

### Welcome from Dr Ajith Parlikad



The beginning of new academic year is always an exciting time – new opportunities, new people, and festive spirits as we look forward to Christmas parties.

On the other hand, we see the winter approaching, and wonder what it plans to bring with it this year.

The importance of maintenance becomes all too clear to the average consumer especially during the winter months as energy bills rise and our boilers and cars creak under the severe conditions. Over the last few years, we have developed a strong research capability in maintenance and through-life management of industrial systems. Examples of our work in this area include fault diagnosis and maintenance planning at Hitachi Rail, analysis of information risks in asset planning at Scottish Water, and developing inspections strategies for Exxon Mobil.

We are excited to announce the launch of new research activities in infrastructure asset management – funded by industry and government. In a time when most of the national infrastructure in the Western world is suffering from under-investment, exploring opportunities to maximise the whole-life value of infrastructure assets is highly critical. We look forward to working with our industrial partners in this exiting venture.

*Dr Ajith Parlikad is a deputy director of the Distributed Information and Automation Laboratory.*

### Meet DIAL's New PhD students:



**Torben Jess** joined DIAL in October 2012 as a PhD student. He completed his Bachelor degree in Business Management and Engineering at the Karlsruhe Institute of Technology in Germany and his Masters degree in Computer Science at the University of Massachusetts in the USA.

During his Bachelor degree Torben had several internships at manufacturing and IT companies and before coming to Cambridge he completed a six month internship in a major international strategy consulting company.

During his Masters degree, Torben focused his research on Multi-Agent Systems.

Torben is working with Prof Duncan McFarlane, Mark Harrison and Philip Woodall on his PhD project. His research focus will be on developing new methods to automatically manage industrial information and determine what information is most valuable.

Beside research Torben likes to go running from time to time and since arriving in Cambridge, he has become very interested in learning to row.



**JiaQiang (JQ) Wang** also joined DIAL in October 2012. JQ graduated from the University of Southampton with a BSc in Information Technology in 2011. He completed his MPhil Technology Policy at the Judge Business School, University of

Cambridge in 2012.

JQ's supervisor is Dr Ajith Parlikad and together they are working on topics related to engineering asset management.

## Meet DIAL's Visitor: Ivian Casali



Ivian Casali is a third year undergraduate Industrial engineering student at the University of Espirito Santo in Brazil, where she has held a position of a junior researcher in supply chain management, focusing

on the fresh produce sector.

She will be a visitor in DIAL group for 10 months, from September 2012 to July 2013. During this time Ivian will be working on a logistic project under the supervision of Vaggelis Giannikas and Professor Duncan McFarlane.

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## Meet DIAL's new Research Associate: Dr Tariq Masood



Dr Tariq Masood joined DIAL in October 2012 as a research associate working on research projects related to whole life management of infrastructure – long term resilient data storage and provision in large scale infrastructure. Tariq gained his

PhD in Reconfigurable Manufacturing Enterprises from Loughborough University, where he was part of the Manufacturing Systems Integration Research (MSI) Institute. Dr Tariq Masood has recently worked as a Knowledge Transfer Partnership Associate at the Manufacturing & Materials Department of Cranfield University, while based at Rolls-Royce, Derby.

During his KTP, Tariq worked on developing next generation global service knowledge backbone to establish feedback on product design and manufacture so that operational disruption and maintenance costs are reduced at earlier product lifecycle stages. While based at Rolls-Royce, Tariq collaborated with global Rolls-Royce stakeholders mainly in the USA, Canada, Germany and the UK across the civil aerospace, defence, energy and marine sectors.

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## Recent DIAL Seminars

### **"Nested patterns in large-scale automotive supply chain"**

Alexandra Brintrup (Cranfield University), 4<sup>th</sup> October 2012, IfM, Seminar Room 2.

In her talk, Alexandra showed that macroscopic production characteristics of supply networks are neither randomly assembled nor purely hierarchical, but are highly nested based on two large-scale

empirical datasets describing the Toyota Motor Company and the Ford Motor Group. A nested pattern means that suppliers produce proper subsets of what other suppliers produce, and niche products are produced only by those firms that already have highly diversified product portfolios.

