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Report on the UK-Japan industrial sustainability study and workshop

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Interim report on the UK-Japan industrial sustainability study and workshop

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Executive summary

This report summarises the findings of an EPSRC sponsored study visit to Japan to explore research and industrial practice in industrial sustainability. The aims of the visit were to:

- share experience and expertise in the field of industrial sustainability
- identify current best practices and industrial needs
- identify opportunities for collaborative projects between UK and Japan

The visiting team included UK academics with backgrounds in environment, sustainability and manufacturing as well as a senior officer from the Engineering and Physical Sciences Research Council (EPSRC).

The timing of the visit reflected growing UK interest in industrial sustainability particularly including the implications for manufacturing industries and the research which might be required to support the emerging industrial context. Japan was seen as having a long-standing and distinguished history of practical industrial efforts towards sustainable production as well as a lively academic community involving many of the leading universities. The visit drew upon a visit[1] by senior Japanese academics to the UK in June 2010 at the invitation of the Royal Academy of Engineering[2].

The programme included visits to leading academic and research establishments, and a workshop/seminar involving many leading Japanese participants from the world of industrial sustainability.

The team made a number of observations about the development of the industrial sustainability field in Japan including:

- emphasis at the policy level on both societal and competitive aspects of sustainability
- strength of the engineering research base supporting industrial sustainability
- growing emphasis on systems approaches
- growing emphasis on system resilience as well as efficiency

The symposium/workshop identified strong enthusiasm for future collaboration based on a shared understanding of the subject area and a broad agreement on the key technical issues. There was also some consensus on priority areas for the future including:

- development of common languages, tools and standards: common languages would enable the sharing, and therefore comparison, of data between the two countries

[1] www.raeng.org.uk/international/activities/UK_Japan_Symposium_Green_Manufacturing_Eco_innovation.htm

[2] www.raeng.org.uk/default.htm

- conducting research that is specifically designed to inform and influence policy development (where appropriate)
- building international communities of expertise

A wide range of mechanisms was identified to help pursue these opportunities including: research placements (sabbatical, doctoral/post doctoral visits), research visits, university linking with sharing of resources and contacts, visiting professorships, international fora, joint projects (with research activity in both countries), joint projects (with separate and complementary activity in both countries), and study visits.

The formation of high-level bilateral discussions could provide a useful mechanism for coordinating such opportunities and marshalling large-scale joint activities – such as the development of common languages, tools and standards as well as helping to inform and influence the policy environment. The opportunity to make useful comparisons between the UK and Japanese approaches was emphasised (ranging from policy to practice and other instruments, such as voluntary agreements). There is ample scope however for mutually beneficial collaborations between individuals, research groups and faculties whether it be through researcher exchange, joint projects or the sharing of data.

Acknowledgements

The group would like to thank the Embassy staff, particularly Mr Kevin Knappet, Ms Seiko Oya and Ms Ymiko Myoken for their help and support in the preparation and execution of this research trip. The group was presented with a rich programme of visits and a distinguished group of academics was assembled to participate in the workshop. Furthermore the seamless logistical operation that was arranged allowed the group to focus on the content of the programme and the unique and vibrant setting of Tokyo.

The group would also like to thank all those who hosted institutional visits and attended the workshop for their warm welcome and knowledgeable and energetic contributions.

Thanks are also due to Dr Eoin O'Sullivan of the Institute for Manufacturing who provided invaluable help, briefing in advance of the trip and support in the preparation of the report.

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Since the groups' visit, Japan has been struck by an earthquake and subsequent Tsunami, devastating areas of the country and placing great strain on the people as a whole. We would like to express our condolences for the national and personal losses experienced, and also our support for the rebuilding programme that is currently underway. We hope that through this report and the associated materials and events, work may be triggered through which the UK research community can play a small part in building a prosperous and sustainable future for Japan.

Contents

1. Context

There is now wide acceptance that climate change is necessitating a radical transformation to the way society operates. Much attention has been focused on understanding climate change itself (e.g. IPCC, 2007) and on the need for low carbon and renewable sources of energy (e.g. Mackay, 2008). However, this activity alone cannot help achieve the targets (e.g. UK Climate Change Act [1]), and objectives (e.g. Cancun[2]) that governments are setting to help mitigate the risks to society of severe climate change.

The industrial system contributes a significant portion of the anthropogenic emissions associated with climate change, and is also perceived to have other negative impacts on the environment at a global systems level (e.g. Rockström et al 2009) and local to production. Furthermore, issues of resource availability (water and materials) are also beginning to have an impact on the way aspects of the industrial system operates (e.g. Guthrie et. al. 2010, Gerst & Graedel, 2008 & REKTN, 2008).

The principles of sustainable development (Brundtland, 1987), demand that historic levels of consumption and emissions of industrialised nations cannot be permitted to stunt the economic development of those countries who have yet to benefit from the positive impacts industry can bring. Nor should the collective activities of all nations deny future generations the ability to meet their needs.

