



DIAL Quarterly July 2013: Information Quality Assessment tool, Masters Projects 2013, Information Requirements in Service & Construction and much more.

Introduction from Dr Ajith Parlikad



Welcome to the summer issue of the DIAL newsletter. It has been an exciting year so far – both in terms of research as well as in reaching out and collaborating with our industrial partners. Over the summer months, we will be exploring new initiatives and opportunities for

research and industrial engagement. To name one such initiative, we will soon be launching a new network of asset management researchers and academics in collaboration with the Institute of Asset Management.

There is a popular saying that information is like radioactive gold. It is a highly valuable asset to any organisation in this digital era. However, if not managed properly, it can greatly affect operational efficiency and effectiveness. Understanding what information is needed, and ensuring that the information is of good quality is critical. In this issue, we introduce our work in the area of information requirements analysis, information quality risk assessment, and intelligent data management. Our talented pool of students is key to DIAL's success - this issue also highlights some of the exciting work done by them.

I hope you have an enjoyable summer – and some time for reflection!

Positions available in DIAL

DIAL is currently recruiting two research associates to work on research projects looking at improving manufacturing automation solutions. If you would like more information please contact Petra Kasmanova (dial-admin@eng.cam.ac.uk)

Congratulations to Dr Rachel Cuthbert!



Rachel Cuthbert has recently finished her PhD research titled "The Information Requirements for Complex Engineering Service Contracts". Rachel has been working as a research associate in DIAL since 2007. We would like to thank her examiners, Professor Mike Bourne from Cranfield University and Professor Sergio Cavalieri from the University of Bergamo, Italy.

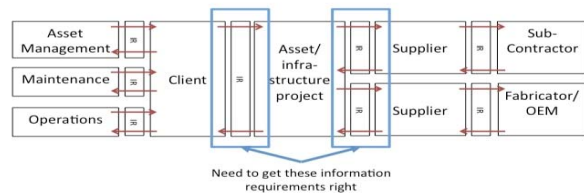
DIAL's visitor Sushant Agarwal



Sushant is currently studying for his masters degree in aerospace engineering at the Indian Institute of Technology in Bombay. Sushant first worked with DIAL in May last year. During his two-month internship, he worked on Data

Quality Assessment for the ALADDIN research project. In May this year, Sushant joined DIAL for a second time to work on Failure Diagnosis processes and fault-data management for modern locomotive systems. He implemented a fault diagnosis technique and developed

interrelated user interfaces that can support effective diagnosis processes and ultimately facilitate the work of maintenance workers. In the context of this research, Sushant has developed a number of C# functions that can reason together to diagnose the underlying causes of trains' failure. To inform the reasoning of those functions, he also implemented a relational database in MySQL.



Senior Academic Promotion for Ajith Parlikad!



We are very pleased to announce that Dr Ajith Parlikad, the deputy head of DIAL, has been made a Senior Lecturer. Ajith's promotion will take effect from 1st October 2013. Congratulations to Ajith!

Information Requirements in Service and Construction

Understanding the information requirements for an organisation is an area which is often seen to be challenging. Of particular interest in recent work has been an understanding of information requirements in the context of Complex Engineering Services (CES). Within this domain, issues arise around what information is required, how available this information is to the information user, and the source/sharing of the information.



Through past research in the CES domain, tools have been developed to support the elicitation of information requirements throughout the service life cycle. Through the application of these, it has been seen that there is a significant impact on the information requirements to support such services, as a consequence of the types and characteristics of contract used to support them.

In the infrastructure and construction sector, information requirements are also a problem area. Particular issues prevalent within the industry are understanding the "minimum" information requirements, the types of information required, and the criticality of decisions made using this information, how

Construction Supply Chain

the required information is collected, owned, stored, controlled, used, shared, and, furthermore, how does Building Information Modelling (BIM) address life cycle information needs.