Preliminary examination hints that the pattern may be caused by large, older firms choosing to add new, unique products into their portfolio along a growth process, whilst small, young specialists produce only standard technologies. *Review by Vaggelis Giannikas*

### **"Intelligent data – The Aladdin project"**

Mark Harrison and Phil Woodall (DIAL), 6<sup>th</sup> September, IfM, Seminar Room 2

### **"A benefit management approach to reduce the risk of IT project failures"**

Dr Gilbert Fridgen (Research Center Finance & Information), Information management, Augsburg University, Seminar Room 1, IfM, 8<sup>th</sup> October.

Abstract: The probability of IT project failures can be mitigated more successfully when discovered early. To support this, transparency regarding a project's cash flow is necessary. Therefore a monetary analysis and calculation of a project's costs, benefits, risks and interdependencies is inevitable to enable comparability, not only of different projects but also of one project's progress at different points throughout its development. Until now, however, a method that appropriately considers costs, benefits, risks and interdependencies when estimating the project business case does not yet exist. Hence, we developed an approach to benefits management collaboratively in an Action Design Research setting. We gathered feedback from business practice (McKinsey & Co. and Hilti Corp.) regarding efficacy and applicability of the method while at the same time upholding scientific rigor. To enable an early detection of IT project failures this method can be integrated into a project management cycle. In this context, we define key figures for performance measurement and project steering, proving data if the project's future prospects indicate a continuation, demand for action, or even an early termination of the project. This approach to benefits management supports reducing the probability of IT project failures.

### **"Boeing Research and Technology", William Krechel**

(Boeing), 17<sup>th</sup> October, IfM, Seminar Room 3

### **"TIRM - A Risk Based Approach for Building Business Cases for DQ/IQ Improvement"**

Phil Woodall and Alex Borek (DIAL), 25<sup>th</sup> October, IfM, Seminar Room 2

## Creating Business Value Through Total Information Risk Management

Data and information have become “big” over the past few decades due to the massive rise of IT capabilities that are today embedded in the heart of every organisation and throughout our society. Getting across the value of improving information quality has, however, always been one of the hardest things to do in information management. The improvement of information quality is too often guided by managers' “gut feeling”. Alexander Borek, who recently submitted his PhD at DIAL, has developed an improved method that uses a risk based approach to find and quantify the value in data and information quality improvement. Traditionally, risk was considered in IT as something that needed to be mitigated, but our research shows that a risk based approach to information governance and quality management helps to fine-tune organisational effectiveness and increase the value of IT. The discourse in IT related to risk has so far focused on



risks in IT projects and risks of dysfunctional or insecure IT systems and has neglected information itself, which is the central resource managed by IT systems.

As part of the IQAM project (<http://www.ifm.eng.cam.ac.uk/research/dial/research/current/iqam/>) a process for Total Information Risk Management to manage these information risks on an organisational-wide scale has been designed. In particular, the process enables modelling and quantification of information risks that appear in the core business processes of an organisation and to determine the benefits of potential information risk treatment options. The process was developed in a rigorous design science cycle which included the application of the process in six industrial case studies in the production and utility sectors across Europe using participatory and non-participatory research. Complementary to the process, a mathematical model for the risk calculations and a mind-mapping inspired java simulation software tool were developed that supported the operationalisation of the process. Three main criteria for process testing were chosen:

- feasibility
- usability
- utility

The process was refined after each of the six implementation case studies in the industry using the feedback and insights that were collected during the studies. After the industrial testing was successfully completed, evaluation interviews with ten international information quality management experts from industry, consulting and academia were conducted to verify the wider acceptance of the Total Information Risk Management process as a new method to inform information governance and quality management. The studies show that a risk based approach to information management can provide valuable insights to set the right priorities for IT investments and information quality related organisational changes grounded in real factual evidence. Moreover, it could help to build convincing business cases for data and information quality management using quantitative figures based on a solid information risk assessment. There are also indications that the process can, as a result, lead to a better IT business alignment and IT benefit realisation. The details of how to apply the concepts and methods of Total Information Risk Management will be presented by Alexander Borek and Philip Woodall to industrial practitioners at the [Data Management and Information Quality Conference 2012](#) organised by IRM UK in London on November, 6<sup>th</sup>.

