

ABSTRACTS

Introduction

The following pages list all the abstracts for papers to be given at the conference. They are group by Stream and are listed in the date/time order in which they appear in the overall timetable. Please remember that some streams are split over more than one day.

Please note that this may be subject to change

To help delegates select relevant and accessible papers, each submitting author was asked three questions. The questions and their range of answers were:

What is the nature of your talk?

- Very practical
- Practical
- A mix of practical and theoretical
- Theoretical
- Very theoretical

Does your talk require prior knowledge of the subject area?

- None
- A little
- Some
- Quite a lot
- Subject experts only

Is your talk accessible and relevant to Practitioners?

- Not at all
- Somewhat
- Relevant
- Very
- Highly

The three answers to these questions are listed after each abstract.

Analytics



Organiser: Nigel Phillips

08/09/2016 : 11:30 : Room-DS1.11

Code: OR58A1832

Segmented Stylometry: Creating a Text Analytics Approach to Automatically Identify "Contract-Written" Student Coursework

Mr Michael Mortenson and **Mr John Waller** (*University of Warwick*)

The rise of companies who offer essay-writing services to students has been widely acknowledged in universities, as well as in the popular press. This presents a significant problem for universities as it is very difficult to detect cheating of this kind with traditional means. This talk presents an algorithmic solution to this problem that draws upon text analytics, machine learning and stylometry (the analysis of variations in literary style between authors). The system takes an input the full set of coursework submissions from all students, and seeks to identify a model of their stylistic ticks (such as frequently used words and phrase, and various metadata such as paragraph lengths, number of references and chapter structure). Using this model, machine learning methods can be used to classify each item to an author, with any mis-classifications (papers that are not shown to be written by the stated author) used to flag up potential contract-writing issues. Additional approaches are used to counter the issue of similarities based on subject – the fact that particular questions and topics lead to their own word frequencies and stylistic approaches – creating a segmented, hierarchical solution to the problem.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Very

08/09/2016 : 12:00 : Room-DS1.11

Code: OR58A1851

Quantified Self by iPhone: Continuous Monitoring, Non-Linear Modelling and Nowcasting of Daily Step Count Variations over 1.5 years in UK

Dr Borislav D Dimitrov (*University of Southampton*) and **Mr Todor Balabanov** (*Institute of Information and Communication Technologies, Bulgarian Academy of Sciences*)

Time series data of hourly step counts were self-recorded continuously for an interval >1.5 years (n>13960 hours) in a male volunteer, aged 48 (one of the authors). The self-quantification was performed by the inbuilt iPhone 5 accelerometer with monitoring, control and visualisation via the free iOS application "Health". The subsequent export and transfer to a computer of the total number of steps per day was done via the free iOS application "QS" by email (manually) in an anonymised comma-delimited (*.csv) time-series format. In total, 3,117,104 steps were recorded during 582 days (daily mean 5355, SD 3185) mainly during the normal diurnal working and walking activity hours. The time series of the total daily data was analysed by non-linear modelling approaches, including exponential smoothing, periodogram regression analysis (PRA) and artificial neural network (ANN) algorithm. Two main cycles of 3.5 and 7 days were described in the total daily step count variations, with amplitude and phase estimation in both original and ANN-modelled data (nowcasting). If further automated and scaled-up algorithms and applications for data extraction (export), transfer, analysis, forecasting, visualisation and feed-back of the results are developed to extend our approach, self-quantified distance monitoring and advisory (decision-support making) systems with time-adjusted chronomics triggers at individual level could be tested and implemented for personalised walking activity promotion, fitness improvement, healthier ageing and disease prevention.

What is the nature of your talk?: A mix
Does your talk require prior knowledge of the subject area?: Some
Is your talk accessible and relevant to Practitioners?: Relevant

08/09/2016 : 13:15 : Room-DS1.11

Code: OR58A1907

Business Analytics and Data Visualisation At The Ministry of Justice

Dr Jonathan Roberts (*Ministry of Justice*)

The Ministry of Justice is overhauling the use and visualisation of data as part of a drive to become more 'data driven', bringing analytics into the heart of decision making. We are creating a series of interactive dashboards to allow officials and the public to interrogate departmental statistics and performance data in a more intuitive way than the pdf documents and CSV files we currently publish. The dashboards are made in Tableau, and hosted on the Tableau Public server. The first two dashboards focus on Crown and Family courts, and allow the user to investigate performance in the justice system, yielding surprising insights into what's happening in courts around the country. In this talk we will present from the dashboards, and discuss how they represent a completely new way of using business analytics and data visualisation to be more transparent and drive improvements in the Justice System.

What is the nature of your talk?: Practical
Does your talk require prior knowledge of the subject area?: None
Is your talk accessible and relevant to Practitioners?: Very

08/09/2016 : 13:45 : Room-DS1.11

Code: OR58A1918

Dominance Relation and 80–20 Rule-Based Multiple Criteria Clustering Algorithms

Dr Salem Chakhar (*University of Portsmouth*), **Mr Tom Baldwin** (*Polaris Consulting Limited*), **Mr Nhat Hoang Dau** and **Dr Djamila Ouelhadj** (*University of Portsmouth*)

The objective of this talk is to introduce two new clustering algorithms permitting to group a set of decision objects described by multiple criteria into a set of ordered classes. The input of the two algorithms is a graph-based representation of the dominance relation where the vertices correspond to the decision objects and the edges to the dominance relation between pairs of decision objects. The algorithms are composed of two successive steps. In the first step, an initial set of decision classes is constructed using either a top-down (from the most preferred class down to the less preferred) approach or a bottom-up (from the less preferred up to the most preferred decision class) approach. In the second phase, the 80-20 rule is used to refine the initial set of decision classes into a manageable set of classes. The algorithms are illustrated using different real-world datasets. The evaluation of these algorithms shows that they reproduce almost perfectly the classification established by the experts.

What is the nature of your talk?: A mix
Does your talk require prior knowledge of the subject area?: Some
Is your talk accessible and relevant to Practitioners?: Relevant

08/09/2016 : 14:45 : Room-DS1.11

Code: OR58A1656

Document Analysis Using Homology

Mr N Phillips (*London South Bank University*)

Typical approaches to document analysis you some variation of measuring distance between documents based on a measure of the words they contain in order to produce clusters of similar documents. These approaches can be quite effective for search applications and for categorisation problems however, they are less useful for knowledge discovery: finding interesting relationships in documents that were not previously anticipated. This paper presents details of a homological approach to analysing corpora that offers a structured-based approach that shows promising in overcoming these limitations. The basis of the analysis is explained and results of applying the technique are explored using two challenging data sets.

What is the nature of your talk?: A mix
Does your talk require prior knowledge of the subject area?: A little
Is your talk accessible and relevant to Practitioners?: Very

Behavioural Operational Research



Organiser: Sally Brailsford

06/09/2016 : 11:00 : Room-DS2.13

Code: OR58A1610

Simple Decision Models? A Synthesis of Three Literatures

Prof Konstantinos Katsikopoulos (*Max Planck Institute for Human Development*) and **Prof Ian Durbach**

(*University of Cape Town*)

Many decisions can be analyzed and supported by quantitative models. These models tend to be complex psychologically in the sense that they require the elicitation and combination of quantities such as probabilities, utilities, and weights. We discuss three strands of work which have asked if and how should these decision models be simplified. There is not much communication among the strands and they have not arrived at the same conclusions: Research on the preference strand has shown that simple models sometimes approximate well the more complex models; the inference strand has put forth conditions under which simple models are more effective than complex ones; and some forecasting researchers have proposed that simple models should be preferred. We argue that the conclusions can be reconciled by noticing that (1) preference research assumes a model of the data, which is typically complex, and evaluates the loss that simplifications incur relative to this model, whereas (2) inference and forecasting work compare simple and complex models on predicting the data directly. The end goal of this work is a theory which specifies a-priori when simple models perform better than more complex models, and vice versa. We review various useful results, but also note that no general results are available yet. We conclude by discussing if and how should decision research and practice change with respect to using simple models.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Highly

06/09/2016 : 11:30 : Room-DS2.13

Code: OR58A1668

Engaging with Behavioural OR: A Guiding Framework for Empirical Studies

Prof Luis Alberto Franco (*Loughborough University*) and **Prof Raimo Hamalainen** (*Aalto University*)

The power of this behavioural perspective lies in its ability to identify the conditions under which the impact of OR-supported processes is enhanced or hindered by behavioural factors, with a view to developing more effective OR practice. To help organise and guide the conduct of empirical studies in behavioural OR (BOR), we draw on practice theories from the social and organisational sciences to propose a guiding framework based on the three central concepts of OR methods, OR actors, and OR praxis. In discussing these concepts, we refer to the developing empirical BOR literature to highlight alternative analytical foci. The implications of the behavioural perspective for advancing the OR discipline will also be addressed, particularly with regards to foregrounding OR praxis in academic papers, attending to a wide diversity of OR actors, developing OR competences, and the role of theory and research methodology.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Very

06/09/2016 : 12:00 : Room-DS2.13

Code: OR58A1901

Behaviour Validation in Discrete Models through a Game Theoretic Approach: A Hybrid Systems Modelling Approach

Dr Navonil Mustafee and **Dr Surajeet Chakravarty** (*University of Exeter*)

Model validation and verification (V&V) is critical to the success of a modelling and simulation (M&S) study as it ensures conformity of a computer model with an existing or a proposed system of interest, and thus provides the stakeholders with the confidence of using the model as a tool for experimentation. Model validation can be defined as the process of building the right model and ensuring that the input-output transformation of the model is sufficiently representative of the transformation that takes place in the system of interest; model verification concerns with building the model itself and ensures that the model is transformed from one form into another with sufficient accuracy (Balci, 1995). In literature we find V&V approaches being applied to the various stages of a simulation study, e.g., conceptual model validation, computer model verification (Sargent, 2011). We propose an extension of this body of research to also incorporate behaviour validation through game-theoretic approaches. Game theoretic modelling helps to analyse multi-decision maker interactions. Factors that are relevant from the real world issue, which the modeller is trying to analyse, are taken to form an abstract representation. Attention is paid to decision-maker or players involved, the choices they have and the benefits they receive from making these choices. The interaction of choices is analysed by studying the solution or the outcome of the interaction of choices. Empirical validity of the solution is often provided by lab and field experiments where the interaction between the players is replicated in a controlled environment. This captures user behaviour and provides an understanding of how the players are likely to behave in a real world situation. Using a Hybrid Systems Modelling Approach combining game theory with discrete modelling will thus enable us to gain from behaviour validation in an M&S study.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

06/09/2016 : 13:30 : Room-DS2.13

Code: OR58A1694

Threads of Validation: Using the TOC Thinking Process to Complement Qualitative Research

Prof Victoria Mabin and **Prof John Davies** (*Victoria University of Wellington (VUW)*), **Dr Sarah Kimani** (*Catholic University of Eastern Africa*) and **Dr Maryam Mirzaei** (*Victoria University of Wellington (VUW)*)

Purpose: This paper describes an approach to conducting qualitative research that we have been experimenting with over the last decade through a number of postgraduate research projects. It draws on the Theory of Constraints (TOC) logic-based 'thinking process' tools to build coherent arguments from qualitative research data collected and analysed using a combination of TOC tools and qualitative research methods. **Design/methodology/approach:** The methodology has been developed iteratively over 7 separate postgraduate research and action research projects, successively adopting and adapting both TOC and qualitative research tools. **Findings:** The combination of the two approaches has provided many advantages: TOC guides the construction of interview questions to elicit the required data; TOC causal mapping facilitates robust and clear argument; and TOC's logic protocols provide threads of validation which are manifest through both narrative and diagrams. In turn, qualitative research methods provide many useful complements to the TOC approach, such as triangulation, saturation and case study protocols, while quotes from interviews are used to bring TOC-style statements to life. **Research implications:** The use of TOC methods with qualitative research appears to guide research design and clarify the logic of argumentation, making it easier to communicate and critique claims. **Practical implications:** Using the TOC methods provides beneficial structure and support for qualitative researchers and vice versa. **Originality/value:** In addition to the novel use of TOC and qualitative methods together, the particular combination of TOC tools differs from the standard TOC approach, using some of the newer or lesser known tools such as the Goal tree and focused Current Reality Tree. The approach is markedly different from mainstream qualitative research.

What is the nature of your talk?: A mix
Does your talk require prior knowledge of the subject area?: Some
Is your talk accessible and relevant to Practitioners?: Relevant

06/09/2016 : 14:00 : Room-DS2.13

Code: OR58A1737

New Challenges for Action Research

Prof Frank Stowell (*UoP*) and **Dr Shavindrie Cooray** (*Curry college*)

Action Research [A/R] has been an important approach for investigating organisational behaviour for many decades. The argument for such an approach says that to understand the way in which the enterprise operates and, importantly, how those that make it up collaborate the inquirer should become a part of that enterprise; A/R enables the inquirer to gain insight by being a part of the enterprise rather than being a neutral observer. But the advent and ways of employing modern Information and Communications Technology (ICT's) has created new challenges for those who favour this approach. Because the flexibility of ICT's offers the means for geographically dispersed members to communicate, either synchronously or asynchronously, it has created an opportunity to employ experts from anywhere around the globe. This has led to the rise of virtual teams and new challenges for those wishing to employ A/R. For example, teams dispersed across the globe may not share a common language or culture with the parent company. Recent research shows that virtual team are typically more conflictual than face to face teams because team members are more unlikely to change their initial personal biases and perceptions through discussion when interacting with others virtually. How then does the action researcher undertake their investigation given these new circumstances' how do they engage and become a part of the enterprise? In this paper we discuss the ways in which A/R has been applied and the challenges they now face. We draw on lessons learnt during additional studies and SPMC workshops to offer a framework of common characteristics that a method of soft inquiry suited to ICT should possess. We suggest that Soft AR can increase its popularity outside of academia by adapting to the new work practices and changed culture that ICTs have engendered in the workplace.

What is the nature of your talk?: A mix
Does your talk require prior knowledge of the subject area?: Some
Is your talk accessible and relevant to Practitioners?: Very

06/09/2016 : 14:30 : Room-DS2.13

Code: OR58A1783

Measuring the Impact of Service Quality on Customer Satisfaction within the Hospitality Industry: A Case Study

Dr Golda Komanapalli, Dr Alexander Kofinas and **Ms Melinda Halasz** (*University of Bedfordshire*)

This presentation explores dimensions of service quality and their impact on customer satisfaction. The research is set in the UK hospitality industry with a theoretical framework based on service quality and customer satisfaction. The main hypotheses is designed based on the support from a literature review carried on disconfirmation model, SERVQUAL gap model, and service quality dimensions to test the SERVQUAL model by Parasuraman et al. Data was collected from a Holiday Inn hotel through self-administered questionnaires. The empirical investigation involved the use of correlation to identify linear relationships between the variables. The study offers little support to the work of Parasuraman et al., in the context of hospitality industry. Given that there are two service quality dimensions that are intangible upon reviewing the empirical evidence of correlation we explored further the linear relationship between service quality dimensions and customer satisfaction and developed a causal model to identify the relationships that help reverse the direction from moderate to weak correlation to moderate to strong correlation.