Through ongoing research within the Centre for Smart Infrastructure and Construction (CSIC), a number of these issues are being researched in order to understand:

- Which information is required for whole-life management of infrastructure and assets?
- Can service information requirement tools be adapted for infrastructure and asset IR?
- To what extent does BIM and related standards meet lifecycle IR needs?

Of particular interest is to understand issues of information handover between the plan-design-build phase of the asset life cycle, and the operate-maintain phase. For further information contact Rachel Cuthbert (rc443@cam.ac.uk)

DIAL's PhD candidate Torben Jess

During the first 10 months of his PhD Torben worked on three major projects. Firstly, a project on using network science for data management, secondly, a project in identifying criteria for using multi-agent systems, and thirdly, the definition of his PhD topic.



The network science project tried to use techniques from network science in order to understand and analyse data management in a better way. Torben is working with Alexandra Brintrup (a former member of DIAL, and currently Lecturer in Manufacturing Informatics at Cranfield University), capitalising on her experience from supply networks.

For the project on multi-agent systems, Torben is addressing issues around deciding when a multi-agent systems is the right approach to a problem. The main issue he is currently working on is finding measurable criteria for the selection of agent architecture in

comparison to potential alternatives. Current research using agent techniques often just assumes that a multi-agent system is an adequate solution to a problem. But it does not further analyse this assumption; it is simply justifying it based on various qualitative criteria. In developing an agent-based and a non-agent-based approach towards the same problem, several experiments comparing these systems will help to better understand when and where agents should be used in the future.

As his third project, Torben is defining his PhD topic and writing his first year report. The topic of his PhD will be "Active market-based industrial data management". The goal of this approach is to make data management more dynamic and value-of-information based. He presented his PhD project during the IfM First Year PhD conference in May this year and was awarded the second prize in the IfM poster competition.

In addition Torben is working on the ALADDIN project together with Mark Harrison, Philip Woodall and Duncan McFarlane in order to improve Boeing data management using machine learning techniques.

Information quality risk assessment tool

It is widely accepted in research and practice that the success of any business is highly dependent on the information available, upon which various decisions are based. Poor information quality can increase capital and operating costs, diminish performance, and endanger environmental and safety compliance. Based on research of information quality problems and solutions in various industries in recent years, DIAL has developed an information risk management process and tool that enables companies to assess and treat organisation-wide risks that arise through poor data and information quality. The tool has a strong mathematical underpinning, and was tested in six industrial organisations spanning various industry sectors such as manufacturing, electricity and water networks.

We have identified six core benefits of using our tool for data and information management:

- Better understanding of how data and information quality affect your business.
- Focuses data and information quality initiatives on the "pain points", where they bring the best business value.
- Offers financial measures to build more sensible business cases for information quality.
- Protects your business against exposures that arise from poor information quality.

To learn more about information risk management, and to understand the risks posed by poor data quality to your organisation, contact Ajith Parlikad (aknp2@cam.ac.uk).

A book that describes our information risk management process is currently being compiled, and will be published in November this year by Elsevier. So watch this space!

Maintenance Optimisation for Complex Engineering Assets

Nipat Rasmekomen, a PhD candidate in his third year, is currently researching on the topic of maintenance optimisation for complex engineering assets under the supervision of Dr Ajith Kumar Parlikad. With advanced technologies available in industry, the nature of engineering assets has developed over time. More complicated systems of assets are being presented in the current climate. Examples of these, so called, 'complex engineering assets' are automated integrated production lines, trains and marine propulsion systems. Nipat is developing a mathematical model which uses the degradation data of multiple components or assets in an asset system to predict possible interactions between them. Maintenance policies derived from the model for such assets can allow potential cost savings and risk reduction when compared to traditional methods of maintenance planning. An initial case study conducted in a transportation sector has proved the applicability of the model in an industrial practice. Nipat is also looking to carry out further case studies to implement the concepts in real-world applications. Please email nr324@cam.ac.uk for more information.



Manufacturing Engineering Tripos (MET) Projects 2013

We have had a number of successful Masters student projects over the Easter term. Many thanks to all of our students for the hard work they have put in, helping us move our research forward!