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## New projects with the Centre for Smart Infrastructure and Construction

DIAL is pleased to introduce two new EPSRC and TSB funded projects that are part of the Centre for Smart Infrastructure and Construction (CSIC):

- **Whole life management of infrastructure assets.** Making decisions regarding maintenance, refurbishment, renewal and investment in new assets based on optimal whole life value is a key to economic sustainability in asset-intensive industries. There is a rapidly growing demand for skills and tools to help resolve conflicts between short and long-term costs and benefits, risks and other business drivers. This project aims to develop tools and guidelines for optimising capital and operational expenditure required to maximise the value generated by infrastructure assets. In particular, we will examine how information from emerging sensing technologies in conjunction with asset and operational information can be exploited to balance through-life costs and risks. Our industrial partners for the project include London Underground, Scottish Water, The Woodhouse partnership, Lain O'Rourke and IBM.

- **Future proofing infrastructure – Long term resilient data storage and provision in large scale infrastructure.** A significant challenge in the sustainment of major infrastructural assets is the retention and on-going availability of critical data. This project aims to establish a base line for future needs of key infrastructure (potential changes and alterations, new usage modes, deterioration management, etc) and determining the nature of the information required to manage these needs. The project will also undertake surveying and examining possible strategies for futureproofing of infrastructural information and where possible providing simple demonstrations of technologies that might contribute to such strategies. Our industrial partners for this project include Cementation Skanska, Arup, Laing O'Rourke, IBM and RedBite.



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## A new project, DisTAL, funded by Boeing

Disruption Tolerant Automated Lean Factories (DisTAL) is a new research initiative funded by Boeing. The research project will run for the next three years developing production control systems required to enable complex manufacturing processes into the next decade. Many high-tech products produced in the aerospace sector are making increased use of lightweight composite materials and flexible high tolerance assembly techniques. Process constraints around the use of composite materials add complexity to the assembly process and these complexities need to be catered for within the production control system. Alan Thorne from DIAL has recently returned from Seattle where he has been carrying out a Disruption Analysis Study at Boeing that will put the groundwork in place for this research project. The project will go on to propose and develop production control systems that can better support the system in managing key disruptions. The DIAL lab will be used as a test bed in the development of these systems before they are migrated to Boeing.

The research project is headed up by Duncan McFarlane and Alan Thorne from DIAL with Craig Battles, Kevin Ung and Lindsey Caton from BR&T at Boeing.

## GS1 Industry and Standards event in Dublin

During 8 – 12 October, Mark Harrison and Vaggelis Giannikas attended the GS1 Industry and Standards event in Dublin.

Vaggelis attended the Transport and Logistics workshop, to understand how industry has adopted and used GS1 standards in logistics operations and better understand some of the challenges that could potentially be solved using intelligent products in a multi-modal logistics scenario. Mark was there to co-chair the launch meeting of a new technical work group 'Pedigree Security, Choreography and Checking Service', as well as presenting in the Auto-ID Labs session and participating in the GS1 Architecture group meeting.

The new work group is contributing to the standardization of electronic pedigree, primarily for the healthcare sector, but also applicable to other industry sectors. The main idea is to use the collection and checking of traceability information as a way of detecting when and where counterfeit products are inserted into the supply chain and preventing them from proceeding further or reaching patients and consumers. The work will make use of the Electronic Product Code Information Services (EPCIS) standard for the event data that will form the pedigree information. The idea of a checking service is to reduce the burden on downstream parties within the supply chain, by allowing any party to effectively outsource the task of checking all of the pedigree data for a specific product instance to an accredited third party solution provider. Defining open standards for the security framework and checking service will give end-users the flexibility to choose which checking service they use, as well as giving them the assurance and controls to ensure that the event data that they contribute to pedigree systems will not leak into the hands of their competitors.