What is the nature of your talk?: A mix
Does your talk require prior knowledge of the subject area?: None
Is your talk accessible and relevant to Practitioners?: Very

06/09/2016 : 15:30 : Room-DS2.13

Code: OR58A1678

Debiasing Overconfidence in the Elicitation of Continuous Probability Distributions

Dr Valentina Ferretti (*London School of Economics and Political Science*) and **Prof Gilberto Montibeller** (*Loughborough University*)

Decision problems often involve alternatives that have uncertain impacts, particularly in the appraisal of complex policies, such as in health, counter-terrorism, or urban planning. Furthermore, many of these impacts are hard to estimate, because of the lack of conclusive data, few reliable predictive models, or conflicting evidence. In these cases, decision and risks analysts often use expert judgment to quantify uncertain impacts. Behavioural decision researchers have identified numerous biases that affect experts in such estimates and therefore impact the quality of a decision analysis. A recent review of cognitive and motivational biases in decision analysis, conducted by Montibeller and von Winterfeldt, identified overconfidence as a relevant bias in this elicitation task, both in terms of its prevalence and its persistence against attempts to reduce it (such as warning the experts about the bias). They also listed a series of debiasing strategies employed in practice by decision analysts, noting the limited evidence about their effectiveness in more controlled experimental settings. The aim of the talk is to report on our early findings from two experiments we recently conducted to test the effectiveness of several debiasing strategies. In particular, in order to reduce overconfidence when eliciting continuous probability distributions, we investigated the effects of using fixed values versus fixed probabilities and counterfactuals versus artificial stretching (joint research with Sule Guney and Detlof von Winterfeldt from the University of Southern California).

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Highly

07/09/2016 : 09:30 : Room-DS2.13

Code: OR58A1730

A Decision Rule Approach for Analysing the Attractiveness of Crowdfunding Projects

Dr Salem Chakhar, Dr Joe Cox, Prof Alessio Ishizaka, Dr Liz Meech, Dr Thang Nguyen and **Prof Andy Thorpe** (*Portsmouth Business School, University of Portsmouth*)

The objective of this paper is to analyze the attractiveness of crowdfunding projects. First, a priori and posteriori information are used to assign the projects into a set of ordered attractiveness classes. Subsequently, a well-known multi-criteria sorting method, namely the Dominance-based Rough Set Approach (DRSA), is used to generate a collection of if-then decision rules that permit us to summarize and generalize the information provided to investors. The dataset used for illustration is obtained from the crowdfunding platform Lendwithcare.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

07/09/2016 : 10:00 : Room-DS2.13

Code: OR58A1805

The Effect of Customer Behaviour on Demand Forecasting

Dr Jonathan Malpass (*BT*)

Accurate forecasts of demand is essential for resource planning. For many years BT has striven to increase forecast accuracy through deploying and tuning various forecasting techniques. A recent enhancement in the forecasting methodology has been to interpret weather forecasts and identify the impact on network faults (i.e. demand). One fundamental issue for this approach is that demand is based on when customers report faults. It has yet to be understood how customer behaviour drives the demand, as some customers will report faults as soon as possible, whilst others may wait to see what happens. This presentation will describe some of the results of a study into customer behaviour and the impact on forecast accuracy.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Very

Cutting and Packing



Organisers: Xiang Song and Julia Bennell

06/09/2016 : 11:30 : Room-DS1.01

Code: OR58A1825

Heuristic Algorithms for 2D and 3D Packing Problems

Prof Shinji Imahori (*Chuo University*)

Cutting and packing problems have been extensively studied in the last decades, mainly due to its computational complexity (almost all NP-hard) and numerous industrial applications such as garment industry, paper cutting, VLSI design and container loading. Among many mathematical problems of the practical packing problems, we consider two-dimensional and three-dimensional packing problems to place all the given small items in one large container with variable size. Such problems are called the strip packing problem if one dimension is variable, and called the area/volume minimization problems if all the dimensions are variable in 2D/3D. As a large object in which small items are placed, we consider only regular shapes; namely a rectangle or a cuboid (rectangular parallelepiped). As small items, we treat several shapes such as rectangles, soft rectangles, rectilinear blocks, irregular shapes (in 2D) and cuboids (in 3D). If we need practical solutions for the problems, heuristic and metaheuristic algorithms are mostly utilized. We introduce some practical heuristic algorithms for the above cutting and packing problems. When we evaluate heuristic and metaheuristic algorithms, we must take into account both of the quality of output solutions and the computation time. The computation time of algorithms strongly depends on their implementations. Even if a naive implementation of an algorithm is not useful for industrial problems, efficient implementations of the algorithm may solve them in practical time. We show efficient implementations of some heuristic algorithms, which improve the theoretical time complexity and/or the computation time in practical sense. Computational results are reported to compare some heuristic algorithms for two-dimensional and three-dimensional packing problems.

What is the nature of your talk?: Theoretical

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

06/09/2016 : 12:00 : Room-DS1.01

Code: OR58A1802

Multi-Period Irregular Bin Packing Problem with Residual Reuse

Mr Ranga Abeysooriya, Prof Julia Bennell and Dr Antonio Martinez-Sykora (*University of Southampton*)

Many manufacturing processes begin with cutting desired items from a stock sheet of material, for example the manufacture of garments, tools, ships, furniture and shoes. There has been extensive research on cutting and packing problems that has produced powerful and sophisticated algorithms to determine the arrangement of items on stock sheets usually to minimise waste material. However, there is limited research that puts this valuable work in the broader context of the inventory and production process. Frequently individual orders or the day's production will be cut from multiple stock sheets (bins) where different standard sizes are available. Bins may not be fully packed resulting in residuals that can be stored and reused. In this study, we seek to plan the cutting of items in order to minimise the costs associated with inventory, material handling and waste, including the use of residuals, and taking into account orders over multiple periods. We

will present our model of the multi-period irregular bin packing problem with residual reuse. This work builds on earlier work that developed an irregular bin packing algorithms for heterogeneous stock sheets. Limited details will be given of the packing algorithm since the focus of this presentation is on the wider production process. Demand is stochastic and we assume all demand must be met within the period. The packing algorithm determines the cutting plan to meet demand, which may result in residuals. These can be stored for future use or discarded. The model will test the impact of a variety of policies around the retention and reuse of residuals and examine the cost sensitivity of these alternative. The computational results demonstrate that the proposed multi period approach with residuals derives better results than solving each order individually and we highlight the scenarios which are more advantageous.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Very

06/09/2016 : 13:30 : Room-DS1.01

Code: OR58A1782

An Exact Algorithm for Nesting Problems

Dr Antonio Sykora-Martinez and **Prof Julia Bennell** (*Southampton Business School*)

In this work we present two mixed integer linear programming formulations for the two dimensional strip packing problem with irregular shapes, also known as nesting problems. For many benchmark data sets, the pieces are allowed to rotate by a finite set of angles. Thus far, optimal solutions to nesting problems only consider cases with no rotation. In this paper we present optimal solutions while allowing rotation. In these problems there are two families of inequalities, the containment inequalities and the no-overlap inequalities. It is well known that the no-overlap inequalities considerably increase the difficulty of solving these models. Therefore, we explore two alternative ways to formulate the no-overlap constraints that permit a given set of orientations of the pieces. The first model uses the nofit polygons to write the no-overlap inequalities and introduce binary variables to select the orientation used by the pieces. In the second model we introduce a new use of the nofit polygon in which different nofit polygons are combined. The performance of each method depends on the instance and neither is dominant. Therefore, we present a combined method that selects the approach for setting the no-overlap constraints for a pair of pieces depends on the number of variables needed in the MIP. We prove the efficiency of both models in a set of small instances, proving optimality in instances up to 10 pieces with 4 angles of rotations.

What is the nature of your talk?: Theoretical

Does your talk require prior knowledge of the subject area?: Quite a lot

Is your talk accessible and relevant to Practitioners?: Somewhat

06/09/2016 : 14:00 : Room-DS1.01

Code: OR58A1767

Rich Vehicle Routing and Loading Problem with Time Windows

Dr Xiang Song (*University of Portsmouth*), **Dr Nasrin Asgari** (*University of Roehampton*), **Prof Dylan Jones** (*University of Portsmouth*) and **Mr Tim Pigden** (*Optrak Distribution Software Limited*)

The rich vehicle routing and loading with time window constraints is a variant of the Capacitated Vehicle Routing problem with Time Windows (CVRPTW) with two/three-dimensional loading constraints, which consists of routing a number of vehicles to serve a set of customers, and determining the best way for loading the goods ordered by the customers on the vehicles used for transportation. There are multi objectives to consider, which includes minimising total travel distance, number of vehicles to use, total unloading time and the sum of the differences between the workload of each tour and the smallest workload. To achieve a range of distinct solutions with no preference knowledge known in advance from the decision maker, a weighted Goal Programming (GP) model was constructed and a Variable Neighborhood Search (VNS) algorithm was designed as the search engine to relieve a computational burden inherent to the application of the GP model. To evaluate the effectiveness of the VNS algorithm, new sets of instances based on real geographic data and simulated customers' data are generated and solved by both the VNS algorithm and the software provided by our industrial partner. Results show that the suggested approach is quite effective, as it provides solutions that are highly competitive with the results found by the software.

What is the nature of your talk?: Practical
Does your talk require prior knowledge of the subject area?: Some
Is your talk accessible and relevant to Practitioners?: Very

06/09/2016 : 15:30 : Room-DS1.01

Code: OR58A1738

The Three-Dimensional Container Loading Problem

Dr Xiaozhou Zhao, Prof Tolga Bektas and Prof Julia Bennell (*University of Southampton*) and **Dr Kath Dowsland** (*Gower Optimal Algorithms Ltd.*)

Our paper investigates the three-dimensional container loading problem with homogeneous and heterogeneous bins. The paper arises from a project with an industry partner who provides container loading software. The project aim was to improve their algorithm performance for multiple container packing problems. A key constraint imposed by the industry partner was to retain the core packing algorithm that constructed a single container. We present an iterated local search and beam search heuristic for solving the allocation of boxes across the different containers and determining the packing order for each container. We introduce new benchmark data sets from industry to test the algorithms. Computational results indicate that while both approaches work on our problem, beam search remains a favourable choice. We also extend our algorithms to consider a range of pricing structures for the heterogeneous containers problem.

What is the nature of your talk?: A mix
Does your talk require prior knowledge of the subject area?: Some
Is your talk accessible and relevant to Practitioners?: Relevant

06/09/2016 : 16:00 : Room-DS1.01

Code: OR58A1705

Dynamic Pricing on the Ferry Industry

Dr Antonio Martinez-Sykora, Dr Chris Bayliss, Prof Julia Bennell, Dr Christine Currie and Dr Mee Chi So
(*University of Southampton*)

In this paper we present a dynamic pricing model within the ferry industry in which efficient packing algorithms are used to fit more vehicles in the ferry, leading to better expected revenues. The origins of revenue management (RM) are in the airline industry. RM practices generated \$1.4 billion in additional revenues at American Airlines in the three year period starting from 1988. One of the consequences of such potential is that most of the world's major air carriers and many smaller airlines have some level of revenue management capability. In the airline industry the number of sales is determined by the number of seats, however, in the ferry industry the number of vehicles which could fit in the ferry depends on the layout used in the ferry. A better placement of the vehicles allows either more vehicles or bigger vehicles to be placed and, therefore, there is a higher chance of increasing the expected revenues. This is the issue when applying the dynamic programming models used by the airline industry to the ferry industry, as we need to be able to measure the space left in the ferry, avoiding overbooking. We propose two different approaches to place the vehicles in the ferry. In a first approach the decks are divided into lanes, and each lane has a known length, width and height, leading to a one dimensional heterogeneous bin packing problem. In the second approach the number of lanes and their widths are not given, so they should be decided by the packing algorithms, leading to a two dimensional rectangular packing problem.

What is the nature of your talk?: Theoretical
Does your talk require prior knowledge of the subject area?: A little
Is your talk accessible and relevant to Practitioners?: Relevant

06/09/2016 : 16:30 : Room-DS1.01

Code: OR58A1623

New Model for One-dimensional Cutting Stock Problem with Usable Leftovers

Dr Xiang Song (*University of Portsmouth*), **Prof Yan Chen** (*Guangxi University*), **Mr Yi-Ping Cui** (*South China University of Technology*) and **Prof Yaodong Cui** (*Guangxi University*)

In the one-dimensional cutting stock problem with usable leftovers (1DCSPUL), items of the current order are cut from stock bars to minimize material cost. The stock bars can be classified into two kinds, standard and

old leftovers. Standard bars are bought commercially. Old leftovers were generated in processing previous orders. Leftovers of the same length are considered to be of the same type. It is assumed that each type of leftovers occupies a bin in the storage area. Large number of leftover types in stock lead to the following adverse effects: (1) increased handling cost of leftovers; (2) increased storage area; (3) complicated cutting plans for future orders. In practical applications, the number of leftover types should be limited to remove these adverse effects. An integer programming model for the 1DCSPUL with limited leftover types is established in this presentation, together with a heuristic solution approach based on a column-generation procedure. The effectiveness of the approach are demonstrated through computational test.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

Data Envelopment Analysis



Organiser: Ali Emrouznejad

06/09/2016 : 11:00 : Room-DS1.12

Code: OR58A1664

An Efficient Parabolic Frontier for Input Reallocation: A Case Study in Environmental Management

Prof João Carlos Soares de Mello, Prof Lidia Angulo Meza and Mrs Juliana Quintanilha da Silveira

(Universidade Federal Fluminense)

Classic DEA models assume independence between the production units, i.e. a particular DMU may increase or reduce outputs or inputs regardless of what the other DMUs are doing. However, this is not always a real case scenario. In some cases, the resources used by each DMU are shared with others, or it may exist limit for the total amount of resources they use. There are two classic models to deal with this situation: Zero Sum Gains DEA models and so-called parametric DEA model. Although, ZSG DEA models are able to deal with both constant and variable returns to scale, so far, the parametric DEA models (spherical, hyperbolic and ellipsoidal) can deal only with constant returns to scale. We introduce a parabolic parametric DEA model to deal with variable returns to scale. We demonstrate some properties of the model. We exemplified the use of the model to determine the redistribution of CO₂ emissions among countries signatory countries of the Kyoto Protocol.

What is the nature of your talk?: Theoretical

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Somewhat

06/09/2016 : 11:00 : Room-DS2.08

Code: OR58A1742

Persistent and Transient Cost Inefficiency in the English Higher Education Sector: A Generalised True Random Effects Model

Ms Maria Papadimitriou *(Lancaster University)* and **Prof Jill Johnes** *(University of Huddersfield)*

Most of the cost efficiency frontier models, focused either on transient or on persistent part of cost inefficiency, confounding firm effects (that are not part of inefficiency) with persistent inefficiency or blending persistent inefficiency with latent heterogeneity. However a decomposition of the two parts, persistent (long-term) and transient/residual (short-term) inefficiencies provides an in-depth analysis of whether short term practises or more long term structural changes within colleges and universities affect the degree of cost efficiency. Hence, more recent developments in panel data SFA models by Colombi et al (2014) and Fillipini and Greene (2016) allow a further appealing distinction in the cost efficiency of HEIs where unobserved firm effects (firm heterogeneity) can be disentangled from time invariant and time varying inefficiency. The purpose of this study is to assess the level of persistent and transient inefficiency in the English HE sector from 2008/09 to 2013/14 by using a four-way error component model (persistent and transient inefficiency, random firm effects and noise) and so as to retain the apparatus of statistical inference stemming from a Generalised True Random Effects Model (GRTE) based on maximum simulated likelihood.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: Some
Is your talk accessible and relevant to Practitioners?: Somewhat

06/09/2016 : 11:30 : Room-DS2.08

Code: OR58A1745

The Efficiency Analysis in the Public Universities from Romania by Using Data Envelopment Analysis: A Case Study

Mrs Gabriela Vica Olariu and **Mr Stelian Brad** (*Technical University of Cluj Napoca*)

The value of a university is how it relates to the society's needs, to the quality assurance regarding the preparing of specialists in various areas of activity, as well as to the performance of research activities and scientific development. For public universities, it is important to know how efficiently the resources are utilized because their funds come from the state (Ministry of National Education). This paper illustrates the application of Data Envelopment Analysis (DEA) to evaluate the relative efficiency of public universities in Romania, using data collected from the reports of the universities' Rectors throughout the years 2012-2015. The input and output variables used in this study are those contributing to performance and efficiency in higher education. The input variables taken into consideration are the number of academic staff, the number of non-academic staff and the number of accredited programs in universities. Although the two inputs have been considered in research, the number of accredited programs is used for the first time in efficiency analysis. The output variables are the total number of undergraduate enrolment, the total number of graduate enrolment and the number of research projects attracted by universities. The model we have used is variable returns to scale (VRS) and output-oriented approach to determine the output maximization of the public universities in Romania. The results of this study show that DEA application to assess relative efficiency among public universities in a certain country is a reliable approach by providing quantitative indicators for comparative analysis.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