It is clear that the manufacturing and industrial system has a pivotal role to play in addressing these issues. We, the manufacturing research community, therefore need to develop knowledge that supports the transition from our current way of doing things, to what might be termed a sustainable industrial system.

Both Japan and the UK have companies at the forefront of sustainable industrial thinking and growing research groups in the field, as well as governments and related agencies who are addressing the issues through policy and funding mechanisms. Both countries have a long history of collaboration in manufacturing, it is therefore appropriate and timely to explore opportunities for collaboration in the evolution of the next generation of sustainable industrial systems.

[1] http://www.legislation.gov.uk/ukpga/2008/27/contents

[2] http://cancun.unfccc.int/cancun-agreements/main-objectives-of-the-agreements/#c33

2. Introduction

Both the UK and Japan have strong and well-established research capabilities across all major disciplines and good interactions between universities and industry. The field of industrial sustainability, however, poses significant challenges for academic structures, drawing as it does upon many different disciplines, and lacking as a field the agreed structure and research processes typically found in more established research areas.

The emphasis on industrial sustainability, as distinct from broader questions of climate change and energy, is designed to encourage a more focused view of sustainability and industrial systems, taking into account the full range of activities including production processes, manufacturing systems and broader supply chain issues, including end-of-life.

In January 2011, a team of industrially-orientated academics with interests in manufacturing and/or sustainability, together with a senior officer from the Engineering and Physical Sciences Research Council (EPSRC), visited Japan with the aim of:

- sharing experience and expertise in the field of industrial sustainability
- identifying current best practices and industrial needs
- identifying opportunities for collaborative projects between UK and Japan

A three-day programme of visits (See Table 1 overleaf), including national funding bodies, industrial speakers and academics was constructed in collaboration with EPSRC and the Foreign and Commonwealth Office.

This report presents the findings from the programme and represents just one of the outputs from the research visit. Other outputs include:

- a UK seminar on industrial sustainability designed to inform the industrial and academic community about UK/Japan interests, capabilities and opportunities
- a mini website with presentations from the visits and subject-relevant links will be available at www.ifm.eng.cam.ac.uk/sis/Japan.

3. Institutional visits

Japan has a diverse research landscape with a range of funding bodies (e.g. JST, JSPS, NEDO - see glossary of acronyms, page 24) and types of research institution, including universities, a national institute (AIST), metropolitan/prefectural supported industrial research institutes, contract funded research institutes (e.g. IGES) and also industrial research laboratories (O'Sullivan, 2011).

In the time allowed it was possible to visit and interact with only a small sample of these institutions. Visits were arranged by the Embassy staff and focused on university academics, some of whom were already known to members of the party, and (as in the case of IGES) organisations which had an agenda and scope which matched that of the visiting party.

Workshop attendees provided a broader range of organisations including AIST, the Engineering Academy of Japan, IGES and academics. The workshop activities will be covered in Section 4.

3.1 Visit programme

Day 1	Japan Science and Technology Agency (JST)	Waseda University Hosted by Professor Hiroki Katayama	Institute for Global Environmental Strategies (IGES)
Day 2	Embassy Workshop (see page 12 for programme)		
Day 3	Keio University, Graduate School of System Design and Management, Hosted by Professor Masaru Nakano	Institute of Industrial Science (IIS), The University of Tokyo, Hosted by Professor Tomonari Yashiro	

Table 1: Outline visit programme

Visits typically involved an initial exchange of current agendas, with the UK team presenting the over-arching aims of the trip, their own research perspectives, and their Japanese counterpart presenting their current programmes and research activities[1].

The visits continued with a discussion, led by the senior members of each delegation, from which notes were taken. After each day's visits a formal reflection session was undertaken whereby the thoughts regarding the visits, general impressions and intended actions were recorded.

The findings represent the group's interpretation of the respective research institutions and the activities undertaken there and are presented on the following page.

[1] A tour of the research laboratory facilities was given in IIS whilst the group attended industrial lectures at Waseda University

3.2. Visit observations

3.2.1 Japan Science and Technology Agency (JST)

JST has a mission to facilitate innovation based on science and technology through the development of networks between academia and industry (O'Sullivan, 2011). It was thought that JST was roughly equivalent to the EPSRC as there were broad similarities between programmes; however JST also encompasses aspects of the TSB in terms of remit.

The broader remit of JST, encompassing a wider range of TRLs (Technology Readiness Levels), was seen as an enabler in technology translation. In discussions it became apparent that JST does not consider technology translation ('valley of death' bridging) to be as problematic as in other countries, where funding bodies are split.

Whilst JST accepts funding bids with multi-disciplinary components it does not actively call for them. JST expressed an interest in how multi-disciplinary calls are handled by EPSRC and also looked to enter more problem-led research areas, EPSRC being an exemplar in this type of funding.