At the Auto ID Labs session, Mark gave an overview of the research at the Cambridge Auto-ID Lab, as well as a presentation about Intelligent Products (based on research that Vaggelis Giannikas and Wenrong Lu are leading). He also gave a presentation about semantic web technology and how this can be relevant to manufacturers, retailers and consumers, helping consumers more efficiently find the products and services that match their needs, with less time spent searching across several different websites. More information about GS1 can be found at [www.gs1.org](http://www.gs1.org)



## DIAL's PhD student, Nipat Rasmekomen, on maintenance of complex engineering assets



With the advanced technologies available in industry, the nature of engineering assets has developed over time. More complicated systems of assets are presented in current climate. Examples of these, so called, 'complex engineering assets' are automated integrated production lines, trains, marine propulsion systems etc. Complex engineering assets usually involve multiple components or assets in an asset system. This could lead to several forms of interactions between the components in an asset. For instance, a failure or degradation of one component may cause another component or the whole system to degrade or fail faster. Maintenance studies on these assets can provide insights on how the interactions can cause problems that need additional maintenance.

Nipat Rasmekomen, currently a doctoral student in DIAL under the supervision of Dr Ajith Parlikad, is looking to provide these insights via a mathematical model. An initial case study conducted in a transportation sector has proved that potential cost savings are evident in industrial practice of maintenance of complex engineering assets. Nipat is also looking to carry out further case studies to implement the concepts in real-world applications. Please email [nr324@cam.ac.uk](mailto:nr324@cam.ac.uk) for more information.

## Recent Research Publications

Woodall, P., Borek, A., & Parlikad, A. (2012). Customised Data Quality Improvement. In Proceedings of the International Conference on Information Quality (ICIQ), Paris, France.

Woodall, P., Koronios, A., Gao, J., Parlikad, A., & George, E. (2012). An Investigation into Data Quality Root Cause Analysis. In Proceedings of the International Conference on Information Quality (ICIQ), Paris, France.

Woodall, P., Oberhofer, M., & Borek, A. (2012). A Preliminary Study on Methods for Retaining Data Quality Problems in Automatically Generated Test Data. In Proceedings of the Americas Conference on Information Systems (AMCIS) 2012, Seattle, USA.

Borek, A., Helfert, M., Woodall, P., & Parlikad, A. (2012). Design and Evaluation of Management Processes in IS: Application of a Process-Based Research Approach. In M. Helfert & B. Donnellan (Eds.), Practical Aspects of Design Science, Communications in Computer and Information Science (Vol. 286, pp. 27–37). Springer Berlin Heidelberg.

T. Masood, and R. H. Weston, "Modelling Framework to support Decision Making in Manufacturing Enterprises," *Advances in Decision Sciences*, vol.2012, Article ID 234939, 42 pages, 2012.

## Future Event: IET Asset Management Conference

Following the very successful event last year, the IET Asset Management conference this year will be taking place on 27 - 28 November 2012 at The Queen Elizabeth II Conference Centre, London, UK. This is the number one conference for professionals and academics involved in asset management and is attended by delegates from all over the globe.

With even higher standards and numbers of submissions this year, the conference will be offering dual and tri-parallel streams, more posters than ever before, a series of workshops, and still all run in conjunction with the IAM's Annual Lecture and Dinner. The conference covers all aspects of asset management including both principles and processes, technical and managerial aspects focusing on tools, standards and data and the application of business processes. Delegates come together to learn and exchange the latest technical knowledge, and to meet and network with other like-minded individuals.

For more information see:

<http://conferences.theiet.org/asset/>

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If you are interested in anything that has been featured in the newsletter or would like further information about DIAL, then please do not hesitate to contact us on [dial-enquiries@eng.cam.ac.uk](mailto:dial-enquiries@eng.cam.ac.uk) or call Petra Kasmanova on +44 (0)1223 764306.

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