Charlie Hughes examined the process of designing asset management systems, specifically investigating the role of customer involvement in the design process. In particular, she looked at defence contracting, where the MoD outsource the provision of aircraft availability to the private sector and where there is the added complexity of combining civilian and military personnel and responsibilities. The asset management system design lifecycle was split into five stages, and key areas for improvement were identified, based upon which a set of guiding principles was developed.

Logan Bishop developed process guidance for “blending” different asset management decisions made during the asset life cycle. Blending describes the process of analysing the interactions between scheduled asset management tasks, with the outlook of optimising whole Life Cycle Cost of a single asset. Logan proposed a mathematical framework to solve such problems and demonstrated the benefits using a case study in the water industry.

Edd West examined disruption tolerant automated lean factories (DisTAL). As part of this activity Edd identified different production processes that are susceptible to operational variability and will thus provide a suitable test bed for an ongoing research activity within this project. Edd's work highlighted vacuum forming as a potential candidate process and work is currently ongoing to look at how this technology can be introduced in to the lab.

Chris Ashby's project developed a discrete event simulation describing arrival and departure procedures being trailed within the Operational Freedoms programme at London Heathrow Airport. This model examines the benefits that these new arrival and departure procedures provide when catering for different weight categories of aircraft. Initial results show that the model is representative of Heathrow operations but further work is required to reflect operational rule sets being used by the Air Traffic Control (ATC). This work will be continued in future projects.

Recent Research Publications

Woodall, P., Borek, A. and Parlikad, A.K. (2013) Data quality assessment: The Hybrid Approach. Information & Management, 50 (7), pp.369-382. This paper proposes a new way of assessing the quality of industrial data, and was applied within London Underground Ltd to help improve the quality of maintenance data for one of the main underground lines.

Masood, T. and Weston R.H. (2013) "Modelling Framework to Support Decision-Making in Manufacturing Enterprises", Advances in Decision Sciences, vol. 2013, Article ID 234939, 23 pages, URL: <http://dx.doi.org/10.1155/2013/234939>

Masood, T., Weston, R. and Rahimifard, A. (2013) "A model-driven approach to enabling change capability in SMEs", International Journal of Advanced Manufacturing Technology, Article in press, May 2013, URL: <http://link.springer.com/article/10.1007/s00170-013-4853-9>

Dheedan, A., Parlikad, A., (2013) "Integrated Monitoring Tasks for the Safety of Critical Systems" Paper accepted for publication and presentation at the 4th IFAC Workshop on Dependable Control of Discrete Systems (DCDS 2013). DCDS 2013 is to be held at the University of York, UK on September 4-6, 2013.

Rasmekomen, N., Parlikad, A. K., (2013), Maintenance Optimization for Asset Systems with Dependent Performance Degradation, IEEE Transaction on Reliability, Vol. 62, No 2, June 2013.

Srinivasan, R., Parlikad, A.K., Value of Condition Monitoring in Infrastructure Maintenance, Computers & Industrial Engineering, DOI: 10.1016/j.cie.2013.05.022

IfM Innovation Fund Award – A New Manufacturing Journal

On 10 July, the IfM held a Dragons’ Den-style event to reward innovative ideas that will improve the impact of IfM research. The five winning projects, which ranged from a manufacturing journal run by the IfM to a web-based platform to share knowledge within and outside the IfM, were each awarded £1,000.

Dr Tariq Masood (DIAL) and Dr Mohamed Zaki (Cambridge Service Alliance) won IfM Innovation Fund Award to start a manufacturing journal for an industrial and academic audience. It is intended to be a peer-reviewed free online journal covering all IfM related research areas.

Tariq and Mohamed are currently in the process of setting up the journal and forming the editorial board having representation from academia and industry. If you are interested in contributing to the journal by writing or reviewing articles, please get in touch with Tariq (tm487@cam.ac.uk).



Tariq Masood with “one of the dragons” Andy Neely

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 or call Petra Kasmanova on +44 (0)1223 764306.