06/09/2016 : 11:30 : Room-DS1.12

Code: OR58A1640

Dominance Relation and Ranking Interval in Parallel Systems Based on Data Envelopment Analysis

Ms Xiyang Lei (*School of Management, University of Science and Technology of China / University of Strathclyde Business School*), **Mr Yongjun Li** (*School of Management, University of Science and Technology of China*), **Mr Alec Morton** (*University of Strathclyde Business School*) and **Mr Qiang Wu** (*School of Management, University of Science and Technology of China*)

In data envelopment analysis (DEA) a standard assumption is that every decision making unit (DMU) should be evaluated based on the weights which are most favourable to it. Recently, Salo and Punkka (2011) have shown how it is possible to produce ranking intervals which show dominance relations between DMUs which take account of all possible weights in some weight set: a DMU is only said to be better than another DMU if its efficiency score is higher for all feasible input and output weights. This paper applies the philosophy of Salo and Punkka (2011) to the case of parallel production systems. In this environment each DMU is composed of a number of independent subsystems. We define a family of dominance relations which generalise those of Salo and Punkka (2011) and show how to compute these. Only one of these dominance relations ("efficiency dominance") is acyclic and so can be used to generate ranking intervals. Nevertheless, the lower order dominance relations we define can be used to identify useful comparators or targets for particular DMUs. We demonstrate our approach by applying it to the economic performance of Chinese provinces.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Very

06/09/2016 : 12:00 : Room-DS1.12

Code: OR58A1697

A DEA Model with Preference Cone to Measuring Efficiency for Undesirable Output

Dr Song Han (*Renmin University of China*)

The main purpose of this article is to improve the existing cone-ratio DEA model to measuring efficiency for undesirable output. That means, the weight for bad output should be negative. Previously researchers proposed using the information entropy of variables to construct the polyhedral convex cone. This suggestion has certain rationality, but also has the following two problems: (1) The weight of polyhedral convex cone just determined by the information entropy of variables, although this will simplify the decision-making process to a certain extent, appropriate to consider the advice of experts, apparently to make the evaluation results more reasonable; (2) Interdisciplinary information entropy increase the complexity of model, as a result, it is not conducive to the popularization and application of the method. In order to overcome these shortcomings, a new method is proposed to construct the preference cone. First of all, using the adjusted CCR model to evaluate the efficiency of decision making units, and the character E represents the effective set. Secondly, according to the advice of experts or a priori knowledge of decision makers, selects 3 most preferred decision making unit in set E. Finally, the efficiency can be evaluated in the framework of the cone ratio model through using the optimal weight coefficient of the 3 decision-making unit to construct "preference cone". Therefore, the results of efficiency evaluation are more reasonable and the method is easier to understand. In the part of empirical research, we use 76 coal-fired power generation enterprises of Zhejiang Province in 2008 as the research object, demonstrates how to use the new method proposed in this paper, at the same time, the evaluation efficiency of other model were calculated.

What is the nature of your talk?: Theoretical

Does your talk require prior knowledge of the subject area?: Quite a lot

Is your talk accessible and relevant to Practitioners?: Somewhat

06/09/2016 : 12:00 : Room-DS2.08

Code: OR58A1740

Data Envelopment Analysis of National Health Care Systems: Evidence from Selected Developing Countries

Ms Saba Masood (*Sheffield hallam University, UK*)

A key policy challenge in developing countries is to improve health care outcomes given the limited health care resources. There has been increasing research in measuring the productive performance of health care systems in developed countries. However, a systematic search of the literature reveals that there are limited compressive and analytical research studies on cross-country comparison of measurement of efficiency in health care system in less developed countries. To fill this gap this study aims to measure relative efficiency of health care systems in selected developing countries using the data collated by the World Bank. The countries were chosen based on similarities in economic development, demographic and cultural situation and data availability over the period of time (2005- 2014). Data Envelopment Analysis (DEA) method, a non-parametric linear programming based technique has been applied to measure the efficiency using the health care resources as input variables and common health care outcomes as output variables. The study has been carried out in two stages. First, technical efficiency in the health care systems has been measured to make a cross-country comparison and determine the degree of efficiency in all the countries. Second, efficiency scores of all the countries have been compared over the period to understand how these developing countries have progressed over the period of time in terms of efficiency in health care system. The findings of the cross country comparison revealed that some countries could achieve better health outcomes while maintaining the current level of health care resources. This study also recommends performance targets for the inefficient countries. The results of this study will influence useful policy recommendations for promoting a more efficient health care system in less efficient countries.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Relevant

06/09/2016 : 13:30 : Room-DS1.12

Code: OR58A1757

KEYNOTE: An Out-of-Sample Evaluation Framework for DEA

Dr Jamal Ouenniche (*University of Edinburgh Business School*)

Nowadays, Data Envelopment Analysis (DEA) is a well-established frontier-based non-parametric methodology for performance evaluation and benchmarking. DEA has witnessed a widespread use in many application areas since the publication of the seminal paper by Charnes, Cooper and Rhodes in 1978. However, to the best of our knowledge, no published work formally addressed out-of-sample evaluation in DEA. In this research, we fill this gap by proposing a framework for the out-of-sample evaluation of decision making units. We illustrate the use of the proposed framework in risk assessment and bankruptcy prediction of companies listed on the London Stock Exchange.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Highly

06/09/2016 : 14:15 : Room-DS1.12

Code: OR58A1806

Measuring Efficiency of Decision Making Unites: Software Update for Advanced Users

Prof Ali Emrouznejad (*Aston University*)

This paper presents software that takes its features closer to the latest developments in the DEA literature. The new software addresses a variety of issues such as: assessments under a variety of possible assumptions of returns to scale including NIRS and NDRS; truly unlimited number of assessment units (DMUs); Analysis of groups of data by estimating automatically separate boundaries by group; Malmquist Index and its decompositions; Super efficiency; automated removal of super-efficient outliers under user-specified criteria; cross efficiency; bootstrapping and models that deal with undesirable and negative data

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Highly

06/09/2016 : 15:30 : Room-DS1.12

Code: OR58A1670

Does Win-Win Opportunity always Result in Pollution Abatement? An Application of Directional Distance Function to Indian Cement Industry

Dr Sabuj Kumar Mandal (*Indian Institute of Technology Madras*)

The motivation of our present study stems from the classic debate on whether or not environmental regulation makes the complying firms more productive and efficient compared to their non-complying counterparts – a proposition called ‘win-win opportunity’ originally derived from the so called Porter Hypothesis. The objective of the paper is twofold. Firstly, to examine whether there exists any ‘win-win opportunity’ for Indian cement firms complying with environmental regulations. In other words, examining whether simultaneously reducing pollution and increasing output level is at all feasible for them or not. Secondly, to verify whether such ‘win-win opportunity’, if exists, can actually lead to pollution abatement. Following directional distance function approach and using firm level data of Indian cement industry for the year 1999-00 through 2004-05, we observe that a potential win-win opportunity does exist in the industry. However, that win-win opportunity may not necessarily induce the Indian cement firms to spontaneously comply with the environmental regulation since regulation imposes a significant cost on them in terms of lower feasible expansion of the desirable output. Implications of our findings on firms’ strategy in the face of environmental regulation are also discussed.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Relevant

06/09/2016 : 16:00 : Room-DS1.12

Code: OR58A1698

Selecting Efficient Components Using DEA to Assembly Optimized Environments in Software Defined Network Function Virtualization (SDNFV).

Prof Francisco Daladier Marques Júnior (*Federal Institute of Education, Science and Technology from Paraíba*), **Prof Marcelo Damasceno de Melo** (*Federal Institute of Education, Science and Technology from Rio Grande do Norte*), **Mr Gervasio Eufrazino Teixeira** (*Federal Institute of Education, Science and Technology from Paraíba*), **Prof Paulo Roberto Freire Cunha** (*Federal University from Pernambuco*) and **Prof Kelvin Lopes Dias** (*Federal University from Pernambuco*)

This paper presents DEA in a seminal new application to assist Decision Makers in choosing more efficient components to assembly a framework in Software Defined Networks Function Virtualization (SDNFV). This study aim at providing optimized services in Infrastructure as a Service (IaaS) as also in Everything as a Service (XaaS), common terms used by service providers in Cloud Computing and related technologies. The analyses were performed over 1700 experiments in distinct timing scales and scenarios for calibration of DMUs by using Internet and tunneling protocols of the Virtual Tenants Networks, generating Virtualized Networks environments with open technologies (OpenStack, OpenDayLight, OpenvSwitch, VXLAN, VirtualBox, iperf, etc.) or not (VMWARE Player Workstation), beside other consecrated for having a higher performance (e.g. virtualization containers: Docker, LXC). After the exploratory analysis of traffic (TCP and UDP) and delay of continuous random variables captured in the measurements, it was noticed strong presence of the self-similarity (SS) anomaly, which seriously impacts on the supply of stable network services (and a real cascade effect) in those environments because it has the characteristic of burstiness, where the variability in traffic persists in a Long-Range Dependency (LRD), which is harmful to all virtualized environments because it has non-Markovian behavior. Thus, many of these stochastic processes were accommodated with Empirical Probability Density Function (EPDF) of heavy tail, which have similar graph of the Pareto-Koopman efficiency frontier. The selection of the most efficient DMUs sought to minimize the effect of the SS, where several DEA models and orientations were analyzed. Hence, DEA was effective to indicate the most efficient components that would be chosen by any decision maker experienced in the analysis and assembly of those environments.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Highly

06/09/2016 : 16:30 : Room-DS1.12

Code: OR58A1657

Assessing Service Performance with DEA: An Application on Employee Level

Mrs Manuela Koch-Rogge and **Mr Georg Westermann** (*Hochschule Harz*)

The service sector is expanding rapidly worldwide and service markets have never been larger. Hence, the economic growth within developed countries is almost exclusively based on services. Since employees have a crucial influence on the perceived quality of the output, they are among the most important input resources in the production of services. Several studies point out the significance of perceived service quality and customer satisfaction to customer loyalty and retention. Thus, proper assessment of employee's performance, employee empowerment and a concern for training therefore becomes a necessity to remain competitiveness. In practice, there are many obstacles to the development of an appropriate performance appraisal. Due to service characteristics like intangibility or heterogeneity, this accounts in particular for the service sector. Performance appraisals therefore are often experienced as "unfair". Traditional, often one-dimensional approaches fail to account for the specific requirements of the service sector. Throughout this paper we outline the standards for "good" performance measures and propose the Data Envelopment Analysis (DEA) as a method for performance measurement on individual level. Using the example of a German cooperative bank with a cohort of 40 employees, we apply a multi-stage DEA approach to measure employee performance and report on the results. A particular focus is laid on a comprehensive sensitivity analysis that was conducted to identify outliers and to ensure the robustness of results. Concluding, we illustrate how strategies on both individual and organizational level may be derived.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Very

07/09/2016 : 10:00 : Room-DS1.12

Code: OR58A1677

Matrix Model for Multiple Group Comparison with Malmquist Data Envelopment Analysis: A Basketball League Example

Mr Ayhan GÖLCÜKCÜ (*Süleyman Demirel University*), **Prof Hasan BAL** and **Mr Volkan Soner ÖZSOY** (*Gazi University*)

Malmquist Index is classically used to measure the productivity growth or technical progress change at different time points. The index allows researchers to make pairwise comparisons between two different points of time. With the same manner, it is used to measure the productivity growth or technical progress difference of two different but similar processes, namely, groups. The application of the index is a bit confusing when there are more than two similar groups like teams in a league. In this study, pseudo codes for p group comparison and matrix model for the Malmquist Index Data Envelopment Analysis is proposed with an example of the Turkish Basketball League. Performances of the teams are evaluated via each player's individual DEA score by averaging it geometrically. Later, pairwise comparison of teams which are decided as groups made by proposed matrix model. The proposed pseudo codes allow pairwise cross efficiency evaluation and proposed matrix model provide pairwise comparisons of groups/teams.

What is the nature of your talk?: Theoretical

Does your talk require prior knowledge of the subject area?: Quite a lot

Is your talk accessible and relevant to Practitioners?: Relevant

08/09/2016 : 09:00 : Room-DS1.12

Code: OR58A1759

A FDH Super-Efficiency Model

Dr Adel Hatamimarbini (*CORE, LSM, Uclouvain,*), **Mr Abdullah Aldamak** (*Ryerson University*) and **Prof Saeed Zolfaghari** (*Ryerson University*)

The free disposal hull (FDH) model, developed by Deprins et al. [The Performance of Public Enterprises Concepts and Measurements, Elsevier, 1984], is derived from a representation of the production technology where production plans satisfy strong disposability of inputs and outputs but without the convexity assumption. This paper contributes to the FDH literature by proposing FDH super-efficiency models that may become infeasible. We modify the proposed models to handle the infeasibility case as well as adjusting the corresponding measures of those DMUs that suffer from the infeasibility problem. The paper concludes with a comprehensive empirical study to illustrate the details and applicability of the proposed models.

What is the nature of your talk?: Theoretical

Does your talk require prior knowledge of the subject area?: Quite a lot

Is your talk accessible and relevant to Practitioners?: Relevant

08/09/2016 : 09:30 : Room-DS1.12

Code: OR58A1831

The Research Results of Restructuring the Higher Education System: An Objective Assessment of Higher Education Institutions that have Passed the Merge Process

Dr Pavel Derkach and **Dr Kirill Zinkovsky** (*Higher School of Economics*)

The main question of interest to researchers and rulebase makers in this issue, is given whether or not a merger, acquisition or organizational restructuring of universities performance gains. The approach seems to be quite simple to implement, but any interpretation of the impact of the university involves consideration of several indicators characterizing the performance, and several factors that can determine the effectiveness. In the calculations we used the multistage with constant returns to scale (CRS), INPUT ORIENTATED model. Hypothesis of research: H1: Higher education institutions are actively involved in the restructuring process, experiences , at least temporary , but the fall in effectiveness H2: Universities have completed the restructuring process , some years ago , will perform better than those that continue restructuring H3: Liquidation as a cut-off mechanism least efficient parts, should lead to an increase in university performance H4: Universities that take the strategy to join organizations ACT, face a decline in performance

What is the nature of your talk?: Practical
Does your talk require prior knowledge of the subject area?: A little
Is your talk accessible and relevant to Practitioners?: Relevant

08/09/2016 : 11:30 : Room-DS1.12

Code: OR58A1811

Efficiency in the Turkish Banking Sector: A Review of Academic Research

Dr Zeynep Kacmaz (*IFS University College*)

As an emerging market, the efficiency of the Turkish banking sector has changed gradually since liberal economic policies were implemented in the early 1980s. With the liberalisation of the sector, Islamic banking was also introduced to the market as an alternative to conventional banking. Research into the efficiency of banks in Turkey began in the mid-eighties, and there are now many published and unpublished studies that analyse the development of the sector, using a variety of methodologies. These studies mainly focus on the conventional banking sector. However, lately there has also been some attention to the efficiency of Islamic banks in Turkey. This study provides an historical review of the research on efficiency in the Turkish banking sector over the past three decades. Both published and unpublished sources have been reviewed. The relative benefits of various quantitative methodologies for this area are discussed, together with a consideration of the obstacles for research, for example in terms of the availability of reliable data, in order to identify opportunities and implications for future research.