It was noted that JST is responsible for producing technology roadmaps and developing and modelling scenarios, which in turn influence future funding opportunities through the Council for Science and Technology Office (CSTP).

3.2.2 Institute for Global Environmental Strategies

The Institute for Global Environmental Strategies (IGES) is a research institute that conducts pragmatic and innovative strategic policy research to support sustainable development in the Asia-Pacific region (and is roughly analogous to SPRU in Sussex). The research institute was formed through a Japanese government initiative in 1998.

Around 100 staff are organised into five groups covering climate change, natural resources management, sustainable consumption and production, economy and the environment and governance and capacity.

Funding is supplied largely in the form of competitive bids, with the Ministry for the Environment, UNEP and World Bank amongst the regular funders of projects. It was acknowledged however that there was tension between demonstrating results in the short term and doing the most interesting and potentially impactful work in the long term.

The regional (Asia Pacific) focus of the research group underlines the connectedness of the environment and resource issues and reflects the disparities in terms of economic development across the region. They also connect with companies to ensure that industry's perspectives are factored into the analyses and policy discussions.

3.2.3 Waseda University

Waseda University is a prestigious private university, which is over 125 years old. Today it strives to establish state-of-the-art research frameworks, with an emphasis on collaborative research activities between the private sector government and academia[2]. The tour group was hosted by Professor Katayama of the Graduate School of Creative

[2] http://www.waseda.jp/eng/forresearchers.html

Science and Engineering. The group heard presentations by industrial partners and also engaged with Professor Katayama in an extended discussion. Industry speakers addressed education programmes and highlighted the application of key techniques, which support industrial sustainability. The presentation by Hitachi highlighting the range and depth of ongoing projects, initiatives and investment, was a clear indication of interest by Japanese industry in industrial sustainability.

Professor Katayama's work focuses on the transfer of Kaizen technology[3]. It was apparent from the discussions that his work had a particular strength in applying manufacturing principles and techniques to address challenges arising from sustainability issues (e.g. re-use and recycling).

3.2.4 Graduate School of System Design Management, Keio University

Keio University was Japan's very first private institution of higher learning and in 2008 celebrated 150 years with the slogan 'Design the future'. As part of this message, the importance of collaboration with industry, government organisations and other universities (domestic and overseas) was emphasised to the group, as was the need for a systems engineering approach to research.

The group was hosted by Professor Masaru Nakano at the Graduate School of System Design and Management, in the company of colleagues and guests from the institution. The School demonstrated an exciting and leading emphasis on systems thinking research (Professor Nakano for example advocates the need to seek optimisation across the supply chain and not just the system of production and aims to expand research from single company to societal issues [4]) with focused projects and topics also addressed (e.g. Nakano et. al. 2002).

Extensive international collaboration with individual universities/groups is encouraged and the group is also engaged with international programmes such as the IMS2020. They are also interested in linking universities together, not only for academic collaboration but also mutual access to companies and data.

Their approach to creating courses from various disciplines with a postgraduate research school, providing students with a wider range of subject areas to choose from, was also worth noting.

3.2.5 Institute of Industrial Science, University of Tokyo

The University of Tokyo was established in 1877 as the first national university in Japan. The Institute of Industrial Science, was established in the University in 1949 and is now home to some 130 laboratories involving 330 permanent staff and around 660 graduate students. The Institute's core research themes relate to production and manufacturing and aim to build foundation for new scientific and engineering disciplines in these fields[5].

Hosted by Professor Yashiro, the Director General of the IIS, the group was introduced to the research group structures and the modes of industrial engagement. A notably flat hierarchy/structure and an interesting family style of research group – where a

[3] http://www.sci.waseda.ac.jp/english/researchprofiles/creative/subject03_1.html

[4] http://www.sdm.keio.ac.jp/en/voices/nakano.html

[5] Institute of Industrial Science, The University of Tokyo, 2009-10 – Brochure

Professor, Assistant Professor, Research Associate and a few students work as a small group – was thought of as an attractive model for promoting excellence and effective working. This view was supported by a number of junior academic staff, with the benefits of the family aspect emphasised.

An interesting mode of industrial engagement in the university took the form of training engineers, on specific courses or through their involvement in research. A notable example of engagement was the provision of research facilities and expertise to industry, allowing them to develop their own ideas.

This research group-based approach supported not only high quality research within specific subject areas, but also the opportunity for groups to collaborate on multi-disciplinary projects.

The group observed individual disciplinary excellence in IIS and the emergence of a systems thinking approach through the Collaborative Research Centre for Energy Engineering (CEE), which brings together projects across a range of disciplines under a systems banner and allows the development of projects incorporating a range of disciplines.

4. Workshop programme

The first section of the workshop consisted of short introductory presentations of 5-10 minutes, concerning the delegates' research and areas of expertise.

The emergent themes and areas of interest were identified by the UK delegation and plans made for breakout group discussions.

The discussion was structured around the following questions;

1. What are the research needs that will help us to achieve a sustainable industrial system?
2. What are the promising topics for collaboration?

Opening remarks	Dr Masatoshi Okada	Engineering Academy of Japan
Overview of UK manufacturing research	Professor Steve Evans	Cranfield University
UK delegation presentations on research activity	Professor Shahin Rahimifard	Lougborough University
	Dr Jacquetta Lee	University of Surrey
	Dr Tim Short	University of Liverpool
	Professor Sir Mike Gregory	University of Cambridge
	Dr Derek Gillespie	EPSRC
Japanese delegation research activity presentations	Professor Fumihiko Kimura	Hosei University
	Professor Yasushi Umeda	Osaka University
	Professor Shozo Takata	Waseda University
	Professor Hiroshi Katayma	Waseda University
	Professor Tomonari Yashiro	The University of Tokyo
	Professor Tetsuo Yamada	Tokyo City University
	Professor Masanobu Ishikawa	Kobe University
	Professor Masaru Nakano	Keio University
	Professor Kenichi Nakashima	Kanagawa University
	Professor Hiro Yamasaki	The University of Tokyo / EAJ
	Professor Kanji Ueda	AIST / University of Tokyo
	Dr Nozomu Mishima	AIST
	Dr Kiwamu Ashida	AIST
	Dr Akira Tezuka	AIST
	Mr Wataru Machida	IGES

Table 2: Speakers at the workshop. Details of presentations and a full list of attendees can be found at: www.ifm.eng.cam.ac.uk/sis/Japan

The attendees were divided into three separate discussion groups, which were chaired and scribed by members of the UK delegation. Each group was encouraged to address question one by allowing each group member in turn to suggest answers from their own perspective. The group then discussed the importance of each of the suggestions and attempted to group similar proposals.

The second task was then to identify the most promising topics for collaboration. Once again, each person was encouraged to speak individually, before moving on to an open discussion. Finally the groups were tasked with selecting 'favourite topics' and explaining:

- each topic in detail
- why each is important or timely
- the extra benefits that collaboration would bring

Each group then fed back through the rapporteur, with the opportunity for group members to provide additional comment and feedback, where they felt items had been missed, omitted or misinterpreted. These sessions were recorded and the themes and discussions are summarised in the workshop section below.

This was not intended to be a rigid process but a framework to encourage discussion and uncover insights. The groups all found different ways to navigate the process. Nonetheless common themes emerged from the group discussions.

After the feedback there was an opportunity to reflect on the themes and topics that had emerged. These are recorded in the closing thoughts section on page 15.

These were summarised and reviewed by the UK delegation immediately after the event and on return to the UK. The findings are presented in the workshop discussion section below.

4.1 Workshop discussions

The following sections document the outcomes of each workgroup.

4.1.1 Workshop Group 1

The group agreed that dialogue across many spheres (academia, industry, government) was required to form a coherent vision for a sustainable industrial system. However, a common language for assessment and evaluation of these visions was required; a language that is valid nationally for the different players, but one which also has global recognition.

A global language could facilitate comparative studies (between countries, industries and policy approaches) which would in turn help inform policy development. To this end, an understanding of systems perspectives was seen as key to supporting the policy development dialogue.

Finally, it was acknowledged that although the language used should be common, and a systems perspective was important, it should be recognised that research, comparisons, policy advice and decisions will ultimately need to be sensitive to local conditions.

4.1.2 Workshop Group 2

As the issues of sustainable development are by their very nature global, the group

highlighted the need for international collaboration, cooperation and coordination in order to address them.

The problems faced are urgent and there is limited academic resource to address them. Effective communication about research activities was therefore seen as important to avoid duplication.

The standardisation of tools (e.g. eco-design) and in particular assessment tools (e.g. LCA) was seen as both an important result of such communication and an enabler/ enhancer of future research.

The need for interdisciplinary research was also underlined. The group felt that we cannot limit ourselves to tools that are applied solely at the level of the firm; there is a need to address sustainability across the social and economic system. This includes the capacity to influence regulation and policy as well as ensuring effective communication with consumers.

It was once again emphasised however that despite the need for international perspectives, many solutions would be local and dependent on the prevailing conditions.

The group also emphasised the role that collaborative research could play on the design of information systems to support sustainable manufacturing. Sustainability as a key element of engineering education was seen as a challenge that must be met in the short-term while researchers needed to play a stronger role in developing scenarios for the long-term.

4.1.3 Workshop Group 3

An improved understanding of system robustness or resilience is needed, while the robustness of key models on which policies are developed was questioned and there was a desire to improve this.

This would bring about a higher degree of certainty about future trends, both legislative and commercial and provide a more robust platform for future research and development.

The group agreed with Group 2 that a clearer vision for a future sustainable industrial system is needed, and that this system Vision should encompass energy and resources, efficiency and resilience, and equity and localisation. This would enable discussion and agreement on what should be made, where and how.

The group agreed with Group 1 that assessment of sustainability was not transparent and transferable and was holding up practice and research progress.

Group 3 was concerned with developing improved systems perspectives that would include modelling of complex systems, new business models and design methods.

The UK and Japan share some key characteristics, (e.g. island nations) and there maybe the potential for enhancing mutual lessons learned in different research arenas as a result of these similarities. However, there are also significant differences in culture which may negate some of these opportunities.

Case studies were suggested as an effective, mutual learning tool, allowing analysis of real time data and legislative endeavours.

Particular areas of interest were the Waste Resources and Action Programme, IT

systems for public/private heath provision, integration of push and pull flow systems in several kinds of industrial areas and non-manufacturing applications, as well as the UK learning on product-service systems.

The UK was also perceived as strong in programme management of complex projects such as eco-cities e.g. Arup.

4.2 Closing thoughts and discussion

Getting education right is essential – it needs to be developed as part of the core of engineering education.

How do we develop engineers with the right skills, how do we make sure they remain current and how do we help the existing stock of engineers learn what they need? This is urgent and we don't necessarily have the time we would normally take to integrate a new teaching area into courses.

Across Japan and the UK we observed a range of models for academia-industry interaction, many of them excellent. It would be particularly useful to study which models work best under which conditions. The subject of industrial sustainability is unusual in the speed of change involved and in the breadth of its impact and interactions, which might mean that standard forms of academia-industry interaction are not always appropriate. This is needed to ensure that our research, our delivery of good researchers, and our general education provision for industry remains relevant and avoids becoming part of the 'greenwash' (see page 25).

Helping industries to learn from another industry might be one way of accelerating progress.

5. General comments

This section attempts to synthesise the workshop findings and also draw on non-organisation specific findings of the visiting team.

5.1 Terminology

A number of academics highlighted a difference between the definition of industrial sustainability under which this study was conceived and their own use of the term. To the Japanese, industrial sustainability refers more readily to the sustainability and longevity of companies and industries in an economic context.

The UK definition focused more on the role of the industrial system in moving towards a sustainable society. In this context 'sustainable' encompassed the triple bottom line as well as intergenerational equity.

The Japanese were aware of, and acknowledged, the UK use of the term and highlighted analogous concepts in their research structures, notably eco-efficiency and eco-manufacturing or green monozukuri.

In general, the agendas of the two countries had considerable overlap and this gave both sides confidence that the course of actions being pursued were sensible.

5.2 Industrial interaction

Throughout discussions, a UK university strength in the area of industrial interaction and engagement in practice led/problem led research topics was noted by the Japanese hosts.

It was noted that Japanese universities act as knowledge centres, which industry actively utilises to address their medium to long-term challenges.

The tour party identified a strength in Japanese universities tackling eco-efficiency challenges and eco-factory challenges, developing sophisticated tools and techniques which could help support both incremental and step changes in the industrial system.

5.3 Multi-disciplinary

The Japanese hosts saw the multi-disciplinary nature of some UK research as a strength. They felt this was demonstrated both in the way that the funding body (in this case EPSRC) handled multi-disciplinary calls and bids, and in some of the activities of research centres and individual projects discussed during the visits.

There was a clear recognition by all participants (both funding bodies and academics) of the need to undertake more multi-disciplinary work, and an eagerness to learn from UK experiences in this area.

5.4 Technical prowess

There is a high standard of research being conducted in the technical areas of sustainability (such as Design for the Environment tools, models and sustainable materials) and UK researchers might benefit substantially from collaborating and learning from the Japanese institutions. Collaboration might offer the opportunity to improve skills, knowledge and methods required in these disciplines, whilst learning could be derived from the novel research structures (e.g. flat structure and family system) which gives rise to effective working groups and environments.

5.5 Systems thinking

There was a clear desire amongst funders and universities alike to significantly increase the quantity and quality of effort given to joined-up research activities that could be presented in a systems thinking context.

There was a desire to feed the findings from these into the respective policy development processes. It was acknowledged, however, that whilst developing techniques and language for such discussion together would be helpful, the outcomes of analyses would be different in the respective countries.

It was broadly acknowledged that the findings and implications of research into the industrial system needed to be communicated to, and understood by, industry and government. A research focus on developing tools solely for the company was important but not the complete picture.

6. Conclusions

The UK and Japan both have a medium to long-term interest in industrial policy, sustainable development and the issues surrounding them. Both countries are developing research programmes which address the need to support the development of sustainable societies, and which necessitate an understanding of how industrial policies may be integrated into such a plan.

In the field of sustainable development there are many challenges across science, technology and social science research, and there are not enough researcher hours to fully address them all. Achieving industrial sustainability provides a number of grand challenges that necessitate global collaboration. Both the UK and Japanese research communities would admit that neither group has enough researchers or the right skills to tackle the entire scope of the problem alone.

This report makes a preliminary attempt to identify areas of common interest and complementary skills, which in the future can be leveraged to the respective national advantage and thus make the most of the available resources in tackling this problem.

6.1 Collaboration

There is a clear desire from the respective countries to collaborate and to engage in academic research in a number of different ways. The findings have identified several areas of common interest and projects where complementary skills may be exploited.

Case studies

Case studies illustrating examples of leading practice in either country could inform policy and practice in both. Comparisons would be useful in terms of both industrial practice and industrial policy. The UK's use of voluntary agreements (rather than legislation) was identified as an area of interest. A good example of this is provided by the Courtauld Commitment under which the Waste and Resources Action Programme (WRAP) is working in partnership with leading retailers, manufacturers and suppliers to reduce the environmental impact of the retail sector.

Complementary skills

In the short term it is possible to build research collaborations which would not otherwise be possible using the existing skill sets of groups. These collaborations would be enhanced by some element of international comparison.

Research exchanges could also be encouraged where complementary skills have been identified, so that the techniques and structures which give rise to and support those skills may be identified, understood and transferred.

Data sets

There was strong interest in accessing data from UK companies. Links could be made between universities to support the exchange of data and provide access to companies in addition to research activities.

It is particularly important to conduct fundamental research on what such a data set should contain.

Common Interests

Where the UK and Japan are facing similar problems or research questions, collaboration should be encouraged at an appropriate level. It was agreed this will require more detailed discussions to establish.

Education

Education was mentioned as a key enabler of change in the industrial system, helping to train the next generation of researchers and practitioners with the critical skills required to tackle sustainability challenges. It was noted that few of the workshop attendees (both from the UK and Japan) addressed sustainability issues as a mandatory component of their courses. International cooperation on the development of teaching techniques and resources may be valuable in rapidly establishing these course components.

Sharing of research trajectories

High-level bilateral discussions (possibly in the form of a biannual conference) could be used to increase understanding of each other's research directions, to share research progress and identify opportunities, as well as to understand the wider political climate.

This would also be an opportunity to calibrate the respective visions of sustainability and how they fit with national policy. A more technical strand, in parallel, may also be worthwhile to support the development of international standards and a common language. Involving a wide range of countries may also be valuable in this type of initiative.

6.2 Mechanisms for academic engagement

There are a number of mechanisms through which UK and Japanese universities may engage:

- Research placements (Sabbatical, doctoral/post doctoral visits)
- Research visits
- University links with sharing of resources and contacts
- Visiting professorships
- International forums
- Joint projects (with research activity in both countries)
- Joint projects (with separate and complementary activity in both countries)
- Study tours

Types of interaction and funding available for UK Japan academic interactions can be found in the document 'Sources of Funding for UK-Japan collaboration: Science and Innovation' produced by the UK Embassy in Japan[1].

6.3 Research plans

It is clear that Japan is conducting very high quality research across the industrial sustainability spectrum. The group was impressed by the tools/methods research as well as the growing emphasis on system level analysis. This is being conducted by focused and well-funded laboratories and includes strong mechanisms for industry interaction. This focus is predicted to grow in Japan. The broad applicability of the research would benefit from collaboration with other countries and the opportunity to encourage UK-Japan interaction is timely.

6.4 Industrial engagement

This visit focused on the academic viewpoint however it was repeatedly emphasised that industrial engagement and two-way knowledge transfer (academia learning from industry and vice versa) was essential to ensure real progress towards a sustainable industrial system. Industrial thought leaders from both the UK and Japan should be identified and engaged in the dialogue going forward.

[1] http://ukinjapan.fco.gov.uk/en/about-us/working-with-japan/science-innovation/science-collaboration

7. Appendix

7.1 Delegation members and research links

Professor Sir Mike Gregory – Head of the Institute for Manufacturing (IfM), University of Cambridge.

Professor Stephen Evans – Professor of Life Cycle Engineering, Cranfield University.

Professor Shahin Rahimifard – Professor of Sustainable Engineering, Loughborough University.

Dr Derek Gillespie – Portfolio Manager, Manufacturing Technologies and Engineering Design, Manufacturing the Future programme, Engineering and Physical Sciences Research Council.

Dr Tim Short – Senior Lecturer, Centre for Engineering Sustainability, University of Liverpool.

Dr Jacquetta Lee – Lecturer, Centre for Environmental Strategy, University of Surrey.

Rapporteur

Dr David Morgan – Embedded Researcher, Institute for Manufacturing, University of Cambridge.

7.2 Records from workshop groups

Workshop Group 1

Discussion 1 - What are the research needs that will help us to achieve a sustainable industrial system?

- Vision for sustainable industrial systems
- Assessment
- System perspectives

  Modelling of complex systems

  Business models

  Design methods

  Equity

Discussion 2 - What are the promising topics for collaboration?

- Vision for sustainable industrial system (multiple countries)
- Visualisation and common language (including assessment and evaluation)

- Developing and developed countries – equity (are they/can they be complementary).
- Comparative analysis of factory performance/citizen lifestyle/business models/ behaviour/value/environmental performance
- Case studies for decision making in difficult environmental situations
- Policy development process and impacts
- Interest in learning about programme management of complex projects (e.g. Eco-cities)

Workshop Group 2

Discussion 1 - What are the research needs that will help us to achieve a sustainable industrial system?

- Efficient use of resources
- Best methods for including in engineering education
- What are the system conditions for industrial sustainability

  Consumers

  System tools

  Key indicators implementable by industry

  Regulation/legislation

  Benefits to industry
- Best methods of applying local technologies to solve global problems
- Better understanding of relationship between international companies and technologies
- Better tools to understand negative impacts of manufacturing activities – not just CO_2 emissions
- Negative impact of product across supply chain
- Effects of negative impact on top down/bottom up approaches
- Improved production methods
- Global view of total impact of product e.g. prices
- Systematic approach to persuade companies that eco-products (when properly designed) are good for company and consumer
- Means of persuading consumers it's good for them
- Understanding of product value to consumers
- How to communicate to consumer
- Body of evidence
- Recycle/re-use much easier more appropriate

Discussion 2 - What are the promising topics for collaboration?

- Standardisation in support of eco-design and LCA
- Use of information systems to support eco-factories and eco-tools
- End-of-life engineering/optimisation/recycling
- Education in sustainability
- Scenario planning: what is sustainability in 2020? 2050?
- Benefits of collaboration between UK and Japan

  Global funding opportunities

  Avoiding duplication of research

  Awareness of wider views

  Influencing policy/regulation

Workshop Group 3

Discussion 1 – What are the research needs that will help us to achieve a sustainable industrial system?

- Definition of industrial sustainability – industry which contributes to a stable society
- Restructuring of industry → research is needed to support the transition to new types of network, bringing in different disciplines including social science
- Partnership-based activities – government, industry and academia – learning, sharing knowledge and experience
- Integration of quality management into design process
- Urban regeneration – development
- Grant design issues
- Domestic vs regional vs international scale
- Methods of evaluating robustness and consistency of scenarios, (back casting vs forecasting) and the need for modelling to account for dynamic and complex interdependences

Discussion 2 – What are the promising topics for collaboration?

- Two key types of collaboration identified – common interests and complementary interests/skills
- International comparison

  Example case study - Recycling and the influence of WRAP in the UK
- Needs an awareness of local differences, although many similarities between UK and Japan (e.g. both islands)

- Further case study suggested on IT systems for public/private heath provision, and the application of pull flow systems in several kinds of industrial areas and non-manufacturing applications:

  User role in innovation

  Continuous improvement

  Just in time

7.3 Glossary, acronyms and additional resources

NB All weblinks live, checked as of April 2011.

AIST – National Institute of Advanced Science and Technology[1].

CSTP – Centre for Science and Technology Policy[2]. Part of the cabinet office that reports to the Prime Minister and is responsible for developing science and technology policy – it describes itself as "the command center for Japan's integrated efforts to advance science and technology (S &T) in a comprehensive and well-planned manner[3]." It consults with both the Prime Minister and relevant agencies in order to set policy in the form of the Science and Technology Plan, which runs in five year cycles. In the third plan Monozukuri was one of the key focus areas.

"Monozukuri technology is more than just the development of technologies for manufacturing. One of the most important policy challenges is to maximise the added value by reaching the service and information technology industries. Technologies for minimal-resource, energy saving and manufacturing of high-quality products that can withstand the rigors of the consumer market have been the Japan's advantages. By boosting such technological strengths furthermore, the CSTP will seek to make Japan the world leader in Monozukuri." Text from CSTP Brochure, 2007/8 page 7[4].

The 4th Science and Technology Plan begins in fiscal year 2011.

CEE – Collaborative Centre for Research in Energy Engineering[5], part of the University of Tokyo.

"Energy and environmental technologies are expected to have important roles ensuring energy security under conditions of tight supply and demand as well as the requirement for reductions of CO_2 emissions to help prevent global warming.

On July 3, 2007, the Energy-Related Research Network was established at the University of Tokyo to organise cross-departmental activities, including those of humanities and social scientists, in energy-related education and research. The Collaborative Research Center for Energy Engineering was also established to develop innovative technologies that will be essential for solving energy and environmental issues[5]." Professor, Atsushi Tsutsumi; Director of CEE.

Eco-efficiency. Knowledge and tools that can be used to help manufacturers create

1 http://www.aist.go.jp/index_en.html
2 http://www8.cao.go.jp/cstp/english/index.html
3 http://www8.cao.go.jp/cstp/english/panhu/introduction.pdf
4 http://www8.cao.go.jp/cstp/english/panhu/7.pdf
5 http://www.energy.iis.u-tokyo.ac.jp/english/e_aims.html

more value with improve manufacturers' environmental performance without significant changes to product, process or equipment.

Eco-factory. Increasing added value and improving production capability and responsiveness. Decreasing the consumption of natural resources and using waste from one process as the input to another.

EAJ – Engineering Academy of Japan.[6] A not-for-profit, non-governmental organisation for public services. It has been formed to contribute to the general advancement of engineering and technological sciences in Japan by members in leading positions with outstanding achievements and extensive knowledge in these and closely related fields.

Greenwash. The use or promotion of green issues by a party when there is little substance to back up claims, or little relevance to the issues which they are claiming to address.

IGES – Institute for Global Environmental Studies.[7] Publications can be found at www.iges.or.jp/en/pub/index.html and information on their global network at www.iges.or.jp/en/network/index.html. Work on sustainable consumption and production can be found at www.iges.or.jp/en/wmr/index.html, with a substantial white paper on the subject at http://enviroscope.iges.or.jp/modules/envirolib/upload/2801/attach/fulltext_whitepaper3_e.pdf.

JST – Japan Science and Technology Agency. JST's mission is to promote science and technology which will "create new values and lead to the future, in order to advance the national welfare and prosperity[8]". As declared in part III of it's vision, JST aims:

"To advance science and technology for sustainable development, while playing a role in Japan's leadership in the S&T field in the face of global society."

It also states it has a role in supporting international research and exchanges, organised at government department, agency and research levels. JST has regional offices in Paris, Singapore, Washington and Beijing.

Relevant JST documents and resources in the area of sustainability include:

JST Center for Low Carbon Society Strategy[9]

JST activities towards Low Carbon Society[10]

Technology Research Partnership for Sustainable Development (SATREPS)[11]

Advanced Low Carbon Technology Research and Development Programme[12]

Green Innovation – JST Symposium and report[13]

Information on researcher exchange and research support can be found here: www.jst.go.jp/EN/menu4/01.html

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6 http://www.eaj.or.jp/index-e.html
7 http://www.iges.or.jp/en/index.html
8 http://www.jst.go.jp/EN/about/index.html
9 http://www.jst-lcs.jp/en/index.html
10 http://www.jst.go.jp/pr/img/gisympo2010/presentationFile_10.pdf
11 http://www.jst.go.jp/global/english/about.html
12 http://www.jst.go.jp/alca/en/
13 http://www.jst.go.jp/pr/gisympo2010e.html

Research highlights can be found in the JST highlights booklet[14].

JSPS – The Japan Society for the Promotion of Science[15].

METI – Ministry of Economy, Trade and Industry[16]. The ministry has one major research institute, the National Institute of Advanced Industrial Science and Technology. (O'Sullivan 2011).

MEXT – Ministry of Education, Culture Sport, Science and Technology[17]. MEXT is the primary funder of university-based manufacturing-related research, primarily through JST and JSPS. (O'Sullivan, 2011).

Monozukuri (or Monodzukuri). In Japanese the words mean mono (thing) and (zukuri) the process of making things. The direct translation however does not however cover the full meaning. The word is associated with the desire to craft excellent products and an ability and pride in constantly striving to improve production systems, processes and craftsmanship (O'Sullivan 2011).

NEDO – New Energy and Industrial Technology Development Organisation[18]. Supports R&D for industrial energy and environmental technologies. NEDO has a dual mission to enhance Japan's industrial competitiveness and address key energy and global environmental challenges. NEDO's budget for it's industrial technology development activities is around £1 Billion. (O'Sullivan, 2011).

Sustainable manufacturing. The term sustainable manufacturing[19] was used in two senses during the trip by the hosts. In one sense it reflected the role of manufacturing in the move to a less resource-intensive, more equitable society. The second meaning referred to the longevity of manufacturing industries, addressing concerns regarding the ageing society, loss of skills and other competitive pressures. Although the terminology involved in discussing industrial sustainability differed (with sustainable manufacturing appearing as a key theme), the underlying challenges identified across many of the visits were common. The distinction is elaborated on by Nakano (2010).

TSB – Technology Strategy Board[20]. The UK's national innovation agency. Their goal is to accelerate economic growth by stimulating and supporting business–led innovation.

WRAP – Waste Resources and Action Programme[21]. UK government-funded body responsible for resource efficiency efforts in the UK. WRAP acts as a coordinator across government, retailers, manufacturers and recyclers in order to help stimulate progress in resource efficiency and make a "measurable difference to the way the UK uses and thinks about resources."

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[16] http://www.meti.go.jp/english/index.html
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[18] http://www.nedo.go.jp/english/index.html
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