiumness reports. The longitudinal nature of this study led to a number of reportable outcomes.

Discussion of Results

It was observed that the PQ attribute structure could accommodate the different mechanisms of consumer experience (cognitive/reflective, visceral, behavioural), however this need was not reflected within the PQ measurement and monitoring activities. It was found that the (static) PQ attributes were well represented by the premiumness code frame, but PQ activities were predominantly focussed on those attributes that elicited the fewest comments (must-have quality vs. attractive quality).

The PQ processes are self-evaluated. While market research feedback from real customers is available, this was largely ignored: the voice of the customer was therefore used only in so far as the team members perceive the customer. Preliminary analyses have suggested that the internal PQ measures do not correlate with customer views. One particular tool was seen to be valuable for managing the design and development process for internal materials, but suffers from a lack of weighting or priority for the features it considers. Furthermore, these internal measures are feature-focussed: a holistic approach to PQ was espoused but not evidenced in normal operations. There is therefore an urgent need to introduce the customer's view accurately into the PQ process, and a need for understandable data that can be safely used by the PQ team (to increase the utility of the premiumness data, to provide accessible and reliable data).

PQ efforts are somewhat constrained by processes and techniques were mandated by the firm's former owners, that suited mass-market products, but which do not accommodate the more discerning luxury or premium car consumer. The PQ team is sometimes frustrated by its level of influence (power) to protect the PQ attribute from erosion during cost cutting exercises or constraints imposed from manufacturing processes. The PQ team believes it is sometimes seen as an intrusion by the attribute teams that it seeks to influence, suggesting an internal conflict in need of resolution.

The PQ team were reluctant to release data to "outsiders", however, the team was open to receive new information: new outputs from this research work (charts and reports) were well-received by the PQ team, and demonstrate a clear way in which the premiumness verbatim data can be used by them. A tool than enables the self-analysis of the verbatim data is therefore needed.

Research Focus #3: New Vehicle Development Workshops

Rationale for Intervention

It had become apparent that there were still pockets within the firm where the PRP findings had not yet been shared or experienced. There was also uncertainty about how successful the dissemination of the PRP data had been, and how well it had been cascaded by the management teams. Furthermore, PRP presentations were criticised as being too long, not interactive and it was difficult to actually apply the information provided. It was therefore decided to develop a workshop for the new vehicle programme teams to provide guidance on the PRP findings, to enable the team members to experience the cars and attempt to evaluate them using the customers' eyes, and finally to have the team members create their own ideas for improving premiumness within the programme.

Aim and Approach

The aim of this intervention was to try a novel approach to disseminating the PRP findings and to test the participants' understanding and motivation/ability to use the information.

Five workshop sessions were conducted over the two day period, each lasting approximately 2 hours long. A total of 46 people took part in the workshops, representing 15 disciplines. Each workshop comprised a short presentation of the PRP findings, a chance for individuals to evaluate the competitor car set and a group task to think about what they can do to improve the premiumness of the new vehicle and what blockers are stopping them. Participants recorded their individual and group suggestions on proforma, which were collected at the end of each session for post-workshop analysis, together with any moderators' notes.

Discussion of Results

The outcomes of the workshop confirmed that while the PRP research had reached its target audience, this had not resulted in the message reaching those who needed to understand it and who were best placed to incorporate it into the product. The need to present to a few people at high level and have them cascade the message is understandable: the full PRP presentation was 4 hours long, presenting constraints on both the market research team and the audience. However the target audience selection process must ensure that the right people are being exposed at this level, and the presentation process should enable the "train the trainer" approach. Even the most willing and pro-active participant can only ask for things that they know about: it was clear that many participants had not heard of the PRP prior to the workshop, suggesting that market research team would benefit from improving the ease with which their work can be discovered and accessed. This would have additional benefit to market research team: if greater use is made of their work, this supports the need to continue. In a resource and cash-strapped environment, market research activities have been the first to be scrapped, as their value is harder to measure and quantify in cash terms than more traditional R&D projects.

Several participants ignored the instructions during the workshop, suggesting either that they didn't listen, or they decided that their approach was more important or relevant. Similarly, there was evidence that some participants could or would only focus on their own priorities, even ignoring customer data. This lack of alignment with customer priorities could lead to effort and resources being expended in areas that may be easy to improve but which will not result in improvements in the eye of the customer. Accommodating the customer's view will require a level of open-mindedness, as it is likely to be in conflict with one's own perceptions of what is appropriate. Technical excellence does not necessarily equate to a high levels of luxury or premiumness as perceived by consumers.

Many of the suggestions for improvement made by the participants were categorised as being "for others" to do, and predominantly focused on specific features. Very few suggestions were made about potential holistic improvements, suggesting that the participants are not willing or able to think in those terms. Several blockers were identified, but the workshop failed to identify how those blockers could be overcome. There was a strong sense that the participants did not feel equipped or empowered to make changes needed to alleviate those blockers: from budget constraints, decision making and the programme and company planning processes, changes were seen as needed at a fundamental, business level before programme level changes could be effected. Participants demonstrated an element of needing to be told what to do: a common request was to be told exactly what they needed to do to improve premiumness (such as a "top 5 to-do list"), rather than work it out for themselves. This approach does not represent the most effective or efficient use of the premiumness findings, but does reflect what designers think they need.

The materials used within the workshop were well received. These materials comprised new ways of representing the data, and further highlighted the value of increasing the utility of the premiumness verbatim data in order to develop flexible analysis approaches to suit the specific application. Developing new materials provided an additional opportunity to analyse the requirements for a verbatim data tool and test those requirements in a prototype tool.

The workshop also raised the importance of keeping premiumness "top of mind" and current: as well as implying the need to continue to run such internal premiumness workshops, it also strengthens the need for a tool to ensure that the materials can be prepared in a timely fashion.

Key findings

A number of research observations and insights emerged from these interventions, which were brought together and scrutinised to identify emergent themes and patterns which are discussed in terms of the study's three main aims.

- to assess how well the PRP data has been understood within the firm;
- to understand how effective the PRP dissemination process was; and

- to evaluate the quality and format of the PRP verbatim data in terms of its ease of use.

How well has the PRP verbatim data been understood?

This is important because the PRP verbatim messages represent the target customers' natural reactions when evaluating luxury and premium cars, providing an opportunity for the firm's designers, engineers and marketers to develop a level of empathy with the intended customers, thus creating competitive advantage.

Prioritisation of Effort as a Measure of Understanding

This research proposes that prioritisation of effort can be used a measure of how well the PRP messages have been understood and assimilated: if the designers and engineers who represent the customer demonstrate that their focus matches what the PRP participants talked about, this would suggest a level of understanding of what is important to the customer.

Both the PQ and Workshop interventions identified a level of parity in terms of the issues that were important to the firm and the customer, but identified a significant disparity between what consumers talked most about when evaluating a car, and where the focus of effort and priority is expended. The interventions also identified a focus on specific features rather than a holistic approach, suggesting reluctance to think in those terms, and a preference to target . those attributes that relate to must-have rather than attractive quality. This suggests that while the nature of the drivers of luxury and premiumness are recognised in principle by the teams, the individual team priorities are not in alignment with those of the customer. This misalignment may be due to personal biases about what is important, difficulties understanding how to manage the priorities or because those areas that currently receive the majority of focus are those elements that are easiest to quantify and measure. This mis-prioritisation could lead to effort and resources being expended in areas that may not result in improvements in the eyes of the customer, to the detriment of those areas that could make a difference: technical excellence does not necessarily result in a high level of luxury or premiumness in the consumers' eyes. Accommodating the customer's view will require a level of open-mindedness, as it is likely to be in conflict with one's own perceptions of what is appropriate.

Self-Evaluation as a Proxy for the Customer

The firm's NPD processes rely on the various individual teams' own expertise to evaluate the design of the product. Market research activities provide feedback on some aspects of the design process, but are often ignored, suggesting that current market research outputs do not meet the needs of design/engineering teams, or that there is an internally-held view that customers are not considered to be able to judge adequately the quality or success of a design. The voice of the customer is therefore largely represented by the team members' own beliefs about the customers' wants and needs. This approach is valid if the experts or expert systems in place comprise an accurate proxy for the customer; that is, the designers or engineers can correctly represent the views of the target customers. The literature has shown that people's

views of luxury and premium products are highly personal and driven by factors such as background, age and experiences. This highlights the importance of strong market research/design interaction to ensure that designers and engineers, who generally have different backgrounds and experiences to the firm's target market, have access to the right information to enable them to incorporate the customers' perception of luxury and premiumness into their decision making processes.

Internal Expert Systems as a Proxy for the Voice of the Customer

If self-evaluation is to be used as a proxy for the customer, then the expertise, systems and processes used to develop the self-evaluation must represent a realistic reflection of the customers' perceptions of luxury and premiumness. These internal systems can be thought of as forms of "expert system" that enable the "subject matter experts" to make and record their evaluations and decisions. Expert Systems are traditionally defined as software-based tools that replace the need to consult actual experts. In the context of this research, expert systems can be viewed as a combination of experts and tools that reduce the reliance on the "in head" knowledge of experts, ultimately reducing the level of expertise required to perform the evaluation.

The PQ team use evaluation tools as a proxy for the customers' opinion. While these have value for managing the design and development process, and make the evaluation process visible and accessible to non-experts. PQ adopts reasonable measure of the technical excellence, but fails to reflect the emotional experience of the customer, however, there is no obvious correlation between the outputs and the PRP verbatim data, and priorities are contrary to the PRP findings. This suggests that PQ expert systems are not a valid proxy for the voice of the customer.

External Surveys as a Proxy for the Voice of the Customer

External customer data are available to the firm, looking at customer opinions of the cars that they drive, covering satisfaction, warranty issues, dealer satisfaction, reasons for purchase and so on. These include the syndicated New Car Buyer Survey and independent JD Power studies (IQS, APEAL, SSI and CSI). These studies differ from ad-hoc exercises such as the PRP in that they are repeated on a continual basis and report on a regular.

The researcher was able to develop a reporting mechanism by which external survey data can be used to track customer opinions of luxury and premiumness issues, which could be used as a proxy for the post-purchase voice of the customer for rational evaluations, and this could be used as a measure of the success of efforts to improve the luxury and premiumness of the firm's vehicles.

Empowerment and Responsibility

The workshops identified a number of blockers that were perceived as preventing the changes needed to implement improvements. However, there was a sense of powerlessness in terms of being able overcome these obstacles. In some cases, this manifest as frustrations

about real influence in terms of protecting attributes from erosion due to lack of priority by other parties, and a sense of being seen as a burden rather than an integral consideration of vehicle design and development. This suggested that a the importance of premiumness/luxury within the NPD process needs stronger support from a management and strategic position if the firm is to be able to effect positive change in the consumers' evaluations of its vehicles.

A level of competitiveness between the different teams and functions was observed, and the study was somewhat hampered by a reluctance to share what they held to be confidential information, even internally within the firm. This suggested a lack of trust, but more fundamentally indicates a fear of being exposed, criticised or ridiculed.

In terms of individual responsibility, two key issues were revealed by the study: the ability to accept expert advice and the willingness to take personal responsibility for change.

The study also revealed that efforts to improve are constrained by legacy processes in the firm, and that availability of information/knowledge about customers' needs and wants with respect to premiumness and luxury evaluation to support the decision-making processes is also inadequate.

PRP Dissemination

The research resulted in a number of observations and insights pertaining to the practical implications of the process, considerations about the way that the data can be presented to improve knowledge transfer, and future dissemination needs.

The Dissemination Process

The study revealed that the PRP message had not reached all those who needed to understand the findings, or those who were most able to effect the necessary changes. This indicated that the effectiveness of dissemination was severely limited by the process by which the recipients are selected. Key audience sectors are omitted by the current process, either by design or by error (e.g. due to lack of contact knowledge). The need to present to a few people at high level who then cascade the message to their teams is understandable, given the duration of the presentations. However, the presentation style and content must support the "train the trainer" approach upon which the cascade process relies. Awareness of the PRP and other market research would benefit from improving self-publicity about such activities within the firm. The workshop represents one such improvement.

Content Considerations

The materials developed for the interventions demonstrated new ways of representing the data that improved the process of knowledge transfer by better meeting the needs of its recipients. The importance of context when presenting the data was highlighted by incorporating photos to relate the data to the vehicles, reducing the likelihood of mis-interpretation. The importance of context when considering premiumness metrics was also confirmed. The limitations of certain types of data were raised: for example, a three point

scale for assessing the quality of materials becomes unreliable at the boundaries between the points, while weightings can influence behaviour within the NPD process.

Future Needs

The study highlighted the need to keep premiumness "top of mind", and confirmed the potential benefits of enabling the designers, engineers and researchers to be able to conduct their own analyses of the PRP data, both in terms of enabling teams to develop their own premiumness improvement activities and in reducing the reliance on the market research team to access customer opinions about premium and luxury cars. It was therefore suggested that market research team continue to facilitate Premiumness Workshops.

Utility of the PRP Data

The study confirmed that the original presentation and detail of the coded verbatim data was not adequate. The raw data were not in a format that was useable or useful to the teams and the data files were difficult and time-intensive to interrogate. The data is therefore not accessible to those best place to make use of the knowledge available within it. The researcher was able to acquire more detailed raw data which provided full granularity of the coding structure and its implementation, however the fractured nature of the storage format necessitated a high degree of expertise, both in terms of the content of the data and how it was linked together, without which attempts at analysis would be unreliable and prohibitively time-consuming. The study therefore confirmed the need to increase the utility of the data by improving its storage, format, linkage and accessibility, and the importance of a PRP verbatim database and analysis tool was therefore substantiated.

Concluding Remarks

A critical factor for the successful re-establishment of luxury into the firm's brands is the level of the NPD community's understanding of rich customer data. This research identified that the main obstacles to the firm's successful integration of their rich customer research into the NPD environment related to their ability to use and share the verbatim data. These issues included the poor utility of the raw data, the detrimental impact of translation and context on the meaning and understanding of the reported findings and the need to share the data and knowledge in a useful format without adding to workloads.

The interventions uncovered the nature of information required by the NPD community, identifying the types of questions they needed answers to, and the formats in which they needed the information to be presented, yielding explicit and latent needs. The interventions further established that it was possible to manipulate the data in a way which met these needs, by enabling the coded verbatim data to be interrogated at the required levels of detail.

Implications for theory/practice

The assumption that internal company experts can act as a proxy for the luxury consumer is challenged.

The importance of strategic alignment and upper-management support to the successful integration of luxury improvement efforts is demonstrated.

New techniques for creating insights from the qualitative and quasi-quantitative data and presenting that knowledge within the wider NPD community have been tested.

A Verbatims Database tool can enable non-experts within the wider NPD community to access and interrogate customer information about luxury and premium cars.

A means of maintaining links from numerical target-like data to consumer responses is feasible.

A mechanism for continued and non-expert interrogation of the rich customer data enables the value and benefit of expensive customer research activities to be maximised.

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Dr Bernie Bridle

Bernie began her career as a mechanical engineer, and spent 13 years in industry as a Project Engineer, Systems Engineer and Bid Engineering Manager, operating at and managing the

interfaces between disparate engineering and business functions for the defence, railway and communications industries. This gave her a strong experience in managing the conflicting requirements of customers, suppliers, resources and legislation, and gave a unique insight into the discordant needs of the aesthetic and the functional.

Bernie was lucky enough to be sponsored by an employer to do a part-time Masters degree at the University of Warwick, which re-awakened her interest in academic research and earned her a Departmental Prize for her dissertation and coursework. She went on to work as a Project Engineer with the University of Warwick's prestigious International Automotive Research Centre, working closely with industry.

Bernie continued this research direction with a move to Cranfield University's EngD programme in late 2005, where she focussed on the use of customer insights in the New Product Development Process, part of which is the topic of this paper.

Bernie is currently an external examiner and project supervisor for Warwick Manufacturing Group's full-time MSc programmes.

Bernie was admitted to the Degree of Doctorate of Engineering in June 2011, and is a Chartered Engineer and Member of the IMechE.

Professor Stephen Evans

Professor Stephen Evans spent 12 years in industry, rising to become Engineering Systems Manager at Martin-Baker Engineering, the world leading manufacturer of ejection seats. His industrial experience led to an emphasis on improving engineering performance and provided an excellent grounding for tackling complex, real-life problems.

Professor Evans has over 20 years of academic experience which includes working collaboratively with leading industrial and academic institutions from around the globe and supervising over 120 PhD. and MSc. students at Cranfield. His research seeks a deep understanding of how industry brings environmental and social sustainability concerns into its design and manufacturing practices. He works with organisations developing solutions that move us towards a sustainable future. He researches and conducts projects with organisations to improve their performance in dimensions such as designing more sustainable products and producing them in more sustainable ways; and increasing the efficiency and effectiveness of design, manufacture and servicing of both products and services.

He has observed that each sector (and each company in it) is only unique in the particular details which hold it back from better performance. The common issues (including lack of innovation, limited collaboration, poor performance management) can benefit from structured responses. Professor Evans has helped organisations create and implement such structured responses to resolve a variety of problems.

He has lead, or co-lead, the first UK EPSRC research projects in the fields of, Concurrent Engineering, Co-development, and in Eco-design.

The Challenge of Conducting Interdisciplinary Research Internationally

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Interdisciplinary collaboration, entrepreneurship, international design promotion

In 2010, Dutch DFA (Design Fashion Architecture) commissioned CBRD (Centre for Cross-Media, Brand, Reputation and Design Management) to carry out research to identify new insights into where the opportunities for Dutch designers and design firms lay in the German market, and potentially in other international locations. The result of the research process was a model and approach to international commerce and interdisciplinary collaboration that design enterprises could adopt so as to better equip themselves in taking a more entrepreneurial approach to entering international markets.

INTRODUCTION

Current global trends related to creativity in design businesses identify the creative industries as one of the fastest growing sectors in the world and one of the best ways to increase competitive advantage among commercial companies as well as between national economies. There is a growing emphasis on the importance of the management of design 'assets' by countries, not just companies, reflected in the number of national design policy and promotion programmes coming into existence (SEE Bulletin 2011). Creative businesses are ideas-based, in terms of their product/service developments and business practices; they also seek to develop new markets as much as to serve those markets that already exist (Collins 2010). In terms of value to the economy, the creative industries represent an annual growth rate of between five to twenty percent in the OECD (Organisation for Economic Co-operation and Development).

The Dutch Design Fashion Architecture (DDFA) programme is supported by the Dutch government and various sectors within the creative industries to promote Dutch creativity abroad. According to DDFA, the creative sector is a key industry within the Dutch economy,

and in terms of the economic outlook for design professionals in the Netherlands, the way out of the current crisis is through innovation and foreign markets, and continuing the Dutch tradition of being 'pioneers in international business' (DDFA Year Report 2010).

The Centre for Cross-Media, Brand, Reputation and Design Management (CBRD), based at Inholland University of Applied Sciences in the Netherlands, conducts applied research into the management of brands, products, services and organisations and helps organisations, enterprises and entrepreneurs find a recognisable image, identity and place in the market or industry in which they operate. The research group typically takes an interdisciplinary and integrative approach to research investigations based on real market needs, believing that it is precisely the interaction between disciplines that can stimulate original approaches to conducting research, as well as leveraging positive contributions for a business and added value for associated products and services. CBRD collaborates with other design management stakeholders, for example, Design Management Europe and the University of Wuppertal's Department of Design Management.

In 2010, DDFA commissioned CBRD to carry out research to identify opportunities for Dutch designers and design firms in the German market. The goal was to provide new insights for the three disciplines of design, fashion and architecture for businesses in the various German regions. Previous market research had already been conducted by several institutions – by universities, UK agencies and industry associations - and collectively the results provided a broad and generic view of the creative sector in the German market. This market research was based on secondary 'desk' research, not primary 'practical/field' research. The value of the qualitative research approach from CBRD was to add specialised knowledge and new insights to this existing research material.

BACKGROUND

Applied research in the Creative Industries can take many forms, reflecting the diverse nature of the disciplines (design, arts and crafts, advertising, architecture, fashion, film, music, television, radio, performing arts, publishing, interactive software) and academic contexts (art schools, business schools and universities) involved. Currently, in the context of design, the idea of an explicitly defined 'design research culture' is undergoing change, and in particular, how to more closely link design research in academia to design practice in industry (Best 2011). In addition, there is debate around the concept of design as research – either applied research, where the resulting knowledge is used for a particular application; action research, where the action is calculated to generate and validate new knowledge or understanding; and fundamental research, which is well established (Frayling 1994). There is also a growing interest in interdisciplinary research, paralleling interdisciplinary developments in professional practice, and raising the question of what roles the creative disciplines might play in interdisciplinary inquiry (Rust 2007). Also taken into consideration is the increased interest in how governments can stimulate economic growth (and environmental and societal

well-being) through their creative industries in general, and national design capabilities in specific (Best 2011).

An inductive approach was taken to this project, allowing a theoretical framework to emerge from the research investigation itself. However, the team carried out initial desk research across three broad categories:

1. Prior knowledge in international marketing: texts on international marketing, international global business and international retail markets (including Albaum et al. 2005, Bruce et al. 2005, Cateora et al. 2007, Rugman & Collison 2009).
2. Prior knowledge in cultural aspects: The Hofstede Dimensions, based on the cultural dimensions of Gert Hofstede, served as a useful reference point for identifying cultural diversity in the international business context and characterisations across different countries (Hofstede 2001, Trompenaars et al. 2003, Mohammed et al. 1996).
3. Prior knowledge from DDFA resources: previously commissioned market research, texts on architecture in Germany, doing business in Germany, and opportunities in the German market (uNN 2007, INVESTRUIT 2005, EVD 2009).

Research Objective

The initial research objective was to find business opportunities for Dutch design, fashion and architecture entrepreneurs in Germany. Prior market research into the creative industries as a whole did not surface concrete new opportunities. Researchers had not differentiated between the needs of, for example, product designers, industrial designers and graphic designers. The CBRD research team recognised that there were likely to be different needs for different areas of design. Our revised research objective was to find new opportunities by refining the approach to allow for the differences in the various aspects of, and professions within, ‘design’. Therefore the generic term of design was sub-categorised into the domains of design (graphic and product), fashion and architecture.

Initial Research Questions

The initial four research questions were:

1. What knowledge do Dutch design, fashion and architecture companies need, if they are interested in becoming active in the German market?
2. What are the key success factors for doing business with Germany, and
3. What business opportunities we can determine for Dutch companies in the field of design, fashion and architecture, which can help build relationships with companies and agencies in Germany?
4. How can the insights obtained in answering the first three research questions be used by DDFA to provide practical and relevant guidance to companies, in order to enable better commercial opportunities in the various German markets?

Research Methodology

The study was conducted in cooperation with the Department of Design Management at the University of Wuppertal (Dr Prof Brigitte Wolf) and consisted of both desk research and field research. The emphasis was on using qualitative research methods such as organising and conducting focus group meetings and individual expert interviews in the Netherlands and Germany. In total, three focus group meetings and 68 individual expert interviews were conducted. In the Netherlands, mostly designers and representatives of agencies and companies were interviewed (39 interviews). In Germany, in addition to designers and other experts interviewed, journalists, founders of grants, researchers, potential clients and employees of business institutes and consulates were included (29 interviews). The interviews were carried out by four research fellows in the Netherlands and by two researchers and a team of students in Germany. The interviews were recorded on video or audio, from which the text of the final report was developed. The same interview structure was followed for each discipline.

During the analysis phase of the study, the comparison of the interview results of design, fashion, and architecture of the Dutch and German research were emphasised, as a method for uncovering new opportunities and approaches.

Research Approach

The research methodology was sub-divided into a number of defined steps as outlined below. The involvement of students necessitated a number of preliminary steps to be followed.

Step 1: Briefing and set up for co-operation with students. Specific streams of study within two schools of Communication (Inholland) and the Department of Design Management (Wuppertal) were identified. Clear briefing sessions between researchers and students were critical to ensure the process would be conducted in the correct manner.

Step 2: Preliminary desk research with the students. Under the guidance of the researchers students conducted initial desk research of websites. This was to select topics for discussion in focus group meetings, to raise awareness of geographical and niche areas of the German market, and to help build the list of potential contacts for focus group invitation.

Step 3: Preliminary phone calls to Dutch opinion leaders/experts. This was to gain insight and gather a viable point of view into where challenges and opportunities faced by Dutch design firms considering German market entry could lie. The experts were drawn from designers, companies, branch organisations and embassies.

Step 4: Target group identification: For each area (design, fashion, architecture, interiors, product design, graphic and communication design), students were briefed with the task of identifying 20 potential interviewees and participants for the focus groups.

Step 5: Preparation for expert interviews. Structured questions were formulated for the team to gain better insight into in the 3 areas of design fashion and architecture. For the Dutch interviews, which were conducted prior to the German interviews, a list of key success

factors (KSF) were hypothesised and used as the basic structure for discussion. These KSFs were identified by analysing existing research reports on the topic, scanning literature across the area of international business (including Hofstede's six culture dimensions) and by the initial phone contact with experts.

Step 6: Field research: conducting the focus groups and expert interviews. The KSFs were validated with the experts in both interviews and focus groups to establish if the proposed dimensions and questions were correct, and amendments made where necessary. The interviews themselves focused on capturing personal stories and experiences of both successes and failures in doing business internationally, especially with regard to previous attempts to enter the German market. By reflecting on their experience of working in Germany, what was revealed was their knowledge needs when it came to doing business in different regions in Germany. For each domain (design, fashion and architecture), care was taken so that the level of business experience in Germany of the respondents had sufficient variation (from no experience at all, to years of substantial business experience). A number of the experts suggested looking at the regional differences in Germany, and the market opportunities in specific disciplines, industries and geographical areas.

For the German interviews the KSFs were also used in combination with questions on business opportunities and the image of Dutch Design. The starting point in Germany was with the commissioners of design in the main, but also the opinion leaders and designers in the 4 categories of architecture/interiors, fashion, product and communication design.

Initial Conclusions

On the basis of the insights gained from the interviews and focus group discussions the team were able to partially answer the initial research questions.

1. What knowledge do Dutch design, fashion and architecture companies need, if they are interested in becoming active in the German market?

   The outcome was that the knowledge needs of Dutch entrepreneurs in the design, fashion and architecture domain were about information that was already widely available in locations such as the ministry of commerce, embassies and branch organisations. So we concluded that the information itself was not the problem but the connection of that information to the target group. The new question that arose was 'why does this information remain unfound?'

2. What are the key success factors for doing business with Germany?

   Here we found a satisfying answer in formulating a list of key success factors and having them confirmed as relevant, accurate and complete by the respondents. Prior to the research, when compiling the list of KSFs, we grouped them into six dimensions: Identity and Image; Drivers (motivations, ambitions, expectations); Communication (cultural, linguistic); Connect; Growth; and Enterprise.

3. What business opportunities we can determine for Dutch companies in the field of design, fashion and architecture, which can help build relationships with companies and agencies in Germany?

The refinement of the research by looking at design, fashion and architecture separately, and the extra dimension of researching in both the Netherlands and in Germany, did not surface substantial new insights on business opportunities. It became clear that the refinement was still much too broad (and the German market too diverse) to gain sufficient in depth insight for specific opportunities. Our conclusion was that it was unrealistic to assume that research for even one domain in one German region would surface useful opportunities for all group members, as it was still too broad. As the uNN research (2007) already stated, the creative industry is very diversified and scattered which makes it difficult (if not impossible) to surface opportunities for even a very distinct sub-group of creatives. This led us to conclude that instead of looking for opportunities for accumulated groups, we should give each individual creative entrepreneur a set of starting points and questions to answer for themselves, to research and formulate their own specific entry strategy into the German market.

4. How can the insights obtained in answering the first three research questions be used by DDFA to provide practical and relevant guidance to companies, in order to enable better commercial opportunities in the various German markets?

It was now clear that the 'practical and relevant guidance' we set out to deliver with question 4 was not about where the opportunities are in Germany. Our initial research confirmed what we already knew from other sources. Nothing new was to be found by standing on the existing empirical data. The team instead concluded that the guidance should come from giving each individual entrepreneur some starting points and questions so as to help them develop their own personal entry strategy.

Revisiting the Research Process

The research team revisited the material gathered in each area (design, fashion, architecture) to look for new starting points, without being guided by the initial research questions. The material was reorganised and the data analysed from a new angle to gather insights and make connections within the research data. At this stage the team completely left the idea of looking for opportunities and went back with an open mind, searching for new patterns and marking pieces of text that had a connection. All the available data from the Dutch and German interviews as well as the existing market research reports were interpreted again.

Using the KSFs as a guide, the team began to look more to the actual experiences of the designers themselves. New patterns and areas of research were distinguished, ones that put more focus on the poignant characteristics of the design community. What did these design experts as entrepreneurs have in common, and what was different? How could the team understand and explain these differences in knowledge needs and viewpoints?

The team compared the real business experiences of the interviewed designers to the KSFs to try to explain the different needs and views. The team also compared the experts' real business experiences with the initial theoretical desk research into international marketing and international business texts, where no explanation of the different knowledge needs was found. Although the texts on international business culture attempted to understand cultural diversity in international business, and did focus on differences between national characteristics of companies, they did not provide any detail on the differences between entrepreneurs who deal with stakeholders and commissioners abroad. Neither Hofstede (2001) nor Trompenaars et al (2003) specify the different attitudes and views of entrepreneurs in their international business-to-business-communication, that is, how they actually operate cross-boarders. The integration of commercial and cultural aspects, between Dutch designers and German commissioners, was important, and somehow needed to be taken into account.

The research team adapted the KSF dimensions to the different knowledge needs and views of the experts and then had to further refine the approach. By looking again in detail to all the data of the interviews with the Dutch designers, a new interpretation and a possible explanation of the differences between the interviewed designers was found. The differences appeared to be caused by the degrees of successfulness in entering the German market.

Revised Research Questions

When looking at the original research questions, what are the opportunities for design, fashion and architecture, industrial and product, the team were unable to find an answer in the interviews and desk research. So the team began to ask new questions, in more detail, and based on the tacit knowledge and practical experience of entering the German market as mentioned by the respondents from the field. This information was not available in text books or research reports. What are the practical difficulties and challenges for those entering the German market? And what is the nature of the dynamic between the Netherlands and Germany, and not just the simpler context of doing business in one country or the other? Which designers had only generic questions to be answered before they would enter the international market? Which designers had more highly articulated questions? Which entrepreneurs already had some international experience but no or little experience in Germany? Which design offices had extensive international experience? And how could each designer build on their existing experiences? Based on the rereading of our qualitative data, the team found new patterns and indicators with which to work.

Research Outcomes

A categorisation based on a typology of entrepreneurs was defined, of which there were five types:

A. Starter: generic company with a question.

B. Scout: starter with articulated professional question.

C. Pioneer: company with little international experience and no business experience in Germany.

D. Nomad: company with extensive international experience and little business experience in Germany.

E. Generator: company with extensive international experience and experience in Germany.

For each type of entrepreneur, the team found there was different knowledge needs. For example, the needs of a ‘Generator’ (who has a lot of experience) are different from the needs of a Pioneer or Scout. To verify their findings, the team went back to the desk research and talked again to the designers on the Dutch side and the commissioners on German side.

In answering research question 4 from a new angle the research team developed a model to be used as a guide for Dutch design entrepreneurs doing business in Germany. The *three-track entry model* is based on the three patterns that surfaced through a series of data interpretation sessions. The three patterns are: Approach, Type and Profile. Each track and each ‘station’ on the track indicates where it is important to pay particular attention when doing business in Germany (see Figure 1).

- **Approach** is characteristic of the manner in which business is undertaken: a systematic linear approach versus an intuitive iterative approach based on trial and error. We also found that this pattern ‘Approach’ was strongly connected to the key success factor dimensions ‘communication' and 'culture'.
- **Type** of business identifies whether the organisation is a Starter, Pioneer or Generator based on the experience in doing international business. This pattern strongly connects with the success factor dimensions ‘enterprise', 'connect' and 'growth’.
- **Profile** is a pattern that indicates the positioning of an organisation based on differentiation (characteristics such as distinctive, competent, conceptual and innovative) versus adaptation (characteristics such as adjusted, functional, risk adverse) choices towards the new market. The 'profile' pattern strongly connected to the success factor dimensions ‘identity' and 'drivers’.

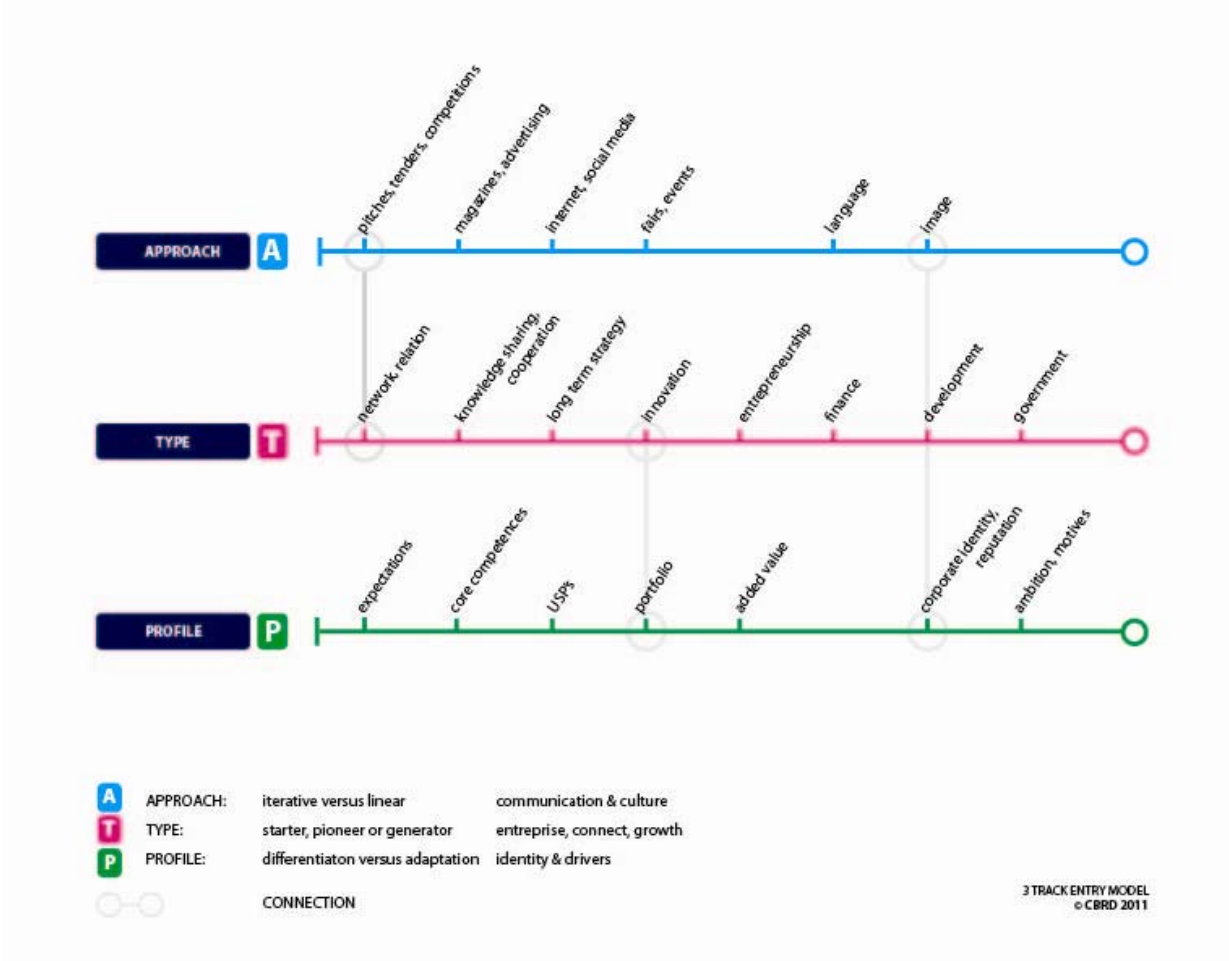

Figure 1: The Three-Track Entry Model

The first two patterns (Approach and Type) give insight in two important starting points. The research made clear that it is plausible to conclude that creative entrepreneurs are more often intuitive in their approach as opposed to being linear. Upon this discovery we analysed the information offered by government and branch organisations and saw that this information as a resource was very linear in its set up, and even advised all entrepreneurs to take a very linear approach when planning for an entry into a foreign market.

Next we found that the Type of organisation had a huge impact on the knowledge needs and relevance of different key success factors. Here a differentiated approach would give a much better match of information.

The third pattern (Profile) gave insight into the key questions that a creative entrepreneur must answer to define his or her entry strategy (see figure 2).

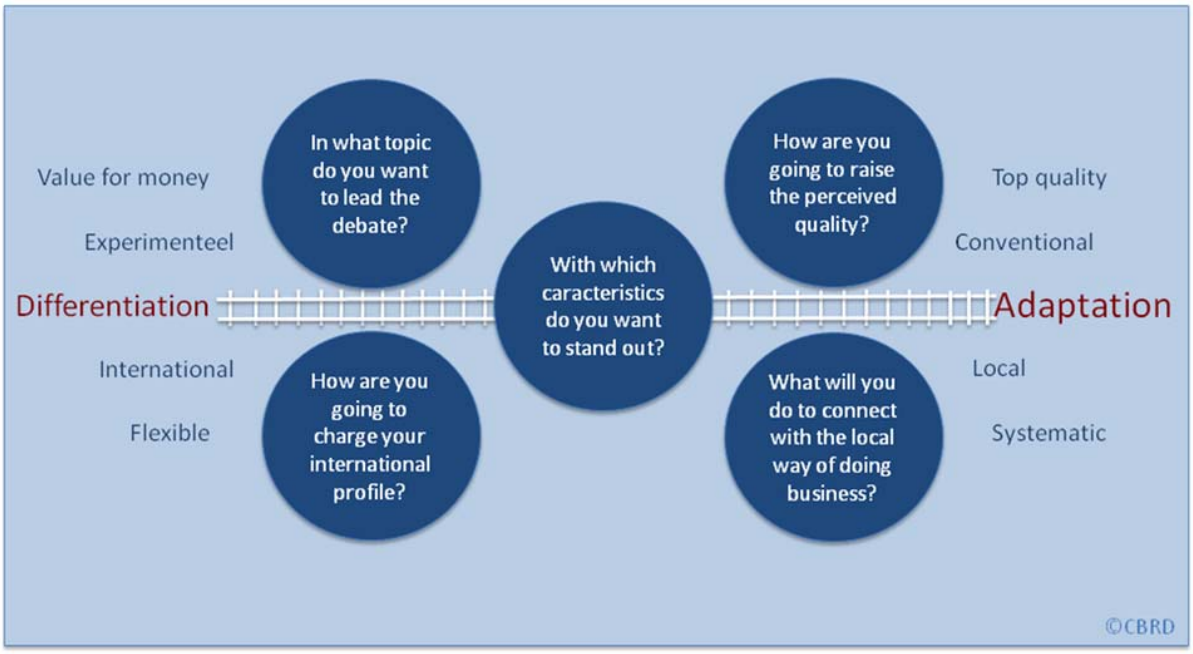

Figure 2: Defining the Entry Strategy

Research Findings

The focus of the research was on mapping the success factors and market opportunities that are relevant to the level of experience of the professionals. A summary report on how Dutch design fashion and architecture can achieve enduring success in Germany identifies the myths and opportunities, what every designer/business person should know about Germany, and successful matches by DFA domains and the German market. The extended report outlines a number of conclusions and recommendations, some of which are outlines below:

- Entrepreneurship and business-to-business communication is a determining factor for gaining commercial success in the German market.
- Proper positioning in the German market can only be achieved by having a good view of opportunities in a specific market.
- The ability to design innovatively does not appear to be quite as decisive in the success on the German market, as having the proper way of approaching clients and contacts.
- An international level of business professionalism is typically a weakness for creatives.

One important finding was the contradiction between the opinions expressed within the Dutch and the German qualitative data. We expected designers (in the Netherlands) and the commissioners (in Germany) to both recognise ‘Dutch design’, but this was not the case. From the Dutch side of the research respondents strongly believed in a self-acclaimed ‘bonus’ for Dutch design when entering the German market, i.e. that Dutch design is

experimental and daring. Yet the German research did not confirm this. It seems that although Dutch design did have a positive impact in the 1990s, the innovative ‘edginess’ of Dutch design has shrunk over the last ten years and this reputation has been partly taken over by the city of Berlin (uNN, 2007). Most people only recognise Dutch ‘stars’ (Rem Koolhaas, OMA, Mecano), not Dutch design per se.

This contradiction lead to a change in the recommendations. In had to be clear to the Pioneers and Scouts that when entering the German market, they could not rely on this Dutch bonus as it is only really associated with design stars, the Generators - well-known Dutch design individuals or agencies with substantial international experience. There were other ways to be a Generator, for example, a firm like CPZ take an adaptive approach to the German market by being technically very strong, and therefore are widely appealing to commissioners for that reason. International design by Dutch companies is seen as being more functional than experimental (Philips Design and NPK).

Specific quotes and comments documented as part of the experiences of the interviewees gave further indication on how Dutch entrepreneurs could formulate their own entry strategy for the German market, depending on their Type, Approach and Profile. The important differentiator was the experience level of the designer, the importance of the designer recognising where they stood (Pioneer, Starter etc.), and how the designer could, for example, evolve and grow their existing brand reputation and recognition levels to develop better relationships and succeed further in the German market.

Usability of the Model

The expectation of the research team is that the three track entry model is useful for doing business internationally, and can be adapted for different countries. Dutch DFA intend to adapt the model for practical application in other regions, more specifically, market research in the creative industries in India and China.

The Profile and Approach track are about identifying starting points which are country independent, and considering what is appropriate for entry into different international markets. For example, the team believe that the ‘differentiation versus adaptation’ dimension holds true for entry in all other countries, but one of the five questions should be tied to the specific culture and market in question. For Germany this is the question 'In what topic do you want to lead the debate?' From the research we learned that Germans will consider doing business with an entrepreneur when they are a known authority on the topic. Germans attach great value to superior product quality. For non-German organisations wanting to enter the German market, this is an especially important criteria for selection over a German party as German businesses are inner market oriented (uNN, 2007). This relative nationalism seems to influence the perceived quality of foreign products (Mohammed et al., 1996).

For the application of the model in any international context this particular question ('In what topic do you want to lead the debate?') needs to be investigated in the research data of a particular foreign market. The team were able to test this when they held a brainstorming session with experts on using the model for entry into the Chinese market, and concluded that for a Western creative company, it is not so much the authority on a certain topic that is key (as is the case for the German market) but the connection to an already well known designer and/or design that symbolizes a certain type of success and status.

Important to the design industry and the professionals working therein, is how the model and approach can be applied in the context of any possible combination of countries (not just Dutch designers working in Germany). What can the model reveal to Dutch designers wanting to work in China? Or English designers wanting to work in India? What are the expectations of designers, and is the model enough to get designers thinking more carefully about how to take an entrepreneurial approach to doing business? And better prepare for doing business in international contexts? How could the research be extended around particular themes, for example, 'security' (important in Germany)? Is 'security' also aligned with other nationalities (as identified in the Hofestede cultural differences), and could this dictate other markets to target with specific security-oriented approaches?

Implications for Theory and Practice

Implications for Conducting Design Business Internationally

1. Designers wanting to work internationally need to adopt a more targeted, professional and entrepreneurial attitude. The three-track model allows designers to identify their own positioning (Profile), to develop a more targeted approach to a particular audience (Approach) and research and formulate their own personal entry strategy into the German market (Type). The starting points and questions enable them to better face the challenge of entering international markets, and better prepare for the opportunities they uncover in the process.
2. Designers have different identities (depending on their discipline), different level of experience, different reasons for entering international markets and therefore have different knowledge needs. Taking these factors into account when developing a differentiated entry strategy means a better chance of a potentially good 'fit' between the Dutch designer and the German commissioner.
3. An international level of business professionalism is typically a weakness for creatives. Success requires a more entrepreneurial approach by designers, but equally, it requires a different approach by Government trade promotion organisations. This includes making information accessible and widely available, in a format that is appropriate for designers, and in a way that can be easily 'found' by designers. Creative entrepreneurs tend to be non-linear and intuitive in their approach. The workshop/working model format enables the development of personal entry strategies through 'learning by doing', as opposed to through analysing research reports.

4. As well as promoting design ‘stars’, it is also important for trade initiatives to invest in designer-entrepreneurs who can network, communicate and build business relationships outside of national communities of practice. International business is done though international networks, and being comfortable engaging in and exchanging knowledge in multi-disciplinary, multi-cultural contexts is important. To succeed, designers need to be able to better recognise and communicate their image, identity, value and place in the market or industry in which they want to operate.

Implications for Conducting Design Research Internationally

Out of this research process emerged a number of good practice guidelines for academic researchers working internationally across institutions on a research agenda where different cultural approaches and communication styles are at play. These guidelines are intended to increase clarity within the research process, the working relationship, and the final results.

1. Secure stakeholder and management support and ‘buy-in’ for the project at all levels, amongst researchers, commissioners, branch organisations, international research partners, students, translators, interviewees and focus groups.
2. Ensure clear and consistent communication during the start up phase and the research process, to ensure trust and understanding is built (via face-to-face meetings, regular updates and rigorous project monitoring, written guidelines and scripts, outline of working methods). Take into account language differences (levels of formality and informality, the need for bi-lingual speakers and translators, terminology specific to each profession) and cultural differences (communication style and approach, applied research skills and approaches versus academic research skills and approaches).
3. Match the right researchers (staff and students) to the right roles in the research process (from conceptual development to completion of final report). Match the right experts from the right disciplines, and if necessary, take a different approach to the other research partners if the local conditions dictate the need for a different approach. Communicate why these different approaches have been taken so as to manage expectations of the results.
4. When conducting research internationally, Geert Hofstede’s 'culture dimension' data for individual countries is a useful resource (freely available online at www.geert-hofstede.com). The team found, for instance, that Germany is a masculine culture and the Netherlands a feminine culture.

CONCLUSIONS AND FURTHER RESEARCH

In consideration of ways to support the management of design ‘assets’ by design promotion organisations, and of ways to support designers wanting to enter international markets, a number of directions for further research by the design management community stand out.

International Commerce

There is a lack of information about the typology of entrepreneurs in business-to-business (B2B) communication focused around design management. Examples do exist, such as Bruce et al. (2005) on international fashion retail, and Design Management Europe (DME) on the successful application of design management within European countries. However more international research focused on entrepreneurship needs to be conducted, in a way that takes into account the cultural differences between types of entrepreneurs and their international B2B communication. The integration of commercial and cultural aspects is important to better inform communication between the creative industries and foreign commissioners.

Interdisciplinary Collaboration

Applied research processes and methods of inquiry are highly appropriate to the interdisciplinary and collaborative nature of the creative industries. Interaction between disciplines stimulates new ways of thinking about how to enter international markets, as well as how to think about original approaches to conducting research. What future roles might creative disciplines play in interdisciplinary inquiry, whether in academic research or professional practice? The opportunity available is to facilitate different types of stakeholder conversations and cross-disciplinary investigations, using more interdisciplinary forums. The workshop/working model format enables group activity and shared learning, and reveals tacit and experiential knowledge in a way that is more immersive and flexible, and less prescriptive. It also allows for a more iterative, less prescriptive embedding of academic models into design practice. This could help to further facilitate discussion and thinking amongst entrepreneurs in how they approach market opportunities and new business development, and how they go about building their own research processes.

The Nature of Design Entrepreneurs

The academic design management community and the research criteria they use are often more closely linked to design research in academia than design practice in industry. Academic research tends to prefer a scientific and linear approach, whereas the design community in industry operates with a mix of iterative, linear and non-linear approaches. For designers, ‘doing is designing… not systematic hypotheses, or structures of thought or orderly procedures... A designer is not a creator of meaning so much as an intuitive searcher after the latest thing’ (Frayling 1994). For academic researchers to have more effect and influence on this target of design entrepreneurs, methods and models that combine linear, non-linear and intuitive methods could be more suitable. For example, use of intuition and the use of rational analysis being complementary, not mutually exclusive (Anderson et al 2010). This could be a starting point for new, co-created approaches that are of equal importance and relevance to design academics and design professionals.

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From Attitude to Action: The Development of the Cambridge Sustainable Design Tool Kit

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Keywords: Sustainable design, Design tool, Design education, Organisational learning

The concept of sustainable design is widely discussed in design theory. However, there are signs, that this notion has not been utilised to its full potential in design practice. A review of existing tool kits has shown, that there is a need for an early stage development tool, which successfully communicates this concept to design practitioners. This study describes the development of the "Cambridge Sustainable Design Tool Kit" which aims to fill this gap. The tool kit is tested in a series of workshops in design consultancies and industry and iteratively improved through this process. The data collected also contributes to a better understanding of technical requirements and success criteria in tool development for design practitioners.

INTRODUCTION

As one of the key aspects of new product development, design plays a central role in the development of more sustainable products. During the last decade the limitations of the primarily technology-centred and product-oriented eco-design movement have become obvious. As a result, design research started to move towards the idea of sustainable design (Boks and McAloone, 2009). In contrast to eco-design, sustainable design is strongly influenced by the notion of systems theory, and therefore aims to optimise the role of a product within new product service systems and consumption scenarios (Vezzoli and Manzini, 2008). Although the idea of sustainability seems to be widely discussed in design

research, there are signs that the true meaning of this notion has not been fully assimilated in new product development to date. This raises the question of how design research can better support the integration of sustainable design thinking in design practice.

This study develops a sustainable design tool kit, which supports the integration of sustainable thinking in new product development in design consultancies and companies. The tool kit targets the early stage of the product development process. Thereby, it specifically aims to support brainstorm and workshop situations in design teams.

The tool kit is developed on the basis of literature and previous research. The central part of the tool kit is formed by a card set which builds on a comprehensive sustainable design strategy collection. The cards are supported by theoretical frameworks, which allow the tool user to better understand individual strategies in relation to the wider picture of sustainable design and sustainable development. The tool kit is being developed for and tested in workshops which were conducted in academia with design researchers and in the domestic appliances industry (Small and medium companies (SMEs) as well as industrial design consultancies). Data has been collected regarding the usefulness, usability and feasibility of this tool. As a result of user feedback and researcher observations, the tool has been improved iteratively through this process.

The paper starts with providing an overview of the current state in the development of sustainable design tools in literature. This provides evidence that there is a need for a physical sustainable design tool for the early stage in new product development. The paper then introduces the theoretical basis of the new sustainable design tool kit, which is followed by the introduction of the tool kit as well as the workshop process. The paper also discusses the testing and improvement of the tool kit and workshop process, before it concludes with preliminary findings and an outlook on future research.

EXISTING SUSTAINABLE DESIGN TOOLS

In order to illustrate the need for an early stage development tool for sustainable design, relevant literature is briefly introduced.

Eco and sustainable design tools in literature

The importance of tools for the assimilation of theoretical knowledge in industrial practice is widely recognised in literature. During the last 20 years, numerous tools have been developed for the purpose of assimilating and providing guidance on the concept of eco-design. Today, eco-design tools can be found for various aspects of new product development (Gomez-Navarro, 2005). This mainly includes assessment tools and strategic tools, but lately also early stage development tools (Lofthouse, 2006).

A review of literature and relevant online sources reveals that tools have been also developed in the area of sustainable design. However, these tools fail to meet the criteria for early-stage

creativity tools in terms of format and function. There are those that have the correct format for design practice, but do not wholly capture the concept of sustainable design. Examples include the *design with intent* tool (Lockton, 2009), or the *design behaviour* tool (Lilly and Lofthouse, 2009). These tools capture particular aspects of sustainable design but are not intended to communicate the overall concept of sustainability. On the other hand, there are tools which aim to holistically convey the concept of sustainable design, but are not suitable for early stage product development. Some tools communicate sustainable design on a higher strategic level (Bassett and Elvins, 2005), providing knowledge which is too abstract for actual design practice. Toolboxes and guidelines communicate the concept of sustainable design in the format of brochures or posters (Lunar, 2008) with similar negative implications for design practitioners. Finally, there are sustainable design strategy collections that have exceeded their scope beyond eco-design (Fuad Luke, 2009). Although these latter collections are the most promising in their delivery of holistic sustainability concepts, they fail in their overall representation, organisation and usability, as noted in Dusch et al. (2010b). This shows that there is a need for a tool, which directly supports the designer in brainstorm and workshop situations with sustainable design knowledge, beyond a list of sustainable design strategies.

Towards a sustainable design tool kit

In an attempt to build on the available strategies, and to make them more suitable for designers, in a previous study the authors introduced a sustainable design strategy card swatch (Dusch *et al.* 2010b), which aims to provide design practitioners with sustainable design knowledge. Initial tests showed that this tool was not flexible enough for the early design stage. Most designers classified this tool as a reference tool, which they could keep in the drawer. Furthermore, they could not imagine using it during workshop and brainstorm situations. Further testing showed that the level of detail offered in the tool was too high. This is seen as a key barrier for successful integration of knowledge in design practice (Collado-Ruiz, 2010).

Another disadvantage regarding physical tools in general is highlighted by Thackara: in his review of the sustainable design card swatch (Dusch *et al.* 2010b) he underlines the high risk that these tools might go unused even though they are well researched and look good (Thackara, 2011).

Based on the learning from these initial tests, the current study involves the development of a tool kit which is delivered in a workshop format, moderated by the researcher. This not only allows a controlled assimilation of sustainable design knowledge, but also the implementation of a didactic learning concept, according to which this knowledge is delivered. This ensures that workshop participants are provided with a positive learning experience and controlled outcomes, which hopefully will also positively influence their interest in the notion of sustainable design, and finally, their product design.

THEORETICAL FOUNDATION OF TOOL KIT AND WORKSHOP

In this section, the overall aim of the tool kit and workshop process is discussed first. This is followed by a discussion of the conceptual idea of the tool kit and workshop process, which leads to a set of specific objectives that the tool kit and workshop process should be able to fulfil. Finally, requirements for development, testing and optimisation of the tool kit and workshop process are introduced.

Overall aim of the tool kit and workshop

Ultimately, the tool kit and workshop process aim to support designers in product design consultancies and companies to produce more sustainable products. This is achieved by providing design practitioners with sustainable design knowledge. Thereby, central aspects of this concept – such as its systemic nature, or the inclusion of user behaviour – are successfully communicated. Here, the difference to established eco-design tools becomes most obvious, as they primarily focus on the design and production of the product only.

Tool kit and workshop concept

The tool kit is developed and tested in combination with a specific workshop process. Both, the tool kit and the workshop process therefore follow an overarching concept. As this concept is central to the theoretical foundation of the tool kit and workshop process, it is discussed with the necessary attention to detail.

The central idea of the tool kit and workshop concept is based on the assumption, that designers make even simple decisions on the basis of a highly complex personal mind-set. Lawson (2006:159) highlights, that “designers have their own motivations, reasons for wanting to design, sets of beliefs, values and attitudes” and concludes that “this intellectual baggage is then brought […] into each project”. This model is also broadly accepted in learning theory. In the context of transformative learning, Sterling (2011) points out, that “there are different levels of knowing and meaning” and introduces a concept of six “levels of knowing” (Sterling, 2003:139) which reach from metaphysics to action. He describes his concept as an “interrelated hierarchy” (p.139), which means that the different levels inform each other not only linear hierarchically, but mutually: bottom up as well as top town. In the context of organisational learning, Argyris (1992) takes a similar approach. He highlights the importance of the reasoning process “from which we draw conclusions of how to act” (Argyris, 1992:7). This leads to his model of single- and double-loop learning which contrasts a simple change of action in the single-loop mode against an “examining and altering [of] the governing variables” (Argyris, 1992:9) in the double-loop mode. In contrast to Sterling, Argyris makes clear, that by ‘govering variables’, he doesn’t mean “the underlying beliefs or values [individual] people espouse” (Argyris, 1992:9), but much more a ‘corporate mind-set’, people adopt when acting as agents for organisations. However, all concepts have in common, that they underline the importance of high level learning beside the acquisition of applied knowledge.

Based on the above, this study introduces the ‘attitude to action’ concept as a theoretical foundation for the tool kit. As the literature makes clear, this approach is appropriate for both individual designers, but also companies, which want to establish a corporate view on sustainable design. Figure 1 illustrates the ‘attitude to action’ concept and highlights the meaning of each individual step.

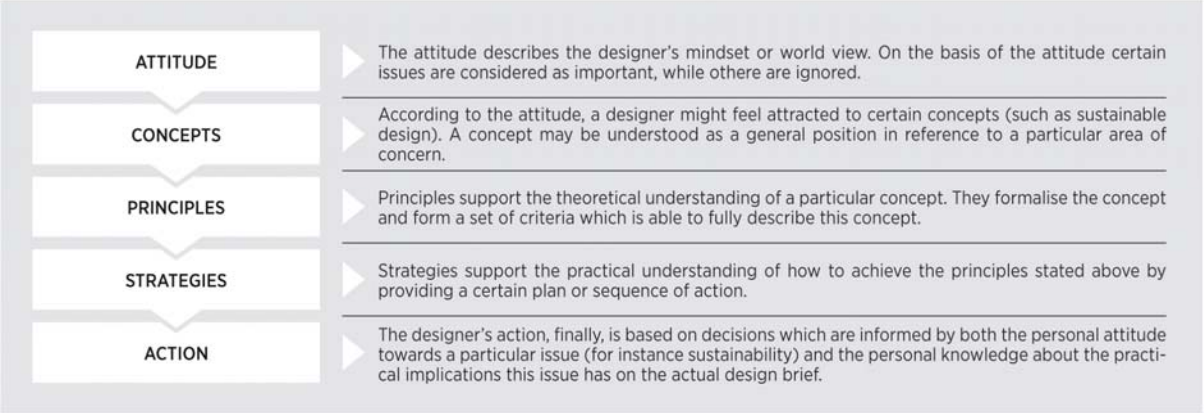

Figure 1: The ‘attitude to action’ concept

Detailed objectives of the tool kit and workshop

Following the ‘attitude to action’ concept outlined above, the tool kit and workshop process aim to:

1. Raise the participants’ awareness of the basis from which they make their design decisions.
2. Challenge the participants’ preconceived ideas of good and responsible design.
3. Communicate fundamental principles of sustainability in order to provide an appropriate reference point for sustainable action.
4. Facilitate the design process by providing an extensive set of strategies and examples.
5. Ensure a better understanding of the short- and long-term implications that sustainable design thinking has on the development process of new products, services and product-service systems.
6. Deliver a clear line of action for the participants to implement after the workshop.

Tool kit and workshop requirements

The requirements outlined blow are chosen to develop, test and optimise the tool kit and workshop process. As a global guideline, the study uses the following criteria introduced by Platts (1993):

- **Feasibility** – does the tool kit and workshop process make sense to the participants?
- **Usability** – how easy are the tool kit and workshop process to follow?

- **Utility** – does the tool kit and workshop process lead to any results, can the defined aims be achieved?

It is recognised, that these high level criteria mean different things to different parts of the tool kit and workshop process. Therefore, this study translates the criteria listed above into more technical requirements, which are based on existing literature, expert interviews with designers, participant feedback and researcher observation.

For the development of the tool kit, the criteria of feasibility and usability are most central, as the aspect of utility can only be tested in combination with the workshop process. Literature provides a number of models, which are concerned with requirements for early stage design tools. Collado-Ruiz (2011) emphasises that avoiding information overload and discouraging fixation are key requirements for successful environmental design tools. Otherwise "sustainability concerns will hardly be considered systematically at [the early] stage". In the same study, a call is made for "soft information" in order to not limit the designers' creativity with too many details. Lofthouse (2006) introduces 'a holistic framework for industrial design focused eco-design tools' and highlights similar requirements. Amongst others, 'non scientific language', *dynamic access,* and a high degree of *visual* information are listed. Thereby, the importance of the right balance between *information* and *inspiratio*n is specifically underlined, in order to provide *education* and *guidance* to the designers. In addition to the requirements provided in literature, an interview study conducted by the authors shows, that such aspects as *quick to learn*, *intuitive*, *playful* and *fun* are of high importance to designers in design practice.

For the development of the workshop process, all criteria are of high importance. To optimise feasibility and usability, the workshop process is designed in alignment with existing theory for business games and workshop situations. According to Gray *et al.* (2010:10) a basic workshop consists of three phases: a divergent opening phase, an emergent exploring phase, and a convergent closing phase. However, it is also possibly to integrate a series of such modules in one workshop, depending on the workshop content, time or participants available (see figure 2).

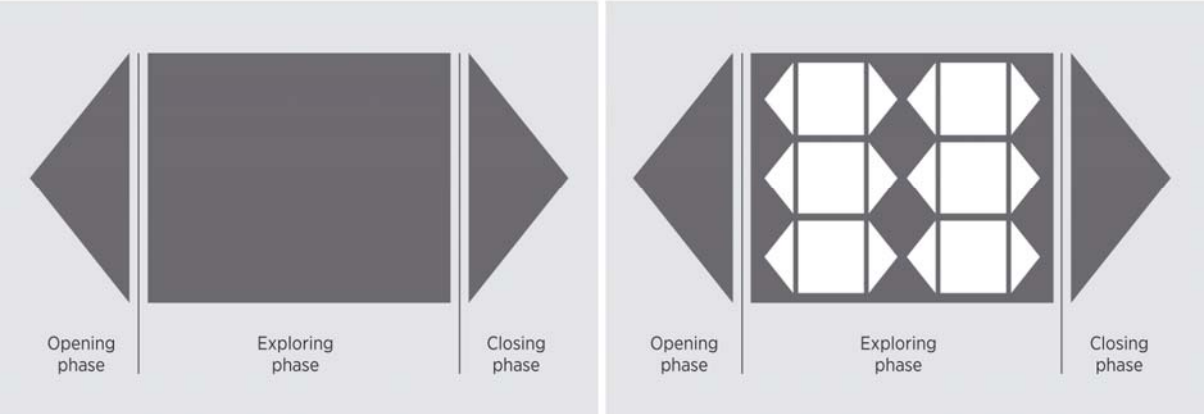

Figure 2: Different workshop phases (Gray et al., 2010 – redrafted)

The aspect of utility is tested in the workshops itself. Thereby the performance and interplay of tool kit and workshop process should be able to fulfil the objectives outlined above.

DEVELOPING THE TOOL KIT AND WORKSHOP

This section is concerned with the tool kit and how it is delivered in a workshop process. The section starts with an introduction of the individual parts of the tool kit. Subsequently, it is highlighted, how each part of the tool kit corresponds with a specific level of the 'attitude to action' concept. The section ends with an introduction of the workshop process.

The Sustainable Design Matrix

The sustainable design matrix builds the philosophical and conceptual foundation of the tool kit. It is based on previous research by the authors (Dusch *et al.* 2010a) and captures the area of sustainable design within the wider context of sustainable development (figure 3). The matrix makes clear, that each design decision is made on the basis of a particular world view of the deciding designer. Thereby, a distinction is made between a behaviour-focused approach, which is based on the belief that behavioural changes are necessary for a more sustainable future; and technology-focused approach, which is based on the belief that new technology is more important than behavioural changes. Further, the matrix makes evident, that the two world views can be linked to four broad categories of design approaches, each with an individual sustainability potential. These categories not only capture the concept of sustainable design but also allow the evaluation of a particular design decision or concept according to their sustainability potential. Therefore, the matrix is utilised for two different purposes: first, to establish a common understanding of the concept of sustainable design between the workshop participants; and second, as a reference point for the assessment of the ideas generated in the workshop.

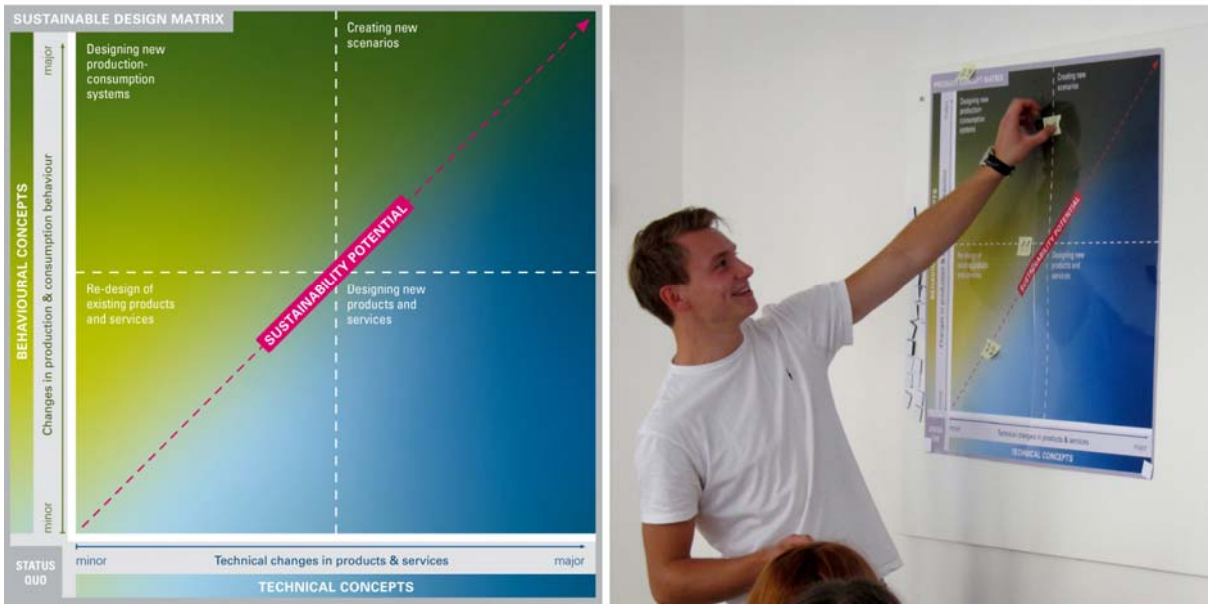

Figure 3: Sustainable design matrix (concept and in use)

Sustainable Design Principle Cards

The sustainable design principle cards describe the concept of sustainable design in a more tangible manner. The principles are the result of previous research (Dusch *et al.* 2010b). By prompting instantly comprehendible aspects – such as 'clean', 'less', 'effective', or 'social' – the cards help the workshop participants to get an initial understanding of how to put sustainable design into practice. Figure 4 displays the full collection of 10 sustainable design principles. The principles are divided into three constitutive levels: The basic level comprises the classic eco-design principles, which predominantly correspond with the technology-centred part of the sustainable design matrix. The middle level is reserved for more conceptual principles, which are normally the result of a number of basic principles. However, here also the social aspect comes into play, which is already linked to the concept of sustainable design. The top level, finally, is reserved for the principle of sustainability, which can be either a principle in itself, or a result of a number of subordinate principles. The hierarchic structure of the principles helps the participants to better understand the concept of sustainable design, and where it exceeds the concept of eco-design.

Figure 4: Sustainable design principles (concept and actual cards)

Sustainable Design Strategy Cards

The sustainable design strategy cards build the central part of the tool kit. The design strategies offer an extensive selection of potential sustainable design actions on an applied level. This enables the workshop participants to better understand how the sustainable design principles (discussed above) can be translated into actual to-dos and finally integrated in design concepts. The cards are based on an extensive sustainable design strategy collection generated in previous research (Dusch *et al.* 2010b). The strategy cards organise the sustainable design strategies according to the following criteria:

1. A **product life cycle** features individual stages of a product's life with 3 different levels of granularity: broad *life cycle phases* (e.g. distribution); medium *life cycle steps* (e.g. transport and storage); and detailed *life cycle topics* (e.g. product

packaging). This ensures that the workshop participants learn to think in ‘product life stories’ and have easy access to the relevant strategies.

2. Two different **product life spheres** supplement the product life cycle. The *industrial sphere* is concerned with the design, manufacture, and retirement of a product, while the *domestic sphere* is concerned with the usage of the product. This helps the participants to better understand that the concept of sustainable design embraces very different stakeholders and needs. It also highlights the potential of behavioural and user-oriented design strategies, which are normally underrepresented in classic eco-design approaches.
3. The **sustainable design principles**, already introduced above. This makes sure, that the design strategies can be linked back to a more abstract level if needed. It also makes clear, that all strategies available can be summarised with these ten principles.

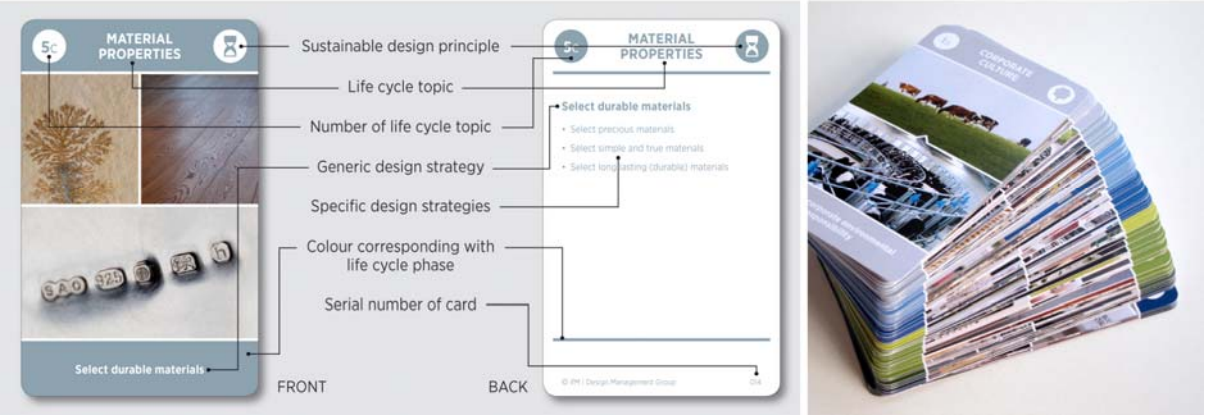

Figure 5: Sustainable design strategy cards (layout and card deck)

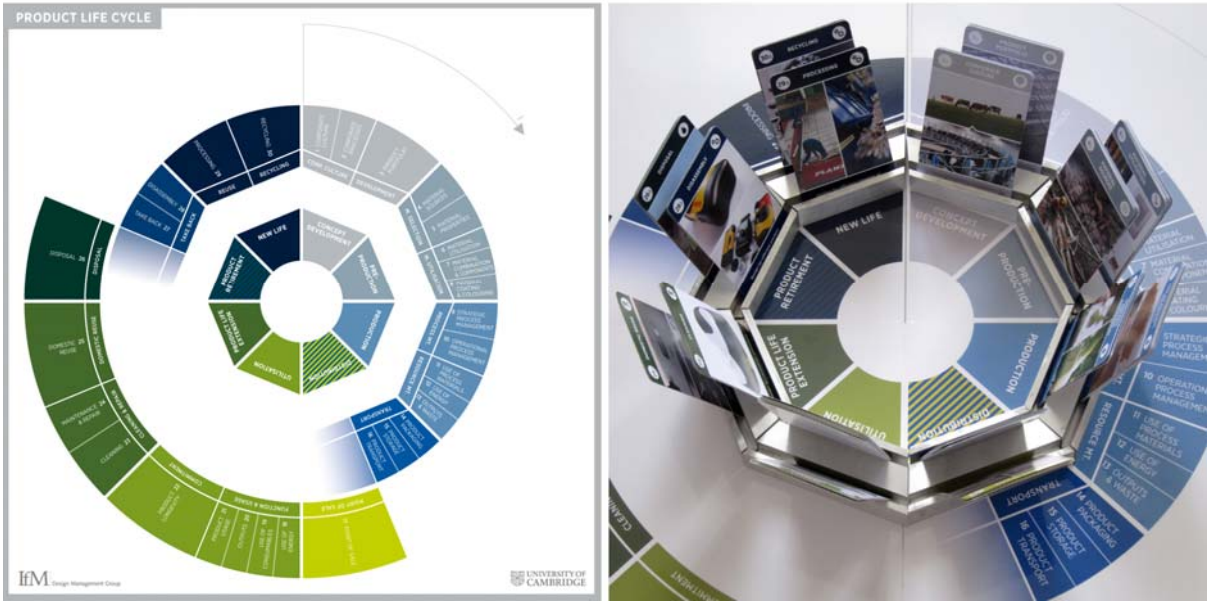

Figure 6: Life cycle with integrated product spheres (concept and actual display)

Altogether, the presented criteria enable the workshop participant to efficiently navigate through the offered information without losing the sense for the bigger picture. Figure 5 shows a detailed representation of the cards.

In terms of their overall design, the cards follow other established card systems such as the IDEO or the Arup cards (IDEO, 2002; Luebkeman, 2009). They all favour a design approach which aims to balance visual and written elements, and which is described by Lofthouse (2006) as the 'information – inspiration' concept. Figure 6 shows a representation of the product life cycle with integrated product life spheres, and how the cards work together with the life cycle model.

Figure 7 shows how the individual parts of the tool kit correspond with the 'attitude to action' concept introduced above. Their sequenced arrangement along the vertical axis already suggests the time-based order in the utilisation of the tool kit. This leads over to the workshop process, which is discussed in more detail in the following section.

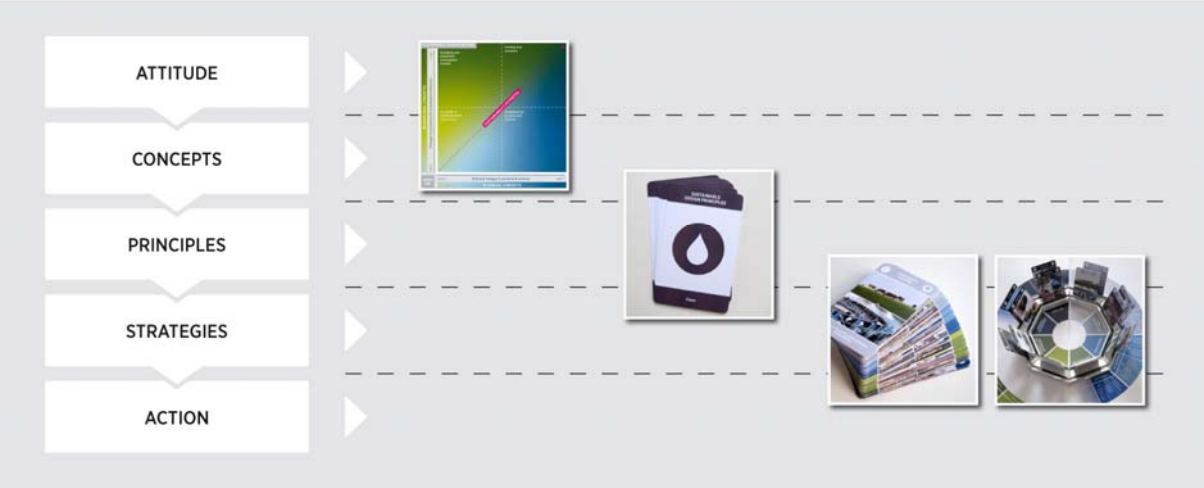

Figure 7: The 'attitude to action' concept with corresponding tool kit elements

Developing the workshop process

Following the 'attitude to action' concept, the participants are guided through a step-by-step process, which initially challenges their perception of sustainable design, and finally provides them with detailed knowledge of how to apply sustainable design thinking on a daily basis. In the centre of each particular step is a brainstorm session in which the participants can explore their knowledge on the basis of a hypothetical design project. Each brainstorm session is opened with a presentation of new sustainable design aspects, and closed with a group discussion about the brainstorm outcomes. Figure 8 shows an exemplary workshop process and illustrates how the individual parts of the tool kit are thereby used. It also illustrates, how the workshop concept is aligned with the 'attitude to action' concept. The authors recognise, that the tool kit introduced in this study may well be utilised in other ways. The process outlined below is optimised for workshop participants, who don't have previous knowledge about sustainable design.

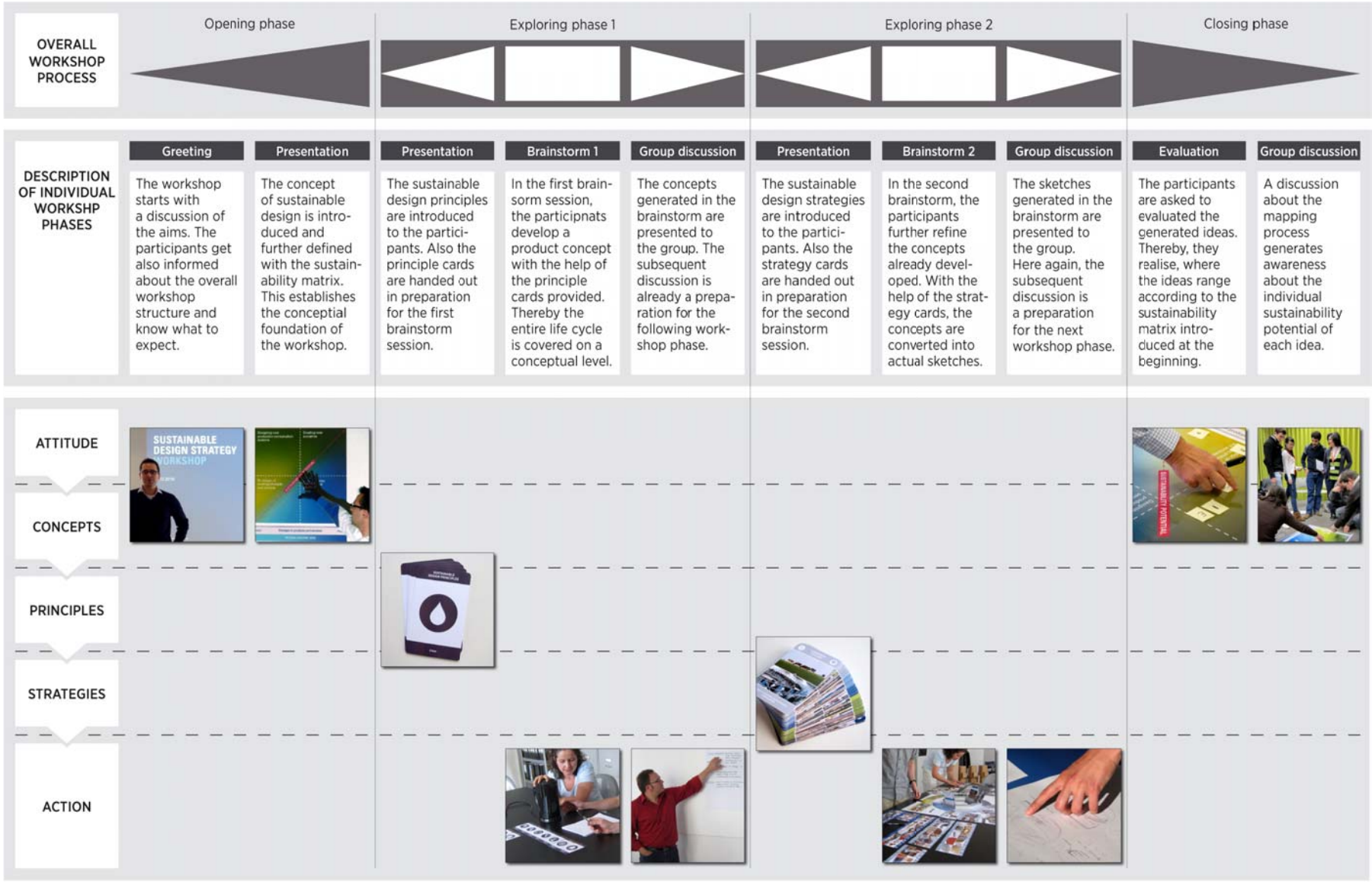

Figure 8: Exemplary workshop process

TESTING AND IMPROVING THE TOOL KIT AND WORKSHOP

The tool kit and the workshop process are currently being tested and iteratively optimised in a series of workshops with designers in academia, design consultancies and the domestic appliance industry (SMEs). The current state of the tool kit and workshop process as outlined above is based on the five workshop sessions that have been conducted to date. Further workshops in academia and industry are planned. The modifications are based on researcher observations as well as participant feedback. Feedback is collected and recorded to every relevant element of the tool kit and the workshop process. The feedback is analysed according to the overall criteria of *feasibility*, *usability* and *utility*. In general, it can be observed, that the most extensive modifications were made between the first three workshops with only minor changes being made after that. However, this observation is only preliminary as the development phase is still under way. The following paragraphs provide an overview over the most important improvements and findings.

To improve the *feasibility* of the tool kit and workshop, the entire process has been iteratively simplified. This is based on the observation, that participants get overwhelmed rather quickly when confronted with too many variables. This development is supported by an increasingly prescriptive workshop concept, which provides the participants with detailed step-by-step guidance throughout the entire workshop process.

Regarding the *usability*, especially the individual parts of the tool kit have been iteratively modified. Here, again, the trend goes clearly towards a simplification of the information provided. However, also the representation of the information provided has been significantly changed over time. Clear icons, colours and type fonts provide consistency across the individual tool kit elements which enables a much more intuitive work flow during the brainstorm sessions.

The modifications made in terms of feasibility and usability resulted in a clear increase of the overall *utility* of the workshop process. The generated results provide evidence that participants in the later workshops developed a much better understanding of the central aspects of sustainable design. While in early workshop settings, participants spent much of their time trying to understand the mechanisms of the tool kit itself, in later workshops, participants could much more easily concentrate on the actual brainstorm and idea generation activities.

The data collected in the workshops, however, are not only prescriptive in terms of further tool kit development, but also have a descriptive function. Workshop results, researcher observation and participant feedback contribute to the field of design research by providing a better understanding of the barriers and drivers for the integration of sustainable design in new product development. Furthermore, the data contributes to a better understanding of requirements and success criteria in tool development for design practitioners in industry. An analysis of the elicited data in this regard will be part of future research activities, on the completion of all planned workshop sessions.

CONCLUSION

Existing early stage development tools used in the design industry have failed to successfully communicate the concept of sustainable design to design practitioners. This study has introduced the development of the Cambridge sustainable design tool kit. The developed tool kit and workshop process aim to contribute to a better integration of sustainable design knowledge in design practice. Initial tests with designers in design consultancies and SMEs show promising results, which justifies further improvement and testing of the tool kit and workshop process. Future work includes not only the testing of the tool kit and workshop process but also the analysis of the descriptive data elicited during the workshop sessions.

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Managing for Multidimensional Design Innovation: What are the Enablers and Restraints?

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The question of how to enable creation capabilities with enterprises in an internationalized, complex world is paramount to design management scholars. This paper derives conclusions and questions from theoretical and empirical work on both product and service design. Based on a seven generations framework for innovation approaches, we can delineate potentials and restraints of exemplary approaches. AT-ONE is a collaborative design-assisted service innovation method developed in enterprise and educational settings. AT-ONE systematically explores Actors, Touchpoints, Offerings, Needs and Experiences elements for creating early stage service innovations. Similarly, design-based "deep dive" workshops have assisted early stage innovation development. We explore these service and industrial design methods grounded in literature and field experiments in three service organizations and one product-based firm, as well as drawing on interviews with involved designers and managers. Our findings show that ideation workshop tools are appreciated and designing offers new terms for the actors. We also identified weaknesses in how the methods were applied. Contrasting the findings with experiences from the actors' other product or service innovation efforts, a set of sensibilities for managing design is offered as heuristics for further work.

1. AIMS

The purpose of this paper is to identify and discuss what can enable or restrain multidimensional design innovation capabilities in an enhanced design and enterprise setting. We focus on settings where designers and other specialists collaborate in and beyond company and disciplinary borders. However, the many divisions in and between

organizations make design work and its managing challenging. As reflected by cognitive engineer and professor Donald Norman (in Mitchell, 1996: 89):

> One thing I soon discovered at Apple is that although I had spent my life developing the science and technology of good design, that seems to be of secondary importance in actual life. (…) It doesn't do any good to have the world's best designers if they are in different parts of the company, or if they're called into the process too late to make a change, or if the components required to make a product come from several different parts of the company that report to different executive officers. I discovered this is true not only of Apple but of companies across the world.

Grounded in previous innovation studies, we identify the focus and restraints of seven generations of innovation approaches. With this extended framework, we explore and compare some current, exemplary ways of fostering multidimensional and design-assisted innovation.

2. THEORETICAL PERSPECTIVES

Designing is one of the fundamental and oldest human activities (Heskett, 1980, 2002). Yet, it seems only partly understood in business thinking and management practices (also Svengren, 1998). Design is not merely an apriori plan or shape of more or less given problems, means, and ends. Design is both input and outcome-oriented *and* also processual – about, with, and for creation of something not yet existing, or existing in some mode and matter elsewhere, maybe subtly, or even in the past. What "is" or "was" are seldom self-evident, and "what might be", as Nobel laureate Herbert Simon (1969/1996) suggested, tend to evolve and shift over time, matter, and place. For example, a number of new tools, media or materials, terms and practices have been developed for the twentyfirst century of importance for designing (Antonelli, 1995; Moggridge, 2007).

Not surprisingly, few organizations seem to master the vast creative potential of designing original, sustainable, or otherwise value innovations. In fact, design in relation to innovation may still be ill-conceived or misunderstood, according to experienced design/innovation researchers Vivian Walsh (2000) and Roberto Verganti (2009). Taking into accout both complex and creative design and innovation, what, then, are actually capabilities for the intersection of design and innovation and their management? Before getting to that question it seems rewarding to reconsider capabilities more generally.

Attention towards can-do's or capabilities

According to philosopher Martha Nussbaum (2011), capabilities are fundamental for all human existence. They are the answer to what a person can do or be. For design/innovation and managing, both "can-do" expertise and its actual unfolding in the tensions of freedom and control are of interest. As we shall see in the enterprise settings explored, the capabilities in action and their orientations and ethical underpinnings are of interest when exploring both design and its management. Furthermore, Nussbaum (2011) stresses that complex action often unfolds in association with others – enabled by what she calls "combinative capabilities". This seems fundamental because actions may need combinations of can-do's,

and I suggest, can-doers' creating efforts with diverse others, including engagements with emergent opportunities and what is not-yet-known. This resonates with entrepreneurial thinking about making "new combinations", which covers a broad scope for innovation including new technology, product, service or system as well as new organizing and marketing, as originally elaborated by Schumpeter (1942/1976).

Connecting "dynamic capabilities" of sensing and seizing opportunities, and reconfiguring something new, to enterprise and innovation is not entirely new (e.g., Teece, 2003), but it can be a sensitizing conception. It may help bridge what designing can do among both people and enterprise action levels. As process innovation researchers often stress, we need to understand innovation not only in the abstract, or as a separate "variable", but explore the actual, often messy ways of innovating in realworld enterprises and environments (Van de Ven et al., 1999).

Previous research has outlined and critically discussed at least five generations of innovation approaches – from technology push or market pull models to system integration and networking models (Rothwell, 1994/2002). This shifting innovation framing grounded in broad patterns or "generations" of industry development activities, as identified by innovation researcher Roy Rothwell and others, still informs innovation management (e.g., Tidd and Bessant, 2009). Instead of merely being regarded as past or dominant approaches, these innovation perspectives apparently are in use *together with* new lingua, both in business schools and in some design/business milieus, as we have experienced and shall see later in the paper. On this background, we suggest variants of development approaches may actually coexist or emerge and become layered in entangled ways, which can be of interest for enabling or constraining both design and innovation.

This may seem puzzling for those who prefer a dominant logic or (one) preferred structure. According to Engwall (2003), many developmental models coexist and evolve in the tensions between knowledge and control. They can be useful for the actors involved even though the models may not support the formation of knowing, he suggests. Past research and experiential accounts have found that established and new design/innovation approaches do interact and even compete in and between enterprise settings (see, e.g., Blaich and Blaich, 1993; Svengren, 1998). How then do actors manage for new approaches in the midst of perhaps many paralell innovation processes?

Based on the previous literature and research on managing innovation, design and creativity, we offer a seven generation framework for innovation approaches and see them as potentially layered orientations or practice patterns, which seems in accordance with some evolutionary design understanding (e.g., Heskett, 2002). This offers a starting point for further exploration and theorizing, as well as critical debating.

Seven Generations (at least) for Understanding Innovation

The British sociologist, Roy Rothwell, primarily working at the University of Sussex's SPRU (Science Policy Unit) where I visited him, was widely regarded as one of the pioneers in

Industrial innovation studies. Rothwell identified five generations of innovation management over a period of forty years that begins in the 1950s. In that way, Rothwell's five generations (5G) of innovation provides an historic overview of industrial innovation management in UK and the Western world after the Second World War. One of the core arguments was that it is rewarding to move from a linear innovation approach to more interactive, systematic, and flexible approaches.

According to ProvenModels, Rothwell created his 5G framework by combining Jorge Niosi's 4G innovation model with his own analyses of innovation management practices. The fourth generation (4G) model of R&D and innovation is however claimed to have been first presented by William Miller in 1990 at the Industrial Research Institute , wrote Miller himself in a note January 10, 2011. The theoretical background of the 5G model is also said to be the extension of a three generation model developed in 1991 by three consultants at Arthur D. Little. This 3G model was used to categorize a series of organizational interventions by which R&D could be used as a strategic, competitive weapon. At 4G, this is presumely optimized "deeper"; business processes are managed in parallel and integrated. The 5G model developed from the 4G process added a stronger focus on technologies and systems that enable innovation.

The five generations framework of innovation management is a descriptive or perhaps normative model of how (manufacturing) companies structure their innovation processes. Grounded in case research and recent literature from real-world designing, Jevnaker (2003) suggested two additional models to expand the places and modes for attending to also emotional design and multi-interactive innovating. The framing is only meant as sensitizing for a further debating on organizations and innovation. The seven generations (at least) are:

Table 1: Seven Generations of Innovation Approaches

GENERATIONS OF INNOVATION PERSPECTIVES *(Label that suggest possible dominant logic).*	KEY ATTENTIONS	SOME CRITICAL CONCERNS
1 G. TECHNOLOGY PUSH	The 'strategy of hope': "Hire good people, give them the best affordable facilities, then leave them alone."	Technology-based struggle. Research & Development in charge and relegated to an 'ivory tower' position.
2 G. MARKET PULL	Need focus: responding to the market's needs. Stronger connections initiated between R&D and operating units.	Market-orientation and connections-based struggles. Recurrent difficulties to explore actual customer preferences.
3 G. COUPLING OF R&D AND MARKETING	Strategic focus on corporate consolidation and 'product portfolios'.	Remains difficult to explore and express varieties of user needs across corporate 'silos'.

4 G. INTEGRATED & PARALLEL INNOVATION PROCESSES (CONCURRENT ENGINEERING/ CONCURRENT DESIGN)	Focus on integrated processes and products, such as the 'parallel and integrated nature' of development processes.	Time and multiple issue-based struggle to develop 'total concepts' fostered by supplier linkages as well as close coupling with leading customers.
5 G. SYSTEM INTEGRATION & NETWORKING (COMPREHENSIVE ELECTRONIFIED)	Focus on 'systems integration and networking' to ensure 'flexibility' and 'speed of development'.	Struggle to adapt or redesign business processes through enterprise resource planning and information systems.
6 G. EMOTIONAL-IMAGINARY	Focus on 'experience economies', identity-building, and branding.	Struggle to reframe enterprises towards expressive identities and creativity-based emotional design.
7 G. MULTI INTERACTIVE (INNOVATING INTERACTIVELY, MULTIPLE MODES AND MATTERS)	Focus on interactive, multifaceted value innovations and 'cocreation' with and for many kinds of users. Potentials for transformative innovation.	Struggle to innovate business models with multiple others and sustain 'business ecosystems' in shifting internationalized and digitized environments.

Several pros and cons of the original five-generation framing have been listed. The framework may be regarded as a too simple representation of highly complex organization and innovation realities. As introduced, processes belonging to distinct generations can occur concurrently (see examples in e.g., Blaich and Blaich, 1993; Svengren, 1998) and generations are therefore not necessarily mutually exclusive. In discussions by socalled ProvenModels in management, causality between the technology and market trends and the innovation process is also said to be ambiguous and create the perception that the last generations are "hot" and other generations are "passé". Nevertheless, the various approaches seem to live on, at least in part, in both product and service innovation settings, which is puzzling and call for a further exploration and debating.

3. APPROACH

I use a strategic sample of exploratory cases to identify what may enable or restrain design innovation approaches in practice. By studying rich exemplary cases ("exemplary" for our discussion and for some current practices), we may identify something of general interest for design innovation efforts that may unfold in other settings as well.

The paper draws on long, semistructured and fully recorded interviews, as well as field observations and numerous conversations in relation to the design and enterprise settings studied. Rather than merely zooming in on new media firms, we explore particular design-assisted innovation approaches in-between established businesses and some new and "old" design groups to uncover how they work with new design/innovation approaches. The material includes data from design-assisted innovation work in three Scandinavian service

companies and one product based company, as well as some of their key allied design agencies. Cases are thus selected from realworld ongoing and recent design innovation efforts in and between the respective companies and collaborating groups, but the approaches and insights do seem to contribute beyond traditional product or service design development.

For example, we here focus on the *HÅG* branded products of *Scandinavian Business Seating* as an exemplary case of expanding product design innovation, a development which the author has followed since the mid 1990s (Jevnaker, 1995), with new rounds of interviewing (12 at least, with company managers and specialists), plus related designer interviews and company presentations, visits, and conversations in 2008-2011. As cases of recent service design approaches, we study the AT-ONE design assisted innovation project (Clatworthy, 2010), as applied mainly in two Norwegian service companies (the third company soon exitted the project). Before individual interviews (15 in total, 11 participants and 4 non-participants) and group interviews (3, thereoff 1 with all companies present), the author also participated in several rounds of workshops, including company and research participants, student designers, and sometimes also business innovation students. The individual interviews were often conducted with a research assistant, and the AT-ONE method was explored with other researchers and in collaboration with the project organizers. In addition, the author benefitted from meeting a number of experienced expert designers and design managers (working in Scandinavia, Europe and UK, the USA and Japan), some of whom have been interviewed in long interviews or focus groups. The method and material are elaborated more fully elsewhere (see e.g., Jevnaker, 1995, 2000; Jevnaker, Lüders and Tellefsen, 2011).

When participating in the service design-assisted workshops, company managers and inhouse specialists in dialogues with external designers and some researchers were eliciting and often "thinking aloud" on varities of problems and opportunities while generating or reflecting on new ideas. In preorganized parts of the workshops, the participants were divided into smaller work groups, and in other parts we were together in plenary work sessions. The total number were limited so that we could always sit around one big table (with good eye-contact etc.). Pauses and social mingling were also organized, which helped foster openness, mutual exploration, and reflection.The small-group arrangements allowed the corporate managers and specialists to enact, voice, and share parts of their rich experiences about specific problems, solutions, situations and opportunities. The exemplary cases and interview material are coded and contrasted in order to identify interesting practices.

4. KEY FINDINGS

Design-assisted renewal and innovation work unfolded in different ways in the companies explored. Yet some recurrent patterns in approaches and design/innovation ingredients could be identified. In the product-based enterprise, company management and inhouse specialists were working with expert designers in all product innovation projects whereas this was not yet common in "product development" in the service companies.

For example, one key allied designer firm, *Peter Opsvik AS*, worked both collaboratively and separatedly with design/innovation over several design and development projects for and with *HÅG*, in fact, over decades (since 1974), innovating both new and existing sitting products, and their meanings. It is worth noticing how this experienced designer and his small studio team worked recurrently with their clients at several client sites and also in many modes. This encompassed cocreation with other designers and specialists in ideation workshops, or in more informal workings or creative partnerships, including exploring problems and solutions in real use situations or in the client's development department, as well as in own studio. The multifaceted efforts left behind trails for continuing design innovation (see Jevnaker, 1995, 2000).

Furthermore, the HÅG brand and its new company, the *Scandinavian Business Seating (SBS),* worked with several other design studios that were bringing in new ideas and ways of working. This happened when working with the human-centred and research-informed *KODE* designers, for example in early ideation and concept-generating workshops, where other specialists from different designing firms in Oslo were also invited in. The product development managers of this product-based company were also recurrently working more collectively and structered with both inside staff and selective external specialists, in a series of project-oriented and highly focused action meetings and creative workshops, from early discovery work to realization, as well as creative and productive *reuse* – of relationships, knowing and questioning, models and components, platforms, patents, practices, and last but not least, a rich design/use philosophizing that moved beyond merely product creation, into the social and cultural realms (see Opsvik, 2008).

Whereas in the service design-assisted company cases as relates to the AT-ONE method, collective creation efforts mainly in early ideation and concept-oriented workshops were the dominant mode of working within this particular research project, which run from 2007–2010. The service innovation work was however comprehensively arranged in several rounds of generating workshops, combined with some preparation, briefings, and follow-up work. Collaborating in such collective, interactive, and design-assisted creation efforts in crossover and structured ideation processes over a fully dedicated time, a day or two each time at least, was experienced as something "new" and rewarding in all the settings explored, whether product or service business firms. The aims were often ambitious in reframing innovation towards active use orientations. As reflected by one company participant:

I do not know fully how it started. What I know, is that it was to be a collaboration in relation to service design and using a methodology as our point of departure for the work. AT-ONE is actually a method which is structured and where the letters point to the various phases we are to go through. We work from the workshop-based method where designers are always involved and taking the end-user perspective all the time. Accordingly, starting from the experience, one does not begin with technical development.We start in the other end finding out how user will finally experience this. Trying to find the best concepts based on impact and meanings for the users or the target groups.

Our findings show that the innovation workshop tools and approaches are appreciated by the corporate participants. According to a middle manager in one of the service companies:

I think it was very exciting, really good. It is entirely, it is another approach to problems than the ones we are used to here, by us, which has given much new insight and understanding, at least for me. And then, I believe all that… about working crossover, with special units, which we are not so accustomed to work with [and] which "think" in somewhat different ways, [that] has been very good, indeed.

These service design-assisted concept-development processes were deliberately oriented towards the often fuzzy early phase of innovation, according to the project leader. As participant observers in most workshops, we noticed that the design-enhanced approaches and designerly tools adopted seemed to expand both problem exploration and solution conjectures, as also suggested by some previous research (see Cross, 2011).

In the AT-ONE service innovation project, existing templates such as service journeys or user experience maps (see e.g. Saffer, 2010) were adapted and used extensively to foster both problem finding and idea-generation of attractive solutions. The project leader together with *live|work* designers (a design agency based in UK and Oslo) and some student designers and maybe their service design teachers also helped create new templates such as idea and insight cards and selective personas as visual profiles or standing paper-figures. With these and other supplemental process tools, workshop groups explored even small irritating events or more latent user needs by working with specific user interviews, personas, and service journey mappings, which broke down the emergent complexities and uncertainties. The experienced and deeply knowledgable company specialists interacting with external and internal "explorers", helped pointing to actual problem areas and possible opportunities, as we could recurrently observe.

In spite of some mixed feelings in the beginning, company participants did find the service innovation work to be useful for their own work as well as for the company: "*I experienced it as very relevant for my job, because I thought it was very exciting to see how, actually the work with the responsibility platform, that is something that is truely fundamental for our company. So it has in a way been implemented in my department for a long time then, you may say. Elsewhere in the house I do not know."*

The service design-assisted work seemed somewhat loosely connected to other innovation and visual design/communication processes, though hinted to and emerging in workshop conversations. Several interview statements pointed to an *overlaying* corporate-oriented stage-gate innovation process model, and others referred to workings within the corporate strategy or product development processes. As reflected by one company participant: "*We have our, we have such [stage-]gate... [model], when it comes to processes, it goes through such gates in the developmental funnel. We have a strategy department that is very good, which NN [a key project gatekeeper] is a part of. Much knowledge and competent personnel."*

In line with research by Engwall (2003), this suggests that more than one innovation approach were unfolding concurrently in these companies. How, then, were the new service design-assisted approaches explored in relation to existing ones? In the follow-up interviews, we asked if anything had been done to *anchor* the AT-ONE method in this company or in the respective department, and got for example this response from a company participant:

No, it is not. We have not approached it in that way and – surely, there are probably processes where it can be used by us as well, but maybe it is more relevant for strategy and those that work with service development. For example, we now work with mobile and web. We have well-developed mobile and web [based offerings], but it can probably become better, so there it could be a method to use. But that I don't know, whether they…, I do not think they know about this actually.

The other interviews with company informants including some non-participants in the workshops, suggested a relatively limited spread or outreach of the AT-ONE method in the respective companies at the time of investigation, although participants were finding the orientation and tools useful (Jevnaker, Lüders, and Tellefsen, 2011). In addition to what we may interpret as somewhat loose connections to actual concept realization, as well as other employees' work processes, some mixed feelings were expressed in interviews. As reflected by one company participant: "*I think my first reaction was that it was maybe somewhat fluid, and also because I was new [in the company] then. It was a bit difficult to capture what the project actually was about. And the same, I think, also the students thought."*

By contrast, in the product-based company, recurrent collaborative workings among allied designers, corporate developers, factory specialist workers, design manager and project managers, development engineers, marketing and brand managers, distributors, and inhouse designers as well as some coworking external suppliers apparently helped foster crossover and transformative design contributions, although initially met with some skepticism there too, but that was years ago (Jevnaker, 1995, 2000). Nevertheless, allied expert designers and collaborating, daring managers remained significant for sustaining design experiments, philosophizing, new conceptions and realizations, and last, but not least, continued engagements.

Finally, it is also worth noting that this product design-based enterprise has expanded its early eco-environmental workings as one of the "cornerstones" of this newly merged Scandinavian Business Seating company. If today's designing requires more green and sustainable, transdisciplinary skilled and transformative approaches than ever before, it may be fruitful to learn from these varities of design/innovation practices and their underpinnings, rather than regarding product (or service) design as merely "old practice".

5. IMPLICATIONS FOR THEORY AND PRACTICE

The evolutionary economist David Teece (2003) has delineated some of the dynamic aspects of enterprise capabilities, such as entrepreneurial sensing, seizing and configuring new

opportunities, which seem to resonate with some current design thinking and its constraints. Design thinking and doing are multidimensional and not any quick fix to learn to master, although everyone may in principle design or become more creative by learning new skills, tools, and approaches, as proposed by e.g., Cross (2011) and Liedtka and Ogilvie (2011).

This study suggests that both expert designers *and* motivated company managers and associated specialists (with other backgrounds than creative design) can engage in and "do" potentially valuable "offering" cocreation when they combine their own and coworkers' capabilities, drives, and engagements with and for others. And yet, many managerial and organizing potentialities and challenges in the intersection of design and innovation work remained unexplored or they reemerged in the companies studied (see examples in Jevnaker, 1995; Svengren, 1998; Jevnaker, Lüders and Tellefsen, 2011, forthcoming). To improve the managing for enhancing design and innovation in enterprises, we offer a set of sensibilities for managing the workings, grounded in the experienced endeavours. The space here allows for summarizing only five:

1. Embedding the new in and with persons' practices in real enterprises

Each and all company manager or staff we interviewed who had participated in the collaborative design/innovation work we explored, said they had learned new (or improved) perspectives and terms. An indication of learning was that they did personally use the design-linked terms such as "touchpoints", and, several informants also told how they adapted and enjoyed parts of the design and creativity-based methods in their daily work with others. This personal engagement is an important ingredient in creative endeavours that can be further strengthened (see e.g., Rickards and Moger, 1999).

Yet, it is still unclear how the new service design-assisted innovation terms and approaches were actually embedded and integrated (or not) in the living enterprises, such as in the culture and many corporate work processes. This is perhaps not surprising, if the new methods were explored mainly within a single short-term project frame and in part as workings with and by student designers. As one informant said, *"Hmm, no, the results that emerged, the students' presentations, we have not used those, because they have not even been shown here, inhouse, and that is something we could consider doing."* She added: *"However, the work method that is used for working with AT-ONE, and what is embodied in the word AT-ONE, that is something we definitely can use here; that is, actors, touchpoints, indeed, what are our touchpoints for example. That is something we work with very actively here, and I can surely learn much from the process that the AT-ONE project has shown to me."*

On this background, embedding, exploring and demonstrating design innovation approaches in more visible, core organizational processes could be explored more, as the design firm IDEO has started to do, although organizational design and service blueprinting are not entirely new to the world. Yet collaborators, also in product design innovation, could probably learn something significant from exploring broader varities of actors. This may beneficially include real customers' service experience journeys, because customers – and

actually many groups of users – may be "cut off" from designers', developers' and managers' direct experiencing, such as when selling through not-ready-to-hand systems, service brokers, distributors and dealers.

2. Engaging in both structuring and spontaneous design/innovating

Designers and also design/innovation management can be contributing to a vitalization and reordering of development efforts. This was identified in the product and the service design cases. Initiatives for improving processes and workings came from both project leaders and management ranks, and they came from design consultants (see examples also in Blaich and Blaich, 1993; Bruce and Jevnaker, 1998).

It is worth noticing that even within a structured innovation approach, participants do not necessarily become similarly structured in their own expectations and participations. According to one employee's response in our follow-up interview after the service innovation workshops: *"Did actually not get any expectations, rather, I was actually just thrown into it and we came along. So did not get any great expectations actually."* She did find the work highly relevant for her own job and company, but also somewhat difficult to grasp at first. Being fairly new in this company, this was not surprising but she was not alone in such reflections.

On this background, it would be easy to recommend clarifying preparation and innovation work goals at least. However, mixed expectations, difficulties of understanding, some "thrownness" and even frustrations may be part of what innovation is all about, as evident in some of the cases explored and as suggested by many authors (see e.g., Van de Ven et al., 1999). The other side – of good (or bad) structuring – is the possible spontanous humour and artful playing when creative people are spending much time working together, which most innovators seem to enjoy, and which may benefit from some nurturing, too, as illuminated in AT-ONE as well as in relation to HÅG.

3. Attending to extraordinarily creative and multiskilled contributions

As elaborated, the specialist-based design-assisted innovation approaches were experienced as highly valuable in ideation and innovation work. According to a marketing manager in one of the service companies, *"It struck me that, oh my God,these designers do contribute a lot in relation to putting ideas on the map in somewhat other way, which makes you able to spin, you reach longer and faster, I think. That was very good."*

The corporate managers of *Scandinavian Business Seating* pointed to the difference of working with highly experienced expert designers in comparison with inexperienced and unfamiliar ones. Also in the service companies, the multiskilled *live|work* designers were highly appreciated by their corporate collaborators. In line with previous studies, we found that expert designers are accumulating experiences and knowing across developmental situations (Lawson, 2006; Cross, 2011; Jevnaker, 1995). What appears to be less understood, are the ways some outstanding designers together with other creative collaborators may

actually *deviate* from existing approaches and cocreate new ones with close cocreators. This may affect ways of interacting and managing, too, as the product design case illuminates:

> ***Project manager:*** *But I think that is much of the reason why he has had such influence. Because he, he believes in what he is doing and he argues very convincing for it, and in a way want to push things through. And it is clear that he does not give up easily, that can be good in many contexts. So then, I do not think you should start such a..., eh, it is better to lean back and listen to what he has to say, before you enter in an argumentation.*
>
> **I(interviewer)**: Yes. So that poses some challenges or qualities for you as project manager?
>
> ***Project manager:*** *Yes, I just found out eventually that it was smart not to be very confronting but rather, yes, find a way to work together with him.*

In conclusion, we should not underestimate how becoming outstanding in an expertise such as creative design is highly intricate (Cross, 2011). Furthermore, managing with and for outstanding designers seems to require particular human qualities as well, including becoming open for designers' own design and managing initiatives. This does not necessarily oppose also heeding organization capabilities and constraints, as suggested by one design manager.

4. Exploring design-assisted strategizing or how design becomes strategic

Although adopting design terms and engaging some overlapping inhouse managers and specialists, it was not clear how the various design/innovation approaches were combined and leveraged to actually become strategic and have more impact in the service companies. Furthermore, emotional design could be improved on many levels in the service companies, as commented also by external designers. An implication is to explore design expertise and design innovation also beyond the current levels. By contrast, outstanding designers' work in combination with designer/enterpreneurial collaborations were recognized as having contributed to the visions and core raison d'etre of the product-based firm. This suggests potentials for further exploration of how design innovation actually *becomes* strategic.

5. Fostering recurrent boundary work in a creative way

Similarly, we identified potentials for improved anchoring, outreach, and managing for service design approaches. According to one company informant: *"I do not know what they know, or I don't know if many knows about this beyond the ones that participated in the project. So then it had to be demonstrated, so to say, or become narrated and put into a concrete context and said, here, you can look at that and than and that, in short, be provided with a developmental trajectory."*

Interestingly, in both service and product design creating work, some designers and close collaborators did engage in rich boundary-spanning activities such as visualizing and expressing core concepts or orientations and their meanings, and also moving others in a concrete, expanded mission, which seemed to be fundamental ingredients for enabling and sustaining design innovating (Jevnaker, 2003b). Considering that missing realization also emerged in our dialogues with industrial designers, relating to other companies as well, the

creative "boundary work" may be underexplored and underacted in managing for design/innovation. Thus, instead of focusing merely on any *one* innovation process or innovation type for all situations, then perhaps leaving boundary work with other ones in the shadow, there seems to be much to learn from *multiple* "generations" of innovation development approaches and specialists' interactive workings, as sometimes unfolding in extraordinarily ways in-between. Simultaneously, we propose not to underestimate combinations of persons' and groups' creativity and learning what one actually can do and be, even when starting in small pockets of organizations or networks.

In conclusion, there are no quick fixes for managing increased complexities, as design usability researcher Don Norman (2011) also says. Yet many possibilities do exist for improving managing for design/innovation, as the cases explored demonstrate, and not all are equally intricate. As one informant from Scandinavian Business Seating said bluntly, *"…to get an integration in relation with launching new products, you put up both marketing people and production people into the project in such a way that they are involved in anchoring the solutions that come. That is the clue, actually."*

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Design Management: Strategy as Practice in Boutique Hotels

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The strategy as practice perspective views strategy as something people 'do' rather than what organisations actually 'have'. This exploratory paper argues that this approach will provide an opportunity for a more comprehensive and in-depth analysis of what actually takes place in the activity of design management. organisational settings. The paper reviews 'practice turn' concepts, with associated empirical research, as a potential foundation for the study of design management and then goes on to discuss boutique hotels as a 'designerly' phenomenon where design is seen as central to customer appeal. We discuss some initial findings from one boutique hotel company and outline a suggested research design going forward in order to gain an understanding of 'design-in-practice'.

INTRODUCTION

Design management, design thinking and design leadership in recent years and with varying degrees of success have achieved interest in business, management and particularly organisational literature. Design Management is typified by its complex, interdisciplinary activities (Cooper & Press, 2005, p.3), in which there is an assumption that design is more than a functional activity and its management more than simply the deployment by line managers of design resources (Gorb, 1990). Consequently it has been argued that design is a strategic activity (Bruce & Daly, 2007), a strategic and management tool, and that design can be understood as a creative asset, making an independent contribution to strategic goals (Perks & Cooper, 2005). A characteristic of such strategic-level design management research tends to be the use of structured frameworks or models. The latter appear not dissimilar to those represented in mainstream rationalist strategy (and to an extent marketing strategy)

literature. Another parallel to the strategy field is the idea that design will impact, along with other business activities, on effective business performance.

There is however a practice-based perspective, an emergent strand of strategic management, which provides an opportunity for more comprehensive and in-depth analysis of what actually takes place in the activity of design management. Focusing on the micro-level social activities, processes and practices that characterise organisational strategy and strategizing (Golsorkhi et al, 2010) it is argued that the Strategy as Practice approach allows engagement with actual practitioners and will better unearth the working reality of design management in organisational settings. It assumes that not only senior management but many others contribute to strategizing and views strategy as something people 'do' rather than what organisations actually 'have'. This exploratory paper is structured as follows. The first part of the paper reviews practice turn concepts, with associated empirical research, as a potential foundation for the study of design management. It then goes on to discuss boutique hotels as a 'designerly'phenomenon where design is seen as central to their customer appeal. We will discuss some initial findings from one boutique hotel company; and outline a suggested research design going forward in order to gain an understanding of 'design-in-practice'.

THE CONTRIBUTION OF STRATEGY AS PRACTICE

'Practice' seeks to describe fundamental phenomena in society and is reflected in the 'practice turn' that has become a focus of attention in strategy, but also in a number of disciplines such as philosophy, history, sociology and science and technology studies (Schatzki, 2001: 1). A number of distinct categories of practice research can be identified; 'practice-based learning' is used to investigate the social and collective process of learning in which practical knowledge is understood as a process, and that "learning takes place as things are done in the relationship between human and non-human elements." (Corradi et al. 2010: 271). However, Corradi et al. (2010) also argue that practice has also been conceptualised, and widely researched 'as what people do'.

Strategic management research has been criticised for being organisation-focused, and condemned for its de-humanisation and lack of relevance to practitioners in the messy reality of 'doing' strategy. In response, the area of Strategy as Practice has emerged with a burgeoning number of empirical investigations. From this perspective, strategy has been defined as 'a situated socially accomplished activity, while strategizing comprises those actions, interactions and negotiations of multiple actors and the situated practices that they draw upon in accomplishing that activity' (Jarzabkowski et al, 2007:7-8). By recognising the critical roles that both individuals and society play in determining strategy, it returns research to its original purpose of understanding and improving the work of practitioners (those who do the work of strategy). As researchers have begun to engage with practitioners in Strategy as Practice research they have sought to advance theoretical understanding in a way that has practical relevance for all those involved in the strategizing (Golsorkhi et al, 2010:1).

As well as the broad parameter of *practitioners*, the Strategy as Practice perspective studies *practices* the social, symbolic and material tools through which strategy work is done (Johnson et al, 2007; Whittington, 2006). Strategic praxis, strategic practice and strategic practitioners and subsequently, professions combine into a theoretical framework that integrates organisational strategic activities with the actors on whom activity depends (Whittington 2006, 2007). It is our intention to study the material practices of design as they are used by practitioners involved in design management.

Design-in-practice

An essential element of the Strategy as Practice research agenda is strategy practices (Jarzabkowski, 2003, 2004; Jarzabkowski et al 2007). However, at the outset of any investigation into practices there has to be recognition that they are difficult to classify and separate being as they are 'entangled and interrelated elements of activity' (Jarzabkowski and Spee, 2009:81). There have been published works on the role of artefacts and technologies (such as the use of Notes technology by Orlikowski (2000) and Powerpoint by Denis et al, (2006). However, given the interrelatedness of practices, researchers such as Orlikowski (2007) have not attempted to separate the material technology but instead have conceptualised practices as sociomaterial. In other words, embracing the notion that the doing of the activity i.e., the use of technology, cannot be separated from the material arrangements in which doing occurs.

Orlikowski's (2000:404) early work into technologies-in-practice, examined how people, as they interact with a technology in their ongoing practices, enact structures which shape their emergent and situated use of that technology. We argue therefore that the study of design-in-practice acknowledges the emergent nature of design outcomes as they are enacted in practice. Design-as-practice mobilizes a way of thinking about the work of designing that acknowledges that design practices are habitual, possibly rule-governed, often shared, routinized, conscious or unconscious, and that they are embodied and situated. Design-as-practice cannot conceive of designing (the verb) without the artefacts, such as blueprints, briefs, specifications, and architectural drawings, which are created and used by the bodies and minds of people doing design. This way of thinking of design sees it as a situated accomplishment in which a number of things, people, and their doings and sayings, are implicated. . It also acknowledges the potential for design artefacts to span work boundaries within organizations such as boutique hotel chains, acting as boundary objects (Jarzabkowski & Spee, 2009; Carlile, 2004).

As with strategy-as-practice (Whittington 1996), conceiving of design-as-practice offers rich resources for understanding what goes on during the practices of design and relating them to organizational outcomes. It moves the unit of analysis and thus the research agenda away from oppositions between individual skill or 'knowing' (Cross 2006), or organizational competence (Kelley, 2001) to an arena which acknowledges the practices which span both.

BOUTIQUE HOTELS

There has been limited empirical academic research into boutique hotels. Two studies have been carried out in the UK by Aggett (2007) and Lim & Endean (2009); however, these have generally focused on evaluating the characteristics of these types of hotels, drawing upon customer feedback. Their research deserves close attention in terms of its discussion of design. Aggett summarises the earlier contributions to boutique hotel research in which design is variously used to distinguish the concept in these terms: as differentiator, individually decorated (literally boutique as opposed to department store); design-led; they feature contemporary or minimalist decor while offering many additional lifestyle amenities; they offer contemporary design with high-tech solutions, they are also "thematic and architecturally notable" offering warmth and intimacy. Lim and Endean find a "mixed response to the design features of boutique hotels" (p.48) from their own research and single out individuality as the most important aspect, their distinct individual character incorporating contemporary luxuries while preserving a tradition of service and heritage and being difficult to replicate. Apart from the these general confirmations of the strategic importance of design, there is little explanation of "design", "design-led" practices and how these are perceived and organised as contemporary and "thematically notable".

From the foregoing research, their distinctiveness lies in the combining the past, their heritage, with the new, their appeal to contemporary lifestyles and provision of the latest technologies. The contribution of history and heritage in branding is evident in marketing and organisational theory and provides an important grounding for practices of strategy and design. Urde et al. (2007) distinguish between three heritage branding themes: retro-branding, relating to a particular epoch and the use of nostalgia as a theme; iconic branding, emphasising mythmaking in the transformation of the brand into an iconic one, and heritage marketing. Historical studies of businesses as distinct from those of heritage, broadly demonstrate the importance of the past in shaping the future. The implication for luxury fashion brands is that "histories can be used strategically to mobilise strong and positive feelings and embed these feelings into people's experiences of organizations" (Ooi 2002, p.617). In a rapidly changing environment, visual and tangible evidence of the past is valued for the sense of place and continuity, and the relative permanence of place helps establish meaningful qualities, it embodies a social memory (Rossi 1982; Carmona et al., 2003). Examples of this process are evident in both established and new centres for luxury consumption. In Shanghai, the Bund attracts department stores and flagship stores including Armani at Three on the Bund and Bund 18, while the elegant former French concession area houses Dunhill and Vacheron Constantin stores.

We interviewed firms specialising in this hotel sector, such as Mackenzie Wheeler Architects and along with the data gathered from interviews within the case study boutique hotel chain (see below) we have selected to undertake our own descriptions of the boutique hotel sector and the role of design in it.

The meaning of the boutique hotel has evolved both temporally and spatially. Initially, it was defined by its limited facilities, which focused almost exclusively on guest rooms and reception area, and as the hotels were located in central, urban areas, food and beverages could be found nearby. These types of hotels are characterised by the re-use of buildings, for example, former commercial buildings and their inherited heritage. Examples include Alias' Hotel Barcelona (a converted Victorian eye hospital), Hotel du Vin's Henley-on-Thames hotel (the old Brakspears Brewery), and the Salthouse Harbour Hotel in Ipswich (originally a warehouse). Heritage itself can offer a number of design solutions, from the building in its re-developed form, to its use as a background theme, a re-interpretation of its historical significance. Within the building a single, distinctive or even fabulous room could differentiate the hotel, with the other rooms and spaces designed to a formula. Furthermore, re-use enables the hotel to engage with sustainability discourses. Boutique hotels have been said to permit the public to enter into a private world, their design allows a sense of democracy, which the consumer can join in. Their popularity and word of mouth recommendation to friends provides a significant marketing communication channel.

Subsequently, the distinctive design of boutique hotels has enabled them to expand beyond their urban origins into the countryside, as small country hotels. Therefore, from a geographical perspective the boutique hotel could be very convenient or very inconvenient, and contrary to American industry practice, typically demonstrates a lack of interest in classification. Ownership provides a further perspective on boutique hotel development. Boutique hotels can demonstrate owner-led quirkiness and reflect the personality of the owner or architect or interior designer in the choice of design details. The development of the concept has seen an element of fashion, the idea of the 'trendy hotel' and a sense of responding to the fashion catwalk with a fast turnaround into a street presence. Style-related themes, for example, the Leopard Lounge and non-star names have been incorporated into designs. Artists, and their artwork, notably used by Steve Wynn to achieve a seminal, distinctive resort style in Las Vegas, contribute a distinctive originality (Ryan, 2009). More recently Anthony Gormley's work has contributed to the 'co-branding' of a new hotel in central London. In its most complete form the 'signature' design is applied to the entire hotel and luxury branding, for example, the Armani Hotel in Dubai has further extended the boutique hotel concept. As Sklair (2006) has demonstrated, the relationship between signature architect, iconic building and media discourse is advantageous to all three elements. Durability though may not be a prerequisite, as specialist one-off places in which contemporary themes have been created and re-created, can receive Boutique style awards.

According to research in New Zealand by Chang (2010) boutique hotels have a special leverage on **'**design knowledge**'** and exercise considerable influence over the significant

stakeholders that constitute urban(e) life. In terms of the central role that design therefore plays in these service products, boutique hotels provide an interesting phenomenon to research in terms of how design, as a strategic activity is actually 'done'.

Initial findings about 'design-as-practice' in Alpha Hotels

Alpha Hotels operates two boutique hotel brands. The conception of a leading hotelier, it began with a single brand in the mid-1990s. Subsequently bought by a property company and having acquired another boutique hotel chain, it has become a trailblazer for boutique and lifestyle hotels in the UK.

In interviews with company personnel, including the Interior Design Director, the appeal of boutique hotels was thought to have come from those staying at hotels on business being tired of hotel offerings and demanding instead 'homes from home'. The essence of the original boutique brand is to have buildings of great character; to fill them full of lifestyle-conscious and aspirational people and have a 'slinky style' and a 'dash of rock n' roll' design elements. These are evident in the use of colour; black and white checked floors, dark wood, and red furnishings and accents to create distinctive zones in the reception area. Oversized and quirkily shaped furniture provides confidential spaces while confronting their users. Pools of light and shade contrast with the central space where reflections off the hard floor surfaces contribute a confident restlessness. However, as homes evolve overtime, so has the chain and the design of the hotels with it. Expansion of the business by definition presents problems of individuality. The earliest and most recently opened hotels have not been designed in the same house style. The 'dark, moody and sensuous', fashion-led, original design is being incrementally altered to reflect something more timeless, more homely and welcoming. Reference points appear to be 'slow fashion' and a return to retro styling reflected in vintage clothes fashion and textile trends. Design, particularly in public spaces, has now to be more enduring, whiter and brighter and even more convivial; dark is now perceived not so much as sensual as gloomy.

These directions are researched and implemented by a new designer, a function that has always been in-house. However the CEO has exercised an important influence on design; he was very influential in terms of dictating design decisions, although his ideas were always viewed as originating from an experienced and visionary place. The designer is not influenced by the other cutting edge fashion boutique hotel chains, which are said to be struggling, but she follows what is 'true to her' and her own style and taste. The Alpha approach is to be inspired by functionality in its artefacts, demonstrated in 'tiles as a surface', 'a bath that you can relate to, combined with mixed colours, and the unexpected mixes of old textiles'. Textures are becoming more important, whether through the use of sacking, Kradvat materials and bare floorboards. By contrast the technology in the bedrooms, specifically televisions and fridges, was vulnerable to changes in design and operational strategy, which contradicts the findings of Lim and Endean (2009) and earlier studies defining boutiques through their 'high-tech' solutions. Lighting will become more important

and corridors need to be bright with clear signage. The design process appears to relate to personal inspiration, 'I like this and that' and the designer moves quickly to make changes if the scheme does not work. This reduces the complexity of the design process, 'there's not a lot of banter but a lot of communication'. The designer has a do-it-yourself approach to the company's new and re-design process, sourcing new materials informally with a colleague, handing over the work specification to be out sourced. The hotel projects require a multi-tasked approach without being too architectural, that the architect's vision and eye for theme and detail in the design are less important. The designer's aim is to make the most of the built environment as a backdrop.

The use of distinctive buildings, in keeping with the boutique concept is a key element of Alpha's strategy, and bold decisions are taken by the CEO with a clear vision for the business. This was most evident in the conversion of one of the oldest prisons in the country into a successful new hotel and part of a former Royal Mail sorting building. Such distinctive buildings have been consistently identified in the literature as a defining element of boutique hotels. Kirby and Kent (2009) demonstrate how architecture can draw on the heritage of the 'locale'. The re-use of buildings draws on and amplifies the heritage and history of the site and its neighbourhood. Further they can build on local relationships of stakeholders with the existing building. The next hotels in the company, under its two brands, will be developed in Canterbury and Dundee. The new Dundee site was a hotel, opposite the V&A Museum, and the initial design concepts will reflect the city's traditional industries in the three 'J's; Jute, Jam and Journalism.

MOVING THE RESEARCH FORWARD

We have provided only an introduction to this study into how design is done in Boutique Hotels. This will be an exploratory study on several counts. Firstly, to date there has been little in-depth empirical research into boutique hotels. More recently researchers have begun to apply conceptions of innovation to the boutique concept (see Lowe, Williams and Shaw, 2011) but prior to this studies have been more descriptive, debating the very notion of what boutique hotels are and what makes them successful (see Aggett, 2007). We have chosen to move away from the latter issue and frame our own definition and notions of the boutique hotel concept with a particular focus on the design dimension, and are happy that these meet those of the initial case study chain's concept of its product and services. Secondly, whilst empirical research into Strategy as Practice has increased phenomenally over the past few years, there are still only scant studies of the material enactment of strategizing. Applying the practice turn to design management furthers the latter research as well as contributing to research into the strategic and central role played by design.

We have only launched into our empirical work, which has been hampered by the lack of new hotel development opportunities as the case company has been in a period of consolidation as a result of the economic downturn. Early research findings indicate that

design is at the heart of the company's brand and product process. As such decisions to do with design are of the highest strategic priority (notwithstanding the huge cost implications). It is carried out in an organic way but with vision and personal style elements. Doing design involves many in the management team as well as outside architects and suppliers. The fact that design has altered overtime provides a challenge. In existing properties incremental changes have had to be made but new hotel developments have to be able to mirror more contemporary design-thinking. All of this has to be done without upsetting the loyal customer base of the company and brand.

Methodologically, applying the Strategy as Practice perspective can be challenging, especially for those not able to undertake solely research work. It requires high level access to organisations due to the nature of needing to get near to and involved with practitioners, and immersed in practices and praxis. The research design going forward with this project will require an ethnographic study. The focus will be a new hotel development project and the unit of analysis will be design-in-practice. Gaining the trust of all organisational and non-organisational members involved in the project will be fundamental. Data collection methods employed will include off-site interviews with those involved in the project; the observation of off-site meetings, discussions, office-based activities and observation and shadowing on-site visits and meetings. The analysis of this array of diverse data will then provide an understanding of the enactment of design-in-practice.

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