What is the nature of your talk?: A mix
Does your talk require prior knowledge of the subject area?: Some
Is your talk accessible and relevant to Practitioners?: Relevant

08/09/2016 : 12:00 : Room-DS1.12

Code: OR58A1744

Graphical Interpretation of Correlation in Data Envelopment Analysis

Mr Ayhan GÖLCÜKCÜ (*Suleyman Demirel University*), **Prof Hasan BAL** (*Gazi University*) and **Miss Esra ÖZTÜRK** (*Gazi University*)

The graphical representation of DEA is mainly made with the help of coordinate axes which are mainly independent. Each dimension of this coordinate system represent a variable. But in real World, if inputs are used to produce output the production system naturally relates inputs with outputs. Moreover, a relation inside the sets of inputs and outputs is also expectable. Obviously, mathematical measure of this relationship is Correlation. Classically DEA measures the efficiency of Decision Making Units (DMUs) under the hidden assumptions of uncorrelated variables and relates these variables with its weighting system. If there is correlation between variables something eventually change. In this study, effect of various types of correlation will be graphically investigated and interpreted. Namely, between the set of inputs and outputs, inside the set of inputs and outputs will be shown starting with one input one output case and then passed to many input many output case step by step.

What is the nature of your talk?: Theoretical
Does your talk require prior knowledge of the subject area?: Some
Is your talk accessible and relevant to Practitioners?: Very

08/09/2016 : 13:15 : Room-DS1.12

Code: OR58A1824

Assessing Public Spending Efficiency in 20 OECD Countries

Prof António Afonso (*ISEG-ULisbon; UECE*)

This study follows the framework of Afonso, Schuknecht, and Tanzi (2005), aiming to look at the public expenditure of 20 OECD countries for the period 2009-2013, from the per-spective of efficiency and assess if these developed countries are performing efficiently compared to each other. Public Sector Performance (PSP) and Public Sector Efficiency (PSE) indicators were constructed and Data Envelopment Analysis was conducted. The results show that the only country that performed on the efficiency frontier is Switzerland. The average input-oriented efficiency score is equal to 0.732. That is, on average countries could have reduced the level of public expenditure by 26.8% and still achieved the same level of public performance. The average output-

oriented efficiency score is 0.769 denoting that on average the sample countries could have increased their performance by 23.1% by employing the same level of public expenditure.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Highly

08/09/2016 : 13:45 : Room-DS1.12

Code: OR58A1751

If the Root of the Problem is the Root Itself: How Revenue Sources Influence the Efficiency of Traffic Service Offices

Mr Ramon Christen (*University of Lausanne*)

Lacking true market competition, public entities are constantly suspected to provide their services inefficiently. Data envelopment analysis (DEA) allows operationalizing the efficiency and assigning a score to each entity. With the aim of explaining the differences in efficiency, the two-step approach regresses the estimated efficiency scores on some environmental factors. The public choice literature proposes specific environmental factors related to revenue sources. Namely, the fiscal illusion theory predicts a lower efficiency if the tax system is complex and diversified. In addition, the flypaper effect describes the link between transfers from other state entities and a lower efficiency. Finally, the debate prevention theory presumes a lower efficiency due to earmarked revenues. Using data from traffic service offices of the 26 Swiss cantons (second state layer) within 2008 and 2014, the three hypotheses are tested empirically. Since the methodological literature that combines the two-step approach with panel data is rather narrow, two different algorithms are eligible. The first considers the production frontier to be fix and runs the DEA over all observations simultaneously. The second algorithm permits the production frontier to change over time and uses only observations of the same year as reference set. For the second step, both algorithms base on a truncated regression with standard errors obtained through a bootstrap procedure. The results indicate higher efficiencies for cantons benefiting from more subsidies. Moreover, the more expenditures financed by earmarked revenues, the more efficient a canton seems to be. The effect of the tax complexity and diversification on the efficiency is ambiguous.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Somewhat

08/09/2016 : 14:15 : Room-DS2.01

Code: OR58A1822

Data Envelopment Analysis DEA: Inputs Component Efficiency Measure

Dr Ezzeddine Mosbah, (*Ministry of training and Employment*)

A decision unit maker (DMU) is identified in the general case as Unit that combines many inputs to produce many outputs. In case of input orientation, evaluation of DMU efficiency gives a global score that can be interpreted as the same for all inputs. In practice, when the manager likes to choose inputs' combination, information and knowledge about how to use inputs are available at the same degree for that decision of the manager is different from input to another and they can't be use at the same degree of efficiency. For that one input can be optimally used but other no. So a decomposition of DMU efficiency score into inputs' efficiencies offer a solution to managers to make a good evaluation and then inputs' allocation.

This paper proposes a methodology in order to decompose the DMU efficiency into inputs' efficiency components and to measure efficiency scores of each one. The approach is applied on Agricultural firms data.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Very

Benchmarking the Performance of Saint-Petersburg Public Hospitals with DEA

Prof Iurii Fedotov and **Mr Kazimir Iablonskii** (*Graduate School of Management, St.Petersburg State University*)

The ambiguity of organizational performance gives rise to a wide variety of measurement models. As far as public healthcare organization (HCO) pursues the goal to provide population with high quality and timely medical care, the performance of HCO has to be modeled by a multiple input–multiple output relation and measured accordingly. The sample in the study consists of 47 St. Petersburg public HCOs and includes observations on utilization of resources provided to the HCOs by the Fund of Obligatory Medical Insurance (FOMI) in 2013-2015. The data taken into account includes four variables reported in these years: material costs (MC), aggregated labor costs (ALC), number of treated patients (NP), and volume (in rubles) of not refunded invoices by medical insurance companies because of inappropriate healthcare quality (NTRF). Material costs variable is the total cost of medical supplies, food, bedding and linens. Aggregated labor costs are calculated as the total of salaries paid to the doctors and nurses from the means of FOMI. The performance was operationalized as technical efficiency of the HCO's operation within the means provided by FOMI and estimated with the help of the data envelopment analysis (DEA) model. The NTRF variable represents an undesirable output. To account for undesirable output in DEA models normalization of the NTRF variable was used. The proposed normalization was compared to other approaches used for accommodating the undesirable outputs. The DEA estimates give consistent ranking of the HCOs in each year and provide valuable information on HCOs' performance to the policy-makers and managers. However, the results obtained have a number of obvious limitations due to specifically "production" (i.e., resource – output) operationalization of performance employed in the study, peculiarities of HCOs and financing system of healthcare in St. Petersburg. The extended operationalization of performance is proposed to incorporate the performance perceptions of the HCO's stakeholders.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Somewhat

Defence and Security



Organisers: David Bangert and Stuart Nicholas

08/09/2016 : 09:00 : Room-DS2.12

Code: OR58A1720

KEYNOTE: The Challenge of Defence Acquisition Growth in a Changing World: Causes and Potential Solutions

Mr David Bangert (*Polaris Consulting Limited*) and **Mr Neil Davies** (*Davies Economic Consultancy*)

It is widely recognised that the cost of Defence equipment rises more quickly than the general rate of inflation. The impact of escalating costs has meant that while repeated Defence Reviews have sought to identify and prioritise the UK's Defence needs, the planned number of systems set out in a Review is usually reduced by the time they enter service, and they are typically delivered considerably later than planned. This has serious implications in a changing world where new threats can, and do, evolve in timescales significantly less than the acquisition cycle of Defence equipment. Work conducted by Polaris Consulting and Neil Davies, ex-MOD Chief Economist, has identified the drivers which have dislocated a large proportion of programmes: including defence inflation, unit acquisition cost escalation, optimism bias and the loss of economies of scale. It has also assessed the repercussions of defence inflation on the ability of the UK to meet novel threats in the coming decades, and presents suggestions as to where approaches and behaviours should be changed to improve outcomes.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Relevant

08/09/2016 : 09:30 : Room-DS2.12

Code: OR58A1868

Measuring the Impact of Intelligent Decision-Making in Military Operations

Dr Nick Walmsley, Mr Matt Bunn, Ms Jenny Conway, Mr Brian Stewart and Mrs Veronica Wardman (*Dstl*)

Command, Control, Computers and Communications Intelligence Surveillance and Reconnaissance (C4ISR) is the enabler that provides the intelligence to support the successful outcome of military campaigns. It encompasses the decision making process, including provision of information to commanders, as well as the underlying means to transfer information, including dissemination of decisions. In the current economic climate where financial investment is subject to increasing scrutiny, it is important to demonstrate value, whatever Defence investment decision needs to be made. Historically, justification of investment in enablers such as C4ISR has been challenging to determine and quantify, due to the inherent tenuous link between such an enabler and campaign success. This work explores a possible framework of alternative technical approaches to achieve a more robust evidence-based decision-making process to better inform future balance of investment decisions. The paper will describe C4ISR effects and metrics, and will seek to establish a framework of methods to best describe the link to campaign outcome in terms of their impact and assessment. Attendees at the presentation will be encouraged to participate and suggest possible methods to explore.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

08/09/2016 : 11:30 : Room-DS2.12

Code: OR58A1774

Developing Option Analysis for Law Enforcement

Dr Philippa Hiscock, Mr Adam Price and Mr Michael Bagg (*Roke Manor Research Ltd*)

In recent years with, reducing Government budgets, decisions to spend public money have come under increasing levels of scrutiny, with the National Audit Office and others identifying a requirement for improvements in the way that decisions are evidenced. This applies particularly to the selection of a solution to an investment problem from a set of candidate options. Within Government there are two primary streams of professional analysts, operational analysts within Defence and operational researchers within wider Government. These groups have, generically, adopted two different types of metric for the assessment and appraisal of business cases; outcome (or effects) based within Defence and monetised benefits in wider Government. Law Enforcement and National Security appraisals are often driven towards the monetised approach while the core capabilities and outcomes might be considered to be more aligned with the philosophy of Defence focused analysis. This issue is perhaps best illustrated when considering the primary requirement upon law enforcement, the protection of life. Here the approach is often to monetise outcomes through application of the Value of a Prevented Fatality, an approach originally developed within the Department for Transport. This presentation will explore the current position and suggest some approaches for bringing together the two separate threads to develop a philosophy that is suited to the needs of law enforcement while maintaining the evidence requirements this area has to meet. It is suggested that a Multi-Criteria Decision Analysis framework might be one tool that is suited to the initial development of a new way of undertaking analysis for evidence based decision making within the law enforcement context.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Highly

08/09/2016 : 12:00 : Room-DS2.12

Code: OR58A1842

The Statistics of Ballistics: Measuring the 'Impact' of Rifles on Team Effectiveness

Dr Duncan Stewart (*Dstl*)

Anecdote and misinformation pervade the performance of small arms in the defence domain; what is more, there is generally very little understanding of how to robustly measure rifle performance. Moreover, a rifle is but one component part of a wider system which also includes: ammunition, people, doctrine and tactics; each introducing their own sources of error. In defence terms the lethal 'system' is considered to be an infantry platoon with all its inherent variability. At the same time, several NATO countries are considering replacing their small arms fleets in the context of changing world political landscape; therefore given the personnel risk and cost implications it is essential that defence OR practitioners understand how rifle performance contributes to overall system effectiveness. Using case studies, this paper demonstrates the use of systems thinking principles together with statistical techniques for measuring system effectiveness such as Probability of Hit (PHit), Multivariate ANalysis Of Variance (MANOVA) significance testing and data visualisation. Some of the material covered in this paper is contributing directly to a draft NATO standard for small arms testing, which will ultimately be used by governments to derive evidence upon which future billion dollar procurement decisions will be made.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Relevant

08/09/2016 : 13:15 : Room-DS2.12

Code: OR58A1820

Digital Data Collection Architecture for UAS Experiments

Prof Patrick Driscoll (*U.S. Military Academy*)

Data collection in support operations research is not new. However, getting beyond human exaggerations, over-enthusiasm, and hyperbole when conducting unmanned aerial system (UAS) experiments that involve

non-repeatable conditions requires realtime network tracking with sufficient detail to support post-experimentation analysis. The architecture of such a system recently developed for use by the U.S. Army is presented and discussed. Several examples will be used to illustrate its effectiveness for capturing what actually occurred during experiment runs versus what might have been reported.

What is the nature of your talk?: Very practical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Very

08/09/2016 : 13:45 : Room-DS2.12

Code: OR58A1687

The Joint Intelligence Model - Quantitative and Qualitative Insights for the Intelligence Enterprise

Mr Richard Adrian-Harris (*Defence Science and Technology Laboratory*)

The Joint Intelligence Model (J2M) is a high level simulation model encompassing the whole of the Intelligence enterprise; from Commanders' Intelligence demands and requirements management, through to collection, sensor platforms, analysis nodes and repositories. J2M provides a framework of configurable components which allows analysts to construct an Intelligence architecture and experiment with the effectiveness of different system mixes. As well as direct model quantitative outputs, which can be linked back up to high level measures of campaign effectiveness, the model can also help generate qualitative insights. J2M uses a mix of agent based and discrete event simulation approaches in conjunction with an intuitive graphical user interface. Over several years of iterative development Dstl has maximised the utility of the tool by optimising the balance between data requirements, component representations and required outputs. This paper covers the development of the tool and modelling process, noting the lessons and trends identified over the last several years, and provides examples of exploitation of the tool in supporting MoD business. The paper will also address areas for further development within the tool, as well as highlighting thoughts as to how the model might be used in the future.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Highly

08/09/2016 : 14:15 : Room-DS2.12

Code: OR58A1626

Analysis of Requirements for the Treatment, Evacuation and Management of the Injured and Sick (ARTEMIS): Modelling the Deployed Military Medical Support System

Mr Neal Davies (*Dstl*), **Mr Ian Griffiths** and **Mr Gordon Squire** (*decisionLab*)

The provision of appropriate medical care is key to any deployment of the UK Armed Forces; to meet the medical needs of UK service personnel and others in need of medical assistance. As such, the UK Ministry of Defence (MOD) needs to understand the nature and scale of medical capability to be deployed for both current and potential future operations. Dstl supports the UK MOD by providing analysis to inform medical planning, policy, equipment procurement and decision making, to ensure a medical capability that is fit for now and the future. To enable this analysis, Dstl commissioned decisionLab to develop a model to simulate deployed medical systems. ARTEMIS is a scenario-level, stochastic Agent-Based model, which simulates the flow of casualties through the medical support system; from point of injury or illness, through evacuation to and between deployed medical treatment facilities, and onto transfer to the UK. It models each individual casualty, evacuation asset (e.g. ambulance, helicopter) and treatment facility, and records a rich dataset that is used to calculate: individual asset utilization, individual casualty pathways, time to treatment for all injuries, as well as overall system performance. ARTEMIS allows Dstl operational analysts to quantitatively assess the ability of a planned medical laydown to meet the requirements of expected Battle Casualties and Disease & Non-Battle Injuries, in the context of a user defined scenario. Such analysis can assess the expected performance of a medical laydown against policy, identify possible deficits, surpluses and weaknesses, leading to refinements in the laydown and testing the potential effect of changes to policy. This presentation will provide an overview of the medical modelling capability required to support the UK MOD, the

development and demonstration of the ARTEMIS model, and how it has/will be employed to support the UK MOD medical customer.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Highly

08/09/2016 : 14:45 : Room-DS2.12

Code: OR58A1866

Artificial Intelligence Algorithms and New Approaches to Wargame Simulation

Dr Stephen Lucek (*NSC*)

The Mission Planner is a decision-making toolset developed by NSC for Dstl currently applied at tactical level. It aims to support Dstl high intensity warfighting simulations by reducing or eliminating the need for complex pre-scripting or human-in-the-loop. Different stochastic optimisation Artificial Intelligence (AI) techniques have been used (Genetic Programming and a novel implementation of Simulated Annealing). The algorithms have been employed in a generic architecture that allows simple application to different problems. This flexibility allows the AI to generate plans against a reduced problem set (a Meta model) which represents only the essential elements of the full problem. The solution can then be evaluated against the full problem set, in this case SimBrig assessing brigade level land engagements. This approach has successfully overcome some of the limitations traditionally associated with the AI techniques used. Formulating the problem in a novel way, using military-like syntax, means that the AI algorithms efficiently generate plans for tactical problems that resemble human-like decision making. We present the approach and techniques used in both the AI algorithms and the Meta wargame simulation.

What is the nature of your talk?: Theoretical

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Very

Ethics and Governance in OR



Organiser: Sayara Beg

07/09/2016 : 11:30 : Room-DS1.08

Code: OR58A1835

Ethics & Governance in OR, Analytics and Data Science - Can it be Measured or Monitored

Ms Sayara Beg (*Datanut Sciences Ltd*)

Ethics and governance is a hot topic in today's world of operational research, analytics and data science. The science of doing it better, means it will not be perceived as 'better' by all of the people, all of the time. So how can we build ethics and governance into the method of operational research, advance analytics and data science? How can we measure its success or even monitor its effectiveness. This talk will be an interactive presentation that will include taking feedback from the audience.

What is the nature of your talk?: Very practical

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Highly

07/09/2016 : 12:00 : Room-DS1.08

Code: OR58A1919

Analyses and Consequences

Dr Emmanuel Lazaridis

You've analysed some data and drawn your conclusions, but those that should be learning from what you have to say don't like what they hear. They can't actually find fault with your work -- privately they may even admit that your work is meritorious -- but you discover that your best chance to present your results to the proper audience has been scuppered, or you get the feeling that you are being sidelined, or perhaps you suddenly find yourself the target of ad hominem attacks. You certainly believe that you are not being treated fairly. Do you champion your conclusions? Do you risk losing your job, becoming known as a troublemaker, or harming your career? The author draws on two decades of experience as a statistician, data scientist, legal professional and occasional poker player to suggest some guidelines for knowing when to hold or fold your cards.

What is the nature of your talk?: Very practical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Very

Forecasting



Organisers: Devon Barrow and Bahman Rostami Tabar

08/09/2016 : 12:00 : Room-DS2.09

Code: OR58A1716

Short- to Medium-Term Forecasting of Aggregate Variables Using Heterogeneous-Agent Simulation Models

Dr Grzegorz Koloch, Mr Marek Antosiewicz and Prof Bogumił Kamiński (*Warsaw School of Economics*)

Short- to medium-term forecasting of quarterly macroeconomic aggregates, like output, inflation or unemployment (up to 2 – 3 years ahead), is mostly performed using classical structural models, time series models, like SVARs/SVECMs, or – especially in central banks, using reduced forms of representative-agent DSGE models. In recent two decades, a strong shift has been observed in structural macroeconometrics from representative-agent modelling towards a paradigm which accounts for heterogeneity of economic agents and complex interactions between them. In this respect, two modelling approaches attract most attention in the field: a DSGE approach (but not based on a representative agent) and an Agent Based Modelling approach (ABM). The first methodology, as it is based on neoclassical foundations and follows the leads of rational expectations revolution, is considered to be mainstream, whereas the second one, since it presents an attractive alternative, but is based on different modelling principles, still aims at becoming mainstream. Heterogeneous agent macroeconomic models are commonly used as tools for long-term forecasting – equilibrium comparative analysis, not for short- or medium-term forecasting. This is because we lack a methodology for constructing a mapping between empirical aggregate data onto a current state of the heterogeneous agent model, from which short- or medium-term forecast could be initialized. In the paper we propose such a methodology. More precisely, we propose a method for terminating simulation output analysis when one is not able to fully specify initial state of the simulation using observations of the real system. We call this situation partial observability and argue that it is common in practice especially in complex agent-based simulations. To our best knowledge, first short- and mid-term forecasts of macro aggregate variables from heterogeneous agent macroeconomic models are analyzed and compared with forecasts produced by popular time-series models. This research was financed by National Science Centre grant No. DEC-2013/11/B/HS4/02120

What is the nature of your talk?: Very practical

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Very

08/09/2016 : 13:15 : Room-DS2.09

Code: OR58A1853

KEYNOTE: Empirical challenges in Predicting Lifetime in Customer Lifetime Value (Clv) Models – Examples and Data from the Retail Industry

Dr Timo P Kunz

Since its emergence in database marketing in the 1980s, CLV has established itself as a popular concept across many industries and has proved its value in informing various strategic and operational decisions.

Accordingly, a mature body of research exists that has produced a plethora of models - from managerial heuristics and simplistic customer value models that are cherished by practitioners for their transparency to comprehensive stochastic models. However, the ever increasing importance of e-commerce and digital communication paired with the rapid advances in recent years in data storage and computing resources have created the need to adapt and augment these models for their application today. Two developments seem particularly noteworthy: firstly, due to the way companies use their data and are now able to individualize their offering and their communication, CLV is now needed on the level of the individual customer rather than on a customer segment or other aggregated level. Secondly, the multitude of data sources now readily available that do not only document the individual transaction but also a multitude of other interactions between the customer and the firm, call for the creation of refined models that make use of this information. This talk highlights the prediction of customer lifetime – in standard models typically expressed as retention rate - as a key component of any customer value modelling approach. Empirical challenges faced by practitioners are presented and data examples from the retail industry are used to illustrate additional possibilities and to point out opportunities for future research.

What is the nature of your talk?: Very practical

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Highly

08/09/2016 : 14:15 : Room-DS2.09

Code: OR58A1850

Boosting Exponential Smoothing Methods for Time Series Forecasting

Dr Devon Barrow (*Coventry University and Lancaster Centre for Forecasting*)

The family of exponential smoothing methods are amongst the most popular forecasting methods used in practice, and are equally well researched. In this study we present a technique for boosting exponential smoothing methods. The proposed technique averages over multiple sequentially fitted models estimated on a set of time series which are iteratively constructed by adjusting the original and subsequent time series for large errors generated by the fitted models. Large errors are identified using methods of outlier and noise detection. The final point forecast is the average of the point forecasts of these sequentially estimated models whose performance depends on previously estimated models through iterative time series construction. The performance of this new technique is evaluated on the M3 data set.

What is the nature of your talk?: Very practical

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Very

08/09/2016 : 14:45 : Room-DS2.09

Code: OR58A1611

The Cost Capability Trade Off Model: Forecasting the Optimum Performance within Budgetary Constraints:

Dr Nira Chamberlain and **Mr Elliot Pinker** (*Babcock Analytics Solutions*)

In time of austerity, many public and private owned businesses are faced with providing a capability under the conditions of budgetary constraints. The question is how can an business entity forecast what they can and can't do under such circumstances. What would be the most robust or optimum decision to take. One possible strategy is to transfer a methodology from the field of Supportability Engineering known as a Cost Capability Trade Off Model. The Cost Capability Trade Off Model is a hybrid model of non-linear regression, Monte-Carlo simulation and design of experiment in order to forecast the optimum performance within budgetary constraints. This model has already been used successfully on an large engineering project but principles can be transferred to most commercial scenarios. This paper will discuss the approach of this modelling application and the philosophy of using engineering principles to help us forecast in the commercial world.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

Game Theory



Organiser: Petros Sekeris

07/09/2016 : 11:00 : Room-DS1.10

Code: OR58A1602

Procurement Auctions with Differentiated Goods

Prof Wei-Shiun Chang and **Mr Rendy Putra Setyawan** (*National Cheng Kung University*)

This study examines two mechanisms commonly used in procurement auctions - procurement auction with incentive and procurement auction with screening. We compare their performance regarding buyers' profit when buyers purchase differentiated goods. We vary the ability of buyers to screen qualified sellers along with the number of the sellers in an auction. Our simulations indicate that the procurement auction with screening is equivalent to the procurement auction with incentive when buyers are able to assess sellers perfectly. However, the effectiveness of the procurement auction with screening drops when buyers' ability to assess seller's ex post quality reduces. Furthermore, the analysis shows that the performance of procurement auctions with incentive is also affected by the number of the sellers. The effect is determined by the levels of reduced quality and reduced price.

What is the nature of your talk?: Theoretical

Does your talk require prior knowledge of the subject area?: Quite a lot

Is your talk accessible and relevant to Practitioners?: Very

07/09/2016 : 11:30 : Room-DS1.10

Code: OR58A1646

Optimisation-Based Decision-Making for Fair Profit Distribution in Global Supply Chains

Dr Songsong Liu (*Swansea University*) and **Prof Lazaros Papageorgiou** (*University College London*)

A supply chain involves all activities transforming raw materials to final products and delivering them to the customers. During the past decade with rapid globalisation, many companies' production plants and distribution centres are located in multiple countries, maybe also in different continents. Due to its complexity, global supply chains have become a challenging issue. In addition, most traditional research aims to maximise total profit of supply chains. However, it may lead to an uneven profit distribution in the supply chain, and a high degree of dissatisfaction of certain members. Thus, how to distribute the profit of the whole supply chain fairly to ensure adequate rewards for each member is still a key issue. Transfer prices, consisting of procurement, manufacturing, and selling prices within a supply chain, affect the costs and revenues of the members at different echelons, and then influence the supply chain strategies, including production, inventory and distribution decisions. Transfer prices are therefore considered as a mechanism for profit distribution. This work aims to develop an optimisation-based decision-making framework for the cooperative game between the members in a three-echelon global supply chain, including primary and secondary manufacturing plants, and markets, to obtain fair distribution of the total profit. We proposed a mixed integer linear programming (MILP) model for the optimal production, distribution and capacity planning of a global supply chain network, where the transfer prices of intermediate products from primary to secondary plants, and of final products from secondary plants to markets are to be optimised. The proposed model is solved by two solution approaches, Nash bargaining approach and lexicographic maximin approach, to find a fair profit distribution. By examining an illustrative example of a supply chain network in the process industry, the obtained results are studied and discussed. The obtained results demonstrate the applicability of the proposed approaches.

What is the nature of your talk?: Theoretical

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

07/09/2016 : 12:00 : Room-DS1.10

Code: OR58A1736

Fairness in Project Supply Chain Coordination using Game Theory

Mr Niladri Palit and **Dr Andrew Brint** (*The University of Sheffield*) and **Dr Alok Choudhary** (*Loughborough University*)

The modelling of supply chain coordination has received considerable attention in the literature, but little attention has been paid to the fair allocation of derived profit and risk from co-ordinating the supply chain. Usually the allocation has been arbitrarily left to depend on the bargaining power of the members. However, the absence of fair allocation mechanisms has been proved to be a problem in both literature and practice. The few models of fairness that have been proposed in the context of supply chain coordination have been in the context of general product supply chains with price and quantity as decision variables. Very limited knowledge is available for project supply chains where the resource consumption rate is a decision variable. Moreover, these models did not take into consideration the effects of loss of efficiency due to fairness. Therefore we propose models of fairness for the equitable allocation of risks and benefits stemming from project supply chain coordination. There is a lack of a unified definition of fairness in the literature. Our model incorporates inequity aversion models (the most commonly used definition of fairness in supply chain literature) for Stackelberg games with take it or leave it contracts, and Nash's bargaining models for repeated games with bargaining situation. We also include the concepts of Shapley value and alpha fairness in order to take care of the constraints of minimizing the loss of efficiency due to fairness.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Quite a lot

Is your talk accessible and relevant to Practitioners?: Relevant

Health and Social Care Modelling



Organisers: Navonil Mustafee and John Powell

06/09/2016 : 11:00 : Room-DS1.09

Code: OR58A1897

KEYNOTE: Operational Researchers (OR) and Healthcare Professionals: Building Relationships to Develop into Fruitful Marriages!

Mr Andrew Fordyce (*Torbay & South Devon NHS Trust*)

Healthcare professionals face a multitude of operational challenges that are an impediment to delivering the best possible patient care; they are thus receptive to help that may contribute towards better decision making. Operational researchers, on the other hand, have the skillset which may meet some of the needs of these professionals. However, working in an applied discipline, OR researchers also have a need – they strive to find a partner to put their research into practice! How do we facilitate building relationship between them? Study of human relationships may offer some guidance. Good relationships develop from partner identification, an attraction, wooing, the chase (and chased), courtship, engagement, understanding mutual needs, commitment and then (perhaps) marriage with formal agreements. The union brings together two individuals and their extended families. There follows a period of learning to live peacefully together; meeting mutual needs ensures a fruitful marriage. Similarly, partnerships between operational researchers and healthcare professionals can be initiated by either party. The wooing and chase can be frustrating; this may be either because the researcher has no experience of real-world decision making or the healthcare professional does not fully appreciate the value that a model offers in the ‘real’ world. However, an enlightened healthcare professional may find the chase of a researcher much less elusive! Time working together, understanding and seeking to meet each other’s professional needs develops a deeper and fruitful relationship. This becomes formalised through honorary contracts, co-writing grant bids, research, network meetings to disseminate learning and joint publications about impact of research in organisations. This culminates into a marriage between both the stakeholders and further matures through mutual trust and understanding. This presentation will discuss the progress of one such relationship from first meeting to commitment to use each other’s skills and the shared passion to solve wicked healthcare problems.

What is the nature of your talk?: Very practical

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Highly

06/09/2016 : 11:30 : Room-DS1.09

Code: OR58A1786

Forecasting Demand for Diagnostic Endoscopy Services Using Population Projections

Ms Alison Harper and **Dr Nav Mustafee** (*University of Exeter*)

Anticipating the effects of an aging population on the demand for health services can assist with efficient planning. Endoscopy services in England have experienced surges in demand following the impacts of changes to cancer referral guidelines, national public-health campaigns, and changes in national screening programs for early bowel cancer detection and prevention. These changes will continue to increase demand. An endoscopy is a diagnostic investigation to visualise the lining of the stomach or bowel using a thin flexible tube and a light source. Bowel cancer is the third most common cancer in England in both genders, and, like

stomach cancer, is more common in ages 65-85 years. Cancer referral guidelines and screening criteria are both explicitly age-linked for this reason. The Office of National Statistics produce biennial population projections per age up to 25 years ahead. The anticipated shift in the UK population structure shows an increase in the total number, and in the proportion, of elderly people to the total population. By mid-2039, more than 1 in 12 of the population is projected to be aged over 80 years. Common methodologies for forecasting demand in healthcare use previous demand to predict future demand. However the rate of population growth is also increasing, now at 0.7% per year, up 0.1% from the previous projected rate two years ago. The sustainability of the NHS depends on having sufficient capacity, and current reports describe endoscopy systems under increasing pressure. Using historical hospital data for different endoscopic procedures and urgency pathways, age groups and gender, population percentages can be extrapolated forward to estimate the volume of endoscopy referrals over the next five to ten years. This output may help decision-makers estimate future needs for endoscopy services.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Very

06/09/2016 : 12:00 : Room-DS1.09

Code: OR58A1644

Forecasting the Demand in the UK for Elderly Care Home Resident Places using Open Source Data.

Dr Colin Stewart (*More Metrics Ltd*) and **Mr Peter Mannion** (*Redmayne Consulting*)

This talk will describe the results from an analysis undertaken to estimate the future demand for care home places for the UK population aged over 50. As part of our work developing mortality and health risk scorecards using open source data, we calculate a set of mortality risk estimates for cohorts of care home residents aged over 50 that we will show can be used to forecast future demand for residential care home places at a UK level. The variation in mortality of care home residents by type of residency, sex and age will be presented and compared to the results of other research in the public domain. Our approach to forecasting future demand using a basic simulation model will then be described. Results for a central forecast (2012 to 2021) will be presented that has been generated by applying our mortality estimates to a starting population distribution taken from the 2011 census. If time allows, the results from further scenarios will be presented to show how different mortality projections might affect the future size of the elderly care home population in the UK.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Very

06/09/2016 : 14:00 : Room-DS1.09

Code: OR58A1613

Solution Approaches for Managing Dynamic Operating Theatre Waiting Lists

Miss Belinda Spratt and **Prof Erhan Kozan** (*Queensland University of Technology*)

It is becoming ever important to improve the efficiency of Australian public operating theatres so as to reduce waiting lists and improve patient outcome by providing on time surgeries. We consider the case study of an Australian public hospital with a large surgical department, long elective surgery waiting lists, and high demand for non-elective surgery. We present a Mixed Integer Non-Linear Programming (MINLP) formulation of the combined master surgical scheduling problem (MSSP) and surgical case assignment problem (SCAP) under a block scheduling policy. By incorporating a rolling horizon approach, we allow for stochastic surgical durations, emergency arrivals and cancellations. We also consider current Australian policies regarding the management of waiting lists and aim to maximise the number of elective patients scheduled over the horizon. Due to the size and complexity of the problem we require the use of a set of suitable heuristics and metaheuristics to produce good feasible solutions in reasonable amounts of computational time. A number of possible solution techniques have been discussed and promising preliminary results are presented.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: A little
Is your talk accessible and relevant to Practitioners?: Relevant

06/09/2016 : 14:30 : Room-DS1.09

Code: OR58A1645

Using a Stock and Flow Approach to Model the English Referral to Treatment (RTT) Waiting Times System and Report Performance Against the 18 Weeks Standard

Ms Tineke Poot (*NHS England*)

In England patients referred for non-emergency consultant-led treatment are on RTT pathways and they have a legal right under the NHS Constitution to start treatment within 18 weeks. England has an RTT waiting time standard of 92% - the proportion of RTT pathways that must be within 18 weeks - which leaves an operational tolerance to allow for patients for who starting treatment within 18 weeks would be inconvenient for the patient or clinically inappropriate. NHS England collects and publishes aggregate monthly RTT data to monitor delivery of this standard. There are many data factors and behavioural drivers that make RTT waiting times very difficult to nationally predict. This talk will discuss the development of a model to project the size of the RTT waiting list and 92% performance using a stock and flow approach. It will also discuss the adjustments and assumptions that were needed to deal with data quality issues, simplify the 'system' and improve our ability to project RTT waiting times nationally. This model is used regularly within NHS England and DH analytical teams to support their policy and operational colleagues in understanding the trends in RTT waiting times, assessing NHS plans and developing actions. The model's projections are a key part of delivery meetings with the Secretary of State for Health on RTT and are routinely shared with ministers and the NHS England Chief Executive.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Very

06/09/2016 : 15:30 : Room-DS1.09

Code: OR58A2929

Reducing Pressure in Emergency Departments through Information Transparency and Real-Time Data: A Case Study from South Devon and Torbay

Dr Navonil Mustafee (*University of Exeter*), **Dr Andrew Fordyce** and **Mrs Susan Martin** (*Torbay & South Devon BHS Foundation Trust*) and **Prof John Powell** (*University of Exeter*)

The UK NHS is going through a period of transition where, in the period of increasing demand for NHS services, the Trusts are being asked to make drastic cost savings and to further manage their budgets. The NHS five year forward view, published by NHS England in October 2014, set out a vision for the future with the threefold objective of meeting the changing needs of patients, to capitalise on the advances in treatment and healthcare technologies and to realise efficiency savings. Towards this seven new models of care have been proposed; these can be implemented locally across England. One of these care models focuses on urgent and emergency care network. It encourages the NHS Trusts to redesign urgent and emergency care for all affected age groups attending and using the Emergency Department (ED). The overall context of this research is on the application of OR techniques like modelling and simulation, predictive analytics, real-time data and business intelligence to help redesign a network of urgent care centres (UCC) that are run by South Devon and Torbay NHS Foundation Trust (subsequently referred to as 'The Trust'). In this abstract, we report on one such project where we worked in collaboration with the NHS managers and clinicians, information analysts and the Trust's IT department to make available real-time waiting times at UCCs and the ED department at Torbay Hospital as a web-based application. It is expected that its dissemination would inform patients that are in need of medical attention to the alternative services for minor injury or conditions (these are run by the community hospitals) and thereby reducing pressure in Torbay ED.

What is the nature of your talk?: Very practical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Highly

06/09/2016 : 16:00 : Room-DS1.09

Code: OR58A1768

Integrated Sexual Health Service Clinic Location Analysis in Hampshire

Dr Marion Penn, Dr Rudabeh Meskarian and Dr Thomas Monks (*University of Southampton*)

Solent NHS Trust provides a fully integrated Sexual Health Service across Hampshire. The service provides outpatient services for GUM (STIs testing and treatment), contraceptive and reproductive health (including termination of pregnancy and vasectomy), sexual health promotion and a Sexual Assault Referral Centre. There are two main types of clinic, central hubs and smaller spokes. The central hubs are located in high population areas and are open every weekday, while the spokes are spread out across smaller population areas and have a variety of opening times. Most hub clinics have a high footfall, which has caused difficulties with waiting times and demand management. We have concentrated on forecasting future demand for different aspects of the service over the next 3-5 years, identifying the number of clinics required, whilst considering the optimal clinic locations that minimise travel times for patients. This has been achieved through extensive data analysis as well as utilisation of mapping and GIS software and numerical location analysis. The use of a variety of analysis techniques provides a broad insight into the underlying problem. We will discuss how this has assisted in discussions with decision makers and provided an evidence base for changes to the configuration of clinics.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Very

06/09/2016 : 16:30 : Room-DS1.09

Code: OR58A1829

A Multi-Methodological Approach for Healthcare Facilities Location Decision Problem

Prof Alessandra Oppio, Prof Stefano Capolongo and Dr Marta Dell'Ovo (*Politecnico of Milano*)

Site selection for urban facilities is a crucial topic in planning decision processes for the several side effects they produce and the multiple criteria involved, especially for healthcare facilities. Health care provision policies generally neglect to address the distribution of health care facilities within cities, entrusting every time the choices to different categories of stakeholders. Starting from a cross-disciplinary deep literature review across different research fields, the research proposes a multi-methodological approach for addressing decisions about healthcare facilities' location. More in deep a Multi-Criteria-Spatial Decision Support Systems (MC-SDSS) has been defined for providing an integrated knowledge about territory and the explicit consideration of the spatial dimension of this kind of decision problems. This study explores the potential use of GIS for modeling the spatial distribution and accessibility of hospitals in the city of Milan (Italy). Several digital and non-digital data have been collected and transformed into GIS data by spatial analysis tools and functions. Based on this analysis, it has been possible to provide suitability maps according to three main thematic issues: Functional quality, Location quality, Environmental quality. According these preliminary results, it possible to identify the need for improvements in the health care delivery system, including the identification of new facilities suitable sites. The combined use of GIS technology and MCDA seems to support health care planners and policy makers for effective planning and resource allocation.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

07/09/2016 : 09:30 : Room-DS1.09

Code: OR58A1599

The SIMTEGR8 Project: Facilitated Simulation for Improving Health and Social Care for the Elderly.

Dr Marianne Bamkin (*Loughborough Universtiy*), **Mr Edward Ostler** (*SIMUL8 Corp*), **Prof Zoe Radnor** and **Prof Stewart Robinson** (*Loughborough Univeristy*)

The SIMTEGR8 project is a research collaboration between Loughborough University, Leicestershire County Council (LCC) and Healthwatch Leicestershire that is analysing the effectiveness of four new interventions designed to avoid unnecessary emergency hospital admissions among the elderly. The project used and adapted the SimLean methodology (Robinson et al, 2012) to build a model for each intervention, which was then demonstrated at pairs of workshops, one for stakeholders and another for patients and carers, for each

of the interventions. At each workshop participants watched the simulation, discussed the reality of the patient pathway and contributed improvements to the simulation as well as to the operation of the patient pathway. As the project progressed, the methodology itself was questioned and evaluated to find out whether the project could have been conducted differently. The workshop discussions were structured around the understanding of the patient pathway, the computer simulation and issues raised by the simulation. The base data used for the initial model was collected from LCC sources prior to the workshops, and it was found that discussion on the models revealed other sources of data, as well as the need to gather certain metrics that would give a fuller picture of the patients using each pathway. It was also the intention to discover the patient viewpoint through a workshop situation, but it was found that the user profile of each pathway precluded individuals from attending. Overall, the concept of the using modelling as a focus for discussion and change in a workshop environment was found to be sound. Participant's suggestions and pledges for actions have been integrated into the intervention planning and informed LCC about the interventions. Some further thought to the design of the methodology would have also revealed more about the pathway from the patients and carers' perspective.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

07/09/2016 : 10:00 : Room-DS1.09

Code: OR58A1732

Evaluation of a Mr Antonios Glampedakis Distribution using Poverty Measures: Issues, Challenges and Advantages: A Nurse Rostering Application

Prof Dylan Jones and **Dr Djamila Ouelhadj** (*University of Portsmouth*)

Several Operational Research (OR) applications are evaluating an allocation of resources to a group of individuals. Those groups of individuals have properties that resemble societies. Thus, insight from disciplines that study societies such as Economics or Social Sciences can be used. In OR the evaluation of the distribution is usually done with an utilitarian approach, or using some statistical models. Inequality or Fairness concepts have been already applied to societal problems. In this study we adapt the concept of poverty (or starvation of resources) to Nurse Rostering Problem. A number of poverty measures that are available in literature are used to evaluate the allocation. Real world analogies with poverty concepts are presented. Applicable issues concerning poverty are studied. A series of experiments are performed in order to study different sets of parameters and evaluate a series of poverty measures. Nurses satisfaction is then investigated independently from the hospital management, forming two conflicting criteria. The results are then compared using Multiple Criteria and other methods. Hence OR models are augmented with more tools to evaluate allocations.

What is the nature of your talk?: Theoretical

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Somewhat

07/09/2016 : 11:00 : Room-DS1.09

Code: OR58A1844

Senior Citizens' Potential Demand for Exercising

Dr Jiun-Yu Yu (*National Taiwan University*)

Taiwan has already become an aged society, and the percentage of senior citizens in capital Taipei is the highest among all cities in Taiwan. Therefore, helping senior citizens live with better quality during the process of getting older has become a tough challenge for Taipei City Government. In the study, we use different ways to analyze data provided by Easy Card Corporation to understand how senior citizens commute within the city. We then compare the result we got from the data with the result from observation method. By doing so, we can summarize the potential demand of exercising for elders in the city. This study has three main achievements: The first is to understand the current condition and potential demand of exercising for senior citizens. The second is that government can use the result of this study as the base of the establishment of the 2nd generation sport center. The third is that government can use the result of this study as a guideline to adjust and reinforce the current facilities in the city.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: A little
Is your talk accessible and relevant to Practitioners?: Relevant

07/09/2016 : 11:45 : Room-DS1.09

Code: OR58A1926

KEYNOTE: The impact of OR on Health Services Past, Present and Future – Shouldn't We Be More Proud and Optimistic?

Prof Thierry Chausalet (*University of Westminster*)

In 2014, Simon Stevens the incoming NHS chief executive predicted in his five-year forward view a £30Bn annual budget shortfall for the NHS by 2020, of which £22Bn should be recovered from efficiency savings. Operational Research (OR) has to be part of the solution. However despite a lot of OR activity in the health sector, there has been on-going criticism about the level of impact that it has had on services. In this talk we will take a brief look back at some of the work we have done and see how we could learn from our success stories and other stories which have not quite made it. Maybe we are too hard on ourselves and we are more successful than we think. We will also attempt to provide a case on how OR might take a greater role within the integrated care agenda.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Relevant

08/09/2016 : 09:00 : Room-DS1.09

Code: OR58A1865

Modelling of Computed Tomography (CT) Services in Ireland using Both Discrete Event Simulation and System Dynamics to Demonstrate the Case for Load Balancing with Cross-Site CT Requisition.

Mr Mahmoud Elbattah (*NUIG*) and **Miss Mary Conlon** (*National University of Ireland*)

Using SD (system dynamics) and DES (discrete event simulation) the current model of radiology service delivery in Ireland is captured. In this position paper we propose a new model of exam requisition in Ireland. In this scenario, patients and referrers can choose where exams are to be carried out, based on their location, preference and availability. Currently there is little load balancing between departments and radiology departments mainly work independently. NIMIS (National Integrated Medical Imaging System) is an integrated RIS (Radiology Information System) and PACS (Picture Archive and Communication) system used in over 55 sites across the public health service in Ireland. NIMIS has radically changed work practices within departments but has not significantly changed work practices between departments. This paper describes ongoing research investigating how SD and DES modelling of NIMIS can facilitate a change of work practices between sites allowing for better utilisation of resources in the context of exam ordering and image reporting.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Relevant

08/09/2016 : 09:30 : Room-DS1.09

Code: OR58A1609

Dissecting the UK Military Medical Chain

Miss Laura Brudenell and **Miss Anjna Kashyap** (*Dstl*)

For every activity the UK Armed Forces undertake, a critical supporting function is the ability to provide medical treatment to the deployed force. The Defence Science and Technology Laboratory (Dstl) undertakes OR on behalf of the UK Ministry of Defence (MOD), to inform planning to provide all deployed personnel with adequate medical care during operations and exercises. Dstl provides analytical support to current operations, involving medical analysis of operational-critical data in tight timeframes, for example in support of the Ebola crisis in West Africa. Medical OR is undertaken using a variety of methods, ranging from simple spreadsheet analysis to simulation models, in order to estimate both Battle Casualties (BC) and Disease and Non-Battle Injury (DNBI) patients. The analysis makes use of several types of data. Historical data is used for detailed analysis of BC and DNBI rates, which can inform medical planning and doctrine developed by senior MOD decision makers. Hypothetical scenarios used for military planning allow the effectiveness of a scenario's

medical plans to be studied and to identify issues with current, planned and future-funded medical capabilities. Medical capability audits are undertaken regularly with input from experts including military personnel, to highlight gaps in the planned medical capability and procurement decisions and to support future balance of investment requirements. Medical analysis, through expert judgment, historical analysis or modelling, is undertaken to provide evidence based assessment of medical treatment requirements, including aspects such as casualty evacuation, deployed hospital capacities and transfers between an operational theatre and the UK. This presentation will provide an overview of the OR undertaken by Dstl, to evaluate the UK MOD capability to provide medical treatment to the UK Armed forces. Case studies on the work undertaken by Dstl (e.g. in support of the Ebola crisis in West Africa) will also be presented.

What is the nature of your talk?: Very practical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Highly

08/09/2016 : 11:30 : Room-DS1.09

Code: OR58A1725

Modelling the Increase in BMI (Obesity) Over the Last 20 Years

Dr Roger Brooks (*Lancaster University*)

There is very strong evidence linking obesity with various long term health conditions such as diabetes, hypertension and arthritis. One common measure of body type is the body mass index (BMI), with categories established for a healthy range, overweight and obese. Data derived from the Health Survey for England shows that the distribution of BMI for the population in England has changed over the last 20 years in becoming more skewed, with a much higher proportion of people in the obese category. However, there is no clear explanation for the precise way in which the distribution has changed. The presentation will describe analytical work to find simple and plausible transformations that would produce the observed change in the BMI distribution. The transformations are expressed in increases in BMI. The pattern of the transformations is that those with a higher BMI tend to have higher increases in BMI. Energy balance equations are then used to convert the transformations into values for additional food calories. One mechanism that might have resulted in such transformations is the adoption of certain lifestyle changes. The increases then come from unhealthy lifestyle behaviours compared to lifestyle patterns 20 years ago. For example, these might be new food and drink products, new food outlets, different leisure activities, and different work patterns. One way of viewing these changes is as diffusions of innovation, as applied to the introduction and spread of new ideas and products. In fact some of these lifestyle changes are new products. Using this perspective, social network effects may play a role and an agent-based simulation model has been developed to explore such effects. Some results from the model will also be presented.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Relevant

08/09/2016 : 12:00 : Room-DS1.09

Code: OR58A1724

The Association between BMI (Obesity) and Long Term Health Conditions

Dr Roger Brooks (*Lancaster University*)

The Health Survey for England (HSE) is an annual survey of households in England (using random sampling) that provides good data on a wide variety of health and lifestyle factors. This includes body mass index (BMI), which is a commonly used measure of obesity, and long term medical conditions, which are health conditions expected to last more than 12 months. Body mass index is calculated using height and weight with these being measured by the interviewer. The interviewer discusses long term conditions with the respondent and codes any such condition using 40 codes. The presentation will describe analysis to look at the association between BMI and long term conditions in the last 10 years of the HSE data. The analysis also takes into account age and gender. Strong associations were found between BMI and five conditions: diabetes, other endocrine, hypertension, heart attack, and arthritis. There is a lot of previous work in this area and these associations are as expected. However, some previous studies just consider obesity categories rather than the actual BMI values. The data set also enables combining the conditions through looking at those respondents

with at least one of the five conditions. Logistic regression curves were then fitted to the data and were found to give a good match. This allows an assessment and comparison of the different factors. There is some indication in the data of the association between BMI and the conditions starting within the "healthy range" for BMI. A statistical test using logistic regression found some evidence of this, which could have implications for the specification of healthy BMI values. The HSE is cross-sectional data and the limitations of this will also be discussed.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Relevant

08/09/2016 : 13:15 : Room-DS1.09

Code: OR58A1616

KEYNOTE: Using Simulation Modeling to Design Value-Based Healthcare Systems

Mr Mahmoud Elbattah (*National University of Ireland Galway*), **Dr Bernard Zeigler** (*RTSync*), **Dr Ernest Carter** (*Prince Georges County*) and **Dr Owen Molloy** (*National University of Ireland Galway*)

For the foreseeable future, quality improvement of Healthcare Service Systems (HSS) will depend on implementing a health information infrastructure that supports human decision making about protocols, processes, and procedures that work together to support the value-based paradigm. Based on a recent formalization of pathways-based coordination of care, this paper presents a simulation framework to guide design, development, and evaluation of architectures to produce value in health outcomes i.e, to reduce cost while improving quality. The Pathways technology is a coordination structure that offers a potential for application to at-risk populations but also more generally where services exist but are not efficiently nor cost-effectively deployed. A simulation model is presented that exemplifies this framework and is intended to predict return on investment for implementing pathways-based coordination as well its sustainability over the long run. Finally, we point out needed expansion of the model to include dimensions such as client risk characteristics, the referral source of clients to the coordination program, the effect of incentives on performance, and alignment of pathways with payments.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Somewhat

08/09/2016 : 14:15 : Room-DS1.09

Code: OR58A1679

Simulation Modelling of the Cost and Benefits of Different Working Patterns to Address the Hospital Weekend Effect.

Dr David Halsall (*NHS England*)

The simple car part test shows that hospitals work most intensely during traditional "office hours", Monday to Friday. There has been for a number of years national and international debate on if patients requiring emergency care out-of-hours have poorer outcomes. A recent publication has shown an association with an increased risk of death if admitted to a hospital as an emergency at the weekend both in England and the USA. NHS England has recently introduced standards to ensure patients get high quality care seven days a week. But this raises the question what is the most effective allocation of resources of clinical and diagnostic staff over the full working week. At a national level a weekend effect can be observed with routinely collected statistics. But at a hospital level random variations in the volume of admissions and patient types makes the weekend effect hard to monitor and control. To identify what impact changing working patterns might have on excess weekend mortality a generic "Bigshire" simulation model has been built. This represents the major medical and surgical emergency care pathways from admission to discharge in a typical hospital. It includes queues of patients waiting for full clinical review and diagnostic tests. This permits the investigation of how delays may build up from different working patterns. By making assumptions on what impact delays could have on outcomes the costs and benefits of different resource patterns can be investigated. A number of scenarios will be presented which show the trade-off between cost, benefit and staff utilisation which can help hospital management plan their resources.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Highly

08/09/2016 : 14:45 : Room-DS1.09

Code: OR58A1605

Addressing Complexity in Simulations using Paraconsistent Logic

Dr Roger Eglin and **Mr Peter Bednar** (*University of Portsmouth*) and **Mr Advait Gandhe** (*ViSIm*)

Medical schools often use simulation as a technique for teaching surgical techniques. Some simulations are based on bi-valued logic - a binary relationship in computing terms, or a relationship based on simple probability. Here, particular levels of certainty are assumed for development of the simulation, allowing a simple framework for modelling basic scenarios. However, the real world represented in a simulation is unlikely to be bi-valued with two clear, definite solutions. Parameters will be fuzzy; they could be anywhere on a scale between these dual outcomes. Accepting this as a possibility, portrayal in a simulation becomes more complex and demanding. In surgical training, a simulation may need to take account of varying circumstances. It could be realized half-way through a procedure that the surgery is not really needed; or that the patient has unexpected physiological anomalies, so that a different approach is called for. Uncertainty brings more problems for modellers. Outcomes may call for subtler choices than a scale of values, e.g. 'A or B, or possibly also C' – modellers cannot be sure because the world is ambiguous. Many simulations fail to allow for situations such as this, which may give trainees a false sense of understanding created by over-simplification. Effectively, simulations based in bi-valued logic reinforce an illusion that there is always a clear solution, or that the solution is known. Human reasoning is not limited in this way. People are capable of assimilating ambiguity: keeping a range of options open or addressing complex issues that are summed up in the phrase 'it depends'. Using paraconsistent logic, it is possible to envisage development of tools (including simulation software) that reflect human capacity to categorise and create resolutions that are inherently self-contradictory. This paper will set out a basis for simulation using paraconsistent logic that is tolerant of ambiguity.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Relevant

Information Systems



Organiser: Mark Xu

06/09/2016 : 11:00 : Room-DS2.12

Code: OR58A1849

Less is More - the Importance of Little Data in Organizational Decision-Making

Dr Christine Welch and **Dr Peter Bednar** (*University of Portsmouth*) and **Mr Peter Imrie** (*QinetiQ*)

When it is possible to analyse integrated data across multiple servers, controlled by separate organizations, benefits are clear, e.g. detection of insurance fraud. However, high-level data analysis cannot answer all organizational needs. Individuals require means to inform themselves in situations that are complex, contextual or require a fast, flexible response. Here, there can be no substitute for 'little data', i.e. data controlled by individuals, oriented towards their own goals and secured for personal access. When faced with dynamic complexity, it is human to want to simplify and tempting to place reliance on automated systems to give 'the answer'. However, such situations require open systems approaches, enabling actors to raise their levels of awareness, taking into account a range of possible perspectives. Actors need to build rich knowledge-bases, structuring ambiguity so that informed choices can be made. For this reason, many examples are emerging that demonstrate the importance of effective support for professionals to organize 'little data' within their work roles. Furthermore, as one commentator recently put it, 'big data would be nothing without the little data that goes along with it', i.e. contextualisation. Examples can be found in fields as diverse as retail marketing, law enforcement, flood control and women's health. One example of support for a personalised decision-making will be discussed: a prototype of a contextualized, private user-controlled Virtual Personal Assistant. An intelligent program, it uses AI and natural language processing capacities, combined with emulation and imitation of individual emotional engagement. Completely independent, it could be made to run on personal devices such as smartphones, interacting with other devices, e.g. Internet of Things, for its owner. All built-in meta-data analysis and pattern analysis etc. is developed locally and not shared with other devices or databases. Thus, it is a bottom-up approach providing what may be described as 'Little Data'.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

06/09/2016 : 11:30 : Room-DS2.12

Code: OR58A1690

Critical Systems Thinking and Information Systems Development

Mr Harry Kogetsidis (*University of Nicosia*)

Organisations face significant challenges including the need to respond to very turbulent environments with high levels of uncertainty and change, increasing customer demands and levels of competition, as well as other economic and social pressures. At the same time, there is no doubt about the importance of information systems in organisations and the contribution that successful information systems development can make in helping organisations respond to these realities. It appears that information systems development is often treated as a technical domain and as a problem to be solved, with the human factor of change often being treated as less important or neglected altogether. On the other hand, there is no doubt that information systems are social systems and information systems development should therefore consider the wider needs

of the organisation and the divergent interests of the various stakeholders. This paper draws on the ideas of critical systems thinking (CST) and argues how this research perspective – with its holistic orientation and commitment to methodological pluralism – can contribute to the successful development of information systems. The paper argues that information systems development should not be developed simply as a means to solving technical problems but instead be treated as a significant tool to help address a complex mix of organisational issues and environmental challenges. Information systems will be more successful if organisations recognise the systemic nature of change, appreciate the many multiple perceptions and conflicted interests of those involved in and affected by the change, and take steps to include them in the IS development process.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Relevant

06/09/2016 : 12:00 : Room-DS2.12

Code: OR58A1741

Organisational Enquiry in 21st Century – Exploring the Use of Soft Methods.

Prof Frank Stowell and Dr Penny Hart (*University of Portsmouth*)

Communication technology has enabled enterprises to capitalise upon expertise anywhere in the world through the deployment of virtual teams. These virtual teams present challenges for those who are called upon to investigate ways of improving organisational performance, specifically how decisions are made in such situations, how participants are engaged in the decision making process and how power is managed in these settings. Traditional methods of organisational inquiry present problems when the team might be separated from the parent organisation by thousands of miles and where the composition and dynamics of the team itself are fluid. Soft methods may be considered but there is little in the current literature exploring what soft ideas can contribute to enquiry in an organisation in an ICT world. To explore some of these issues we engaged with an enterprise in which knowledge sharing was critical, but whose members, although all in the same establishment, moved on every three years. We wanted to explore how soft ideas combined with ICT could be used in organizational enquiry when the participants were, in some respects, transitory and where there were issues with succession planning and the preservation of tacit knowledge. A soft method, the Appreciative Inquiry Method (AIM), was used as it had been used in previous research using ICT and offered a way of enhancing the face to face meetings. This paper describes the research and the lessons learnt for its application.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Relevant

06/09/2016 : 13:30 : Room-DS2.12

Code: OR58A1672

KEYNOTE: Understanding the Impact of Analytics - Challenges and Opportunities for Research

Prof Yanqing Duan (*University of Bedfordshire*)

The emergence of Big Data and the advance of analytical technologies provide organisations with extraordinary opportunities to differentiate themselves through analytics. How, why and to what extent is Analytics impacting on business operations and performance? Information systems' researchers are facing many emerging research challenges as well as opportunities in order to address these questions and to know how to maximise the value of analytics in the era of Big Data. This presentation will first provide a brief review of the current development of research on understanding the impact of Big Data Analytics. Based on the author's involvement in the research projects focusing on examining the impact of analytics on business competitive advantages, innovation, strategic decision making, and student experience management in UK HEIs, the presentation will discuss the key challenges emerged from the recent research projects. To address these challenges and opportunities, the presentation will provide a base for stimulating debates and discussions on future research agenda.

What is the nature of your talk?: A mix
Does your talk require prior knowledge of the subject area?: Some
Is your talk accessible and relevant to Practitioners?: Very

06/09/2016 : 14:00 : Room-DS2.12

Code: OR58A1784

Semantic Text Mining Using Domain Ontology - A Prototype for Detecting Marine Tenders

Dr Andrew Lee and **Dr Han Liu** (*University of Portsmouth*), **Dr Sajid Siraj** (*Leeds University Business School*) and **Dr Mark Xu** (*University of Portsmouth*)

Big data within Information Systems research is a contemporary phenomenon where the challenge is to make sense of data, particularly for unstructured textual data. There are many text mining approaches based on key-word based searching, including syntactic text processing methods and Natural Language Processing (NLP), however these often retrieve irrelevant results, highlighting a gap in leveraging the meaning of domain specific textual data to improve on existing retrieval results. This presentation addresses the development and evaluation of a prototype information retrieval workflow which incorporates both domain and document structure ontologies to identify marine industry related tenders from unstructured text documents. The prototype is implemented in KNIME, an open source data mining tool, allowing the enhanced semantic text mining function to apply to other domain ontologies that contain domain specific knowledge, for example healthcare records, CV searching and patent mining.

What is the nature of your talk?: A mix
Does your talk require prior knowledge of the subject area?: None.
Is your talk accessible and relevant to Practitioners?: Highly

06/09/2016 : 14:30 : Room-DS2.12

Code: OR58A1832

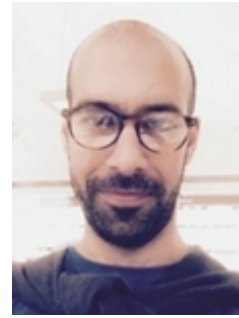
Segmented Stylometry

Mr Michael Mortenson and **Mr John Waller**, (*University of Warwick*)

The rise of companies who offer essay-writing services to students has been widely acknowledged in universities, as well as in the popular press. This presents a significant problem for universities as it is very difficult to detect cheating of this kind with traditional means. This talk presents an algorithmic solution to this problem that draws upon text analytics, machine learning and stylometry (the analysis of variations in literary style between authors). The system takes an input the full set of coursework submissions from all students, and seeks to identify a model of their stylistic ticks (such as frequently used words and phrase, and various metadata such as paragraph lengths, number of references and chapter structure). Using this model, machine learning methods can be used to classify each item to an author, with any mis-classifications (papers that are not shown to be written by the stated author) used to flag up potential contract-writing issues. Additional approaches are used to counter the issue of similarities based on subject – the fact that particular questions and topics lead to their own word frequencies and stylistic approaches – creating a segmented, hierarchical solution to the problem. The talk will detail the specifics of the method, as well as discuss some of the future options to improve upon it.

What is the nature of your talk?: A mix
Does your talk require prior knowledge of the subject area?: Little
Is your talk accessible and relevant to Practitioners?: Very

Infrastructure



Organisers: Andy Chow, Fuzhan Nasiri and Tohid Erfani

07/09/2016 : 09:30 : Room-DS1.04

Code: OR58A1648

Agent-Based Modelling of Transport Network Resilience

Dr Andy Chow (*University College London*)

Transport networks are vital for sustainable development, wellbeing, and security of a society. However, they can be vulnerable to various natural and man-made disruptions. Sustainable and feasible strategies call for effective management of existing infrastructure which relies on thorough understanding, modelling, and optimisation of the underlying complexity of the network systems when disruptions occur. This paper presents an agent-based modelling approach for estimating and managing the vulnerability and resilience of transport networks subject to different magnitudes of disruptions. Different from the traditional equilibrium based approaches, the network is represented by a multi-agent system developed on the MATSim (Multi-Agent Transport Simulation) platform. Based on the prevailing network conditions, the agent-based model regards each traveller as an 'agent' and estimates their behaviour in terms of choices of activities and the associated durations, travel routes, modes, and departure times. Each agent will make and revise their individual travel choices such that their expected 'utility' gained from the trips is maximised. Different from the equilibrium based approaches, the agent-based model captures the transient process of the network systems and even allows the system end up in chaotic state with inappropriate measures. This feature is shown to be important for evaluating network vulnerability and resilience with disruptions under which the network systems are highly dynamic. We apply the simulation framework to a real world network in the city of Anaheim, CA. The network consists of over 32,000 links, 16,000 nodes, and 3700 facilities. We consider a set of hypothetical disruptions of different magnitudes. The results show that managing travel information and behaviour is important for maximising the network resilience. It also reveals that the amount of data incorporated and computational effort spent in the modelling process can affect significantly the corresponding evaluation of network vulnerability.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Relevant

07/09/2016 : 10:00 : Room-DS1.04

Code: OR58A1703

Using Smart Meter Data in Managing Low Voltage Electricity Networks

Dr Andrew Brint and **Mr Goudarz Poursharif** (*Sheffield University*)

Large amounts of secondary data are becoming available for the owners of infrastructure networks such as electricity, water and road. As this information has been collected for other purposes, there is a danger of "Data Rich Information Poor (DRIP)" situations. This is true for the electricity Distribution Network Operators (DNOs) where the completion of the roll out of smart meters in 2020, will provide them with large amounts of lv load information but the benefits are unclear. Problems and solutions discussed will include: Missing data - Smart meter data sets (will) have significant gaps in them. For example, older smart meters will not be providing data in real time but after a delay of many weeks. Aggregated data - The half hourly readings from

a single smart meter when viewed over number of weeks can provide a picture of the residents' lifestyle, e.g. the timing of meals, when the house is likely to be unoccupied, etc. Therefore the DNOs will only have the readings from groups of meters, not individual ones. What impact will this have on usefulness of this data for network management? Time resolution - Load readings will be at half hour resolution. While this is a major advance on the quarterly meter readings that might be available at the moment, what is the consequence of not having minute resolution data e.g. for loss calculations? Unknown phasing - Smart meters will not detect the phase a house is connected to. If the individual smart meter readings on a circuit are available over several days along with the phase currents at the distribution substation, then linear programming can be used to determine the phases. What can be done in the cases where there are many fewer readings or where several meters have been aggregated together?

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Relevant

07/09/2016 : 11:00 : Room-DS1.04

Code: OR58A1755

Integrating Flexibility and Adaptability in Water Investment Decision Making under Climate Change Uncertainty

Mr Kevis Pachos (*UCL (London Global University)*)

There is an increasing awareness that freshwater resources are limited and water availability is expected to decrease in many regions. Planning for water resources infrastructure is an essential process to meet the growing populations demand for water. This involves evaluating various alternatives engineering projects that can be undertaken to secure a reliable and economically efficient system of water supply. However, development of such optimal plans is complex; crucial investment decisions which have to be made in the present need to account for the needs of a future which is largely unknown. Climate change is the main source of supply uncertainty and its impact on source yields is deeply uncertain. Adaptation is increasingly being suggested as a way to account for the uncertainty in planning for future water infrastructure. Since present decisions can impact the ability to adapt the system to future needs, flexibility should be considered in the option programme appraisal process. Current widely used approaches do not enable the value of flexibility to be explicitly included within the decision making process and risk overinvesting in redundant capacity. To overcome these limitations, while accounting for supply uncertainty, we introduce an approach to strategic long-term water resource planning that explicitly considers adaptation ability and values flexibility. The plans are adaptive in that options are delayed or accelerated as uncertainty about the future is progressively revealed. The approach uses a hundred plausible future supply realities over a 50 year planning horizon at 5-year intervals producing a set of pathways that remain optimal under certain supply scenarios. A practical application to the forecasted London supply-demand deficit demonstrates the benefits of seeking adaptability. The results prove the utility of the proposed approach with adaptive plans achieving substantial improvement in performance compared to alternative optimisation approaches.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Highly

07/09/2016 : 11:30 : Room-DS1.04

Code: OR58A1778

Seaport and its Dependent Infrastructure Resilience

Mr Kamal Achuthan (*UCL*)

Seaports handle 95% of UK trade and serve as the gateway for imports and exports. Being an island nation, ports are considered as a critical infrastructure and the whole of UK supply chain system relies upon it. Disruption to major ports can cause huge impacts to dependent supply chain organisations and the economy. Some of the critical supplies such as food and energy supply chain disruptions could immediately impact the daily life of UK population. Ports are vulnerable to threats and with emerging risks due to climate change need to be resilient. However, their resilience depends upon the number of stakeholders that make up the port system and their complex interdependencies. Ports are complex system with different functions carried

out by a number of stakeholders and are highly inter-dependent on each other. The sea-side and land-side access are tightly linked with port operations and that failure at one could cascade to complete closure of a port. Risk management practices and business continuity measure among port stakeholders are still confined to individual organizations and lack understanding of system risks, consequences and critical dependencies. In this presentation, MARS (Methodology for assessing resilience of seaports) a decision support tool developed to address the above issues will be described using port of Immingham as case study. MARS is a user friendly port operations simulation model that includes all key activities of a port system as variables that could be altered to depict a threat scenario. The tool can be used to establish consequences of a disaster such as periods of disruption, recovery times and business impacts in terms of ship throughput, tonnage of goods etc. with and without resilience plans. The presentation will also discuss the methodology of using it as part of a stakeholder participatory resilience planning exercises and its benefits.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Relevant

07/09/2016 : 12:00 : Room-DS1.04

Code: OR58A1872

The Application of Set-Based Concurrent Engineering to Enhance the Design and Manufacturing of Oil/Water Separator

Dr Ahmed Al-Ashaab (*Cranfield University*), **Mr Najam Beg** and **Mr Gautam Kumar** (*Caltec Limited*), **Mr Ti Lu** and **Mr Muhd Ikmal Isyraf Mohd Maulana** (*Cranfield University*)

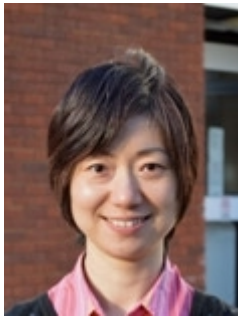
Set-Based Concurrent Engineering (SBCE) is an approach that has the capability to improve the efficiencies of the product development process. SBCE provides an environment where design space is explored thoroughly which lead to enhance innovation. This is achieved by considering an alternative set of solutions after gaining the right knowledge to support the decision to narrow down the set of solutions until the single optimal design solution is reached. This paper is presenting a novel application SBCE in order to generate alternative design and manufacturing methods to enhance the efficiency of an oil/water separator. The SBCE application has let to generate an enhanced compact design with around 40% cost reduction.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Quite a lot

Is your talk accessible and relevant to Practitioners?: Highly

Inventory Management



Organisers: Huijing Chen, Chee Khian Sim, Patrick Beullens and Michael Robinson

06/09/2016 : 11:00 : Room-DS2.09

Code: OR58A1636

Cooperative Replenishment through Bidding

Dr Behzad Hezarkhani (*Nottingham University*)

Collaborative purchasing and replenishment has proven to be beneficial in supply chain management. This talk addresses the situation where buyers, potentially in possession of private procurement channels, carry out cooperative purchasing by submitting their bids to a coordinator. The collaborative organization is faced with two basic decisions: (1) who will be allocated with the products, and (2) how much each party should pay. We discuss mechanisms that could achieve desirable outcomes in this settings with special attention to the strategic behavior of the buyers.

What is the nature of your talk?: Theoretical

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

06/09/2016 : 11:30 : Room-DS2.09

Code: OR58A1798

Optimisation of Maintenance Repair & Overhaul (MRO) Spare Parts Forecasting Models using Data from Several Fast Moving Consumer Goods (Fmcg) Facilities

Miss Stella Lazoura, Dr Philip Brabazon, Dr Banafsheh Khosravi and Dr Djamila Ouelhadj

(*University of Portsmouth*), **Mr Mike Robinson** and **Mr Goutham Adithya Veerakumar** (*Entec Global Group*)

In the MRO context, the pattern of demand for spare parts tends to be intermittent. A more refined four-way categorisation of demand is: slow-moving, intermittent, erratic and lumpy. Several forecasting models have been proposed in the literature including Croston's and the Syntetos-Boylan Approximation, and recommendations have been made as to the choice of model for each demand category. Using operational MRO data from several FMCG production facilities, this study assesses the performance of relevant forecasting models. A number of approaches to select the training set with which to optimise each model's parameter(s) are developed and compared. The quality of forecasts are evaluated using classical measures such as mean squared error and by calculating the exact safety margin that provides a maximum stock-out quantity of zero. The best performing models per demand category are identified and the findings are compared to guidelines in the literature. Abbreviations MRO - Maintenance, repair, and Operations; FMCG - Fast Moving Consumer Goods;

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Very

06/09/2016 : 12:00 : Room-DS2.09

Code: OR58A1800

Spare Parts Inventory Pooling/Sharing Model for Fast Moving Consumer Goods (FMCG) Companies.

Mr Ali Hamdan and **Dr Djamila Ouelhadj** (*University of Portsmouth*), **Mr Mike Robinson** and **Mr Goutham Adithya Veerakumar** (*Entec Global Group*)

This study proposes a spare parts inventory-pooling framework for sharing MRO spares across two or more facilities that are owned by single and/or multiple companies in order to optimise the operations, inventory holding and machine downtime costs, while still satisfying the unpredictable demand. From the perspective of MRO procurement and fulfilment process, strategic, operational, beneficial, and cost implications of sharing spares are identified. OR methodologies such as multi echelon, sustainable distribution, Shapley & core, Erlang loss function, and queueing theory; are evaluated and used to design & operate this cooperative framework and discussed thereafter. Computational experiments are conducted using MRO inventory, demand, procurement, and finance data from multiple FMCG companies to evaluate the performance of the proposed framework to achieve the KPIs. Abbreviations MRO - Maintenance, repair, and Operations; FMCG - Fast Moving Consumer Goods; OR - Operations Research; KPIs - Key Performance Indicators.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Highly

06/09/2016 : 13:30 : Room-DS2.09

Code: OR58A1807

Approximate Dynamic Programming Algorithms for Multi-dimensional Inventory Optimization Problems

Dr Christopher Kirkbride (*University of Lancaster*)

We focus on optimizing inventory management decisions in a production system with process flexibility. With process flexibility, facilities are able to produce more than one product type during each production period. Determining optimal production decisions in a stochastic manufacturing system with process flexibility forms a complex, non-decomposable decision problem that cannot be solved via classical Dynamic Programming. We model this problem as a Markovian decision process, and suggest novel parametric Approximate Dynamic Programming algorithms for decision making in systems with process flexibility. The algorithm has been developed such that strongly performing production policies are achievable in large-scale process flexibility problem. Numerical studies reveal that the resultant parametric algorithm delivers reliable policies in process flexibility problems, regardless of the problem setup and flexibility design.

What is the nature of your talk?: Theoretical

Does your talk require prior knowledge of the subject area?: Quite a lot

Is your talk accessible and relevant to Practitioners?: Somewhat

06/09/2016 : 14:00 : Room-DS2.09

Code: OR58A1826

Inventory Decisions with Advance Demand Driven by Price Discount

Mr Muzaffer Alim (*University of Southampton*)

Price discounts are widely applied in supply chain management in order to manipulate the demand and reduce the uncertainty. Making discounts for perishable products, multiple products and pre orders are the most common usage of discounts. But also discounts can be used to encourage customers to accept late delivery. We consider an inventory problem with advance stochastic demand in which customers are allowed to order in advance of their need within a planning horizon and price discounts. The aim of the price discount is to change demands due date so that the supplier can arrange its stock while customers are enjoying the financial compensation in exchange of later delivery. However, not all customers are treated with a discount and the customers are willing to accept the price discounts with a probability. We formulate the problem by a Markov Decision Process and solve it by primal/dual LP model and backward dynamic programming approach. Various combination of inventory parameters under capacity constraint are tested. Numerical experiments provide an optimal inventory policy and a discount policy. We investigate the conditions under which price discount

brings more benefit and observe how the optimal policy is behaving. We also discuss some managerial insight about how to encourage customers to be honest on their true due dates.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Somewhat

06/09/2016 : 14:30 : Room-DS2.09

Code: OR58A1838

Inventory Management and Taxes, and Possible Implications from Brexit

Dr Patrick Beullens (*University of Southampton*)

Textbooks on inventory control point out that the carrying costs of stocks should include various factors, including taxes. However it is not made clear how to actually incorporate the impact of taxes into inventory models. Should we include corporation tax (CT), or value added tax (VAT) (or sales tax), or both, into our models, and if so, how? This paper examines in detail how to accurately account for CT and VAT in inventory models for a firm in the UK subject to government rules and schemes that were applicable in 2015. It will be shown how analytical results can be obtained which recognise the particular situation of the firm, including its size and the locations of its suppliers and customers. Possible implications from Brexit on the models, optimal decisions, and future profits are identified. Joint work with Hua Jin.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Very

Lean Manufacturing



Organiser: Hom Dhakal

06/09/2016 : 11:00 : Room-DS1.02

Code: OR58A1590

KEYNOTE: Critical Success of Lean Implementation: Philosophy, People, Culture and Continuous Improvement

Dr Hom Dhakal (*University of Portsmouth*)

Keynote: Originating from the Toyota Production System (TPS), lean manufacturing or lean thinking is defined as a philosophy which strives to deliver more values for the business and its customers by reducing the non-value added activities by balancing the process flow. In an attempt to stay in the competitive market, many organisations worldwide are seeking to implement lean philosophy through the adaptation of various improvement initiatives and lean tools in their products and processes. In spite of several benefits that lean offers, there are many reports highlighting the failure of lean practices. The successful implementation of lean depends on several factors such as careful implementation of organisational change initiatives, analysing lean readiness level before implementation, understanding of cultural issues and top management's commitment. This keynote talk aims at highlighting the critical issues for successful implementation of lean philosophy in both service and manufacturing sectors by focusing on the four main areas which are as follows: 1. Philosophy 2. People 3. Culture 4. Continuous improvement The keynote talk will focus on the typical benefits of lean by providing an in-depth analysis on the suitability of the common tools and techniques of lean manufacturing such as 5S visual management, just-in-time (JIT), single minute exchange of dies (SMED), total productive maintenance (TPM), value stream mapping (VSM), and Poke Yoke (error proofing) by correlating to different case problems.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Very

06/09/2016 : 12:00 : Room-DS1.02

Code: OR58A1762

Lean Philosophy in Practice from a Nigerian Perspective

Dr Ifechukwude Dibia (*Chevron*), **Prof Nick Bennett** and **Dr Hom Dhakal** (*University of Portsmouth*)

Lean Philosophy in Practice from a Nigerian Perspective Dr. Ifechukwude K. Dibia, Dr. Hom Nath Dhakal, Professor Nick Bennett Contact: dibiaifechukwude@yahoo.com Author(s): Dr. Ifechukwude K. Dibia (Lean Six Sigma facilitator CNL) Dr. Hom Nath Dhakal (Reader, School Engineering, University of Portsmouth, Portsmouth, UK) Professor Nick Bennett (School of Engineering, University of Portsmouth) Abstract Purpose – This paper looks at Lean in Nigeria using existing models to ascertain the degree of Leanness within sampled organisations. This paper tells the Nigerian Story on Lean deployment, its implementation, challenges and the enablers for sustenance. Design/methodology/approach – The active participatory action research method was used with interviews conducted in the course of the study. Analysis of the interview was carried out based on the views from in-depth literature study. Findings – Findings showed that in Nigeria just as in other countries, Leadership commitment, process excellence and people competency is as important as the will and drive for the Lean deployment to succeed shown by the people. Research limitation/implication – The cases investigated are based in Nigeria and to an extent limits the generalization of the findings although the key

factors necessary for successful deployment, implementation and sustenance of the Lean philosophy and its benefits in any organization as shown in this research and documented in existing literatures seems to be the same in any part of the world. Practical implication – The paper tells the Lean story from a Nigerian perspective. Social implication – The successful implementation of lean anywhere depends on Leadership commitment, people commitment, process optimization and excellent process management. Originality/value – This is one of the first documented study of Lean from the Nigerian perspective. Keywords: Lean, Leadership, People, Process, Outcome, Nigeria Paper type: Case study

What is the nature of your talk?: Very practical

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Very

06/09/2016 : 13:30 : Room-DS1.02

Code: OR58A1764

Lean Implementation: Creating Value through People

Dr Ifechukwude Dibia, Mrs Jennifer Lawal (*University of Portsmouth*) and **Dr Spencer Onuh**

Lean Implementation: Creating Value through People Dr. Ifechukwude Kingsley Dibia, Jennifer Nguseer Lawal, Dr. Spencer Onuh Contact: Jennifer.lawal1@myport.ac.uk Author(s): Dr. Ifechukwude K. Dibia (Lean Six Sigma facilitator CNL) Jennifer Nguseer Lawal (Researcher, Business School University of Portsmouth) Dr. Spencer Onuh (Centre for Satellite Technology Development, National Space Research & Development Agency, Abuja, Nigeria) Abstract Purpose – This paper looks at the implementation of lean in an industrial laundry machine manufacturing company. It looks at the deployment of lean in the organization from the awareness stage to the implementation stage. Design/methodology/approach – This study uses the Lean 'Leadership, People, Process, Outcome' (LPPO) implementation model which is a conceptual soft system approach that includes the use of value stream mapping and people awareness and education for the effective implementation of lean. Findings – This paper shows that leadership commitment, general awareness and visible consistent wins from the implementation of lean helps in sustaining it as a process improvement philosophy within an organization. Research limitations/implications – This case study is limited by the confines of its use, although the approach used and the 'LPPO' model can be adopted for use in the implementation of lean in any organization. Originality – This paper provides a practical step by step guidance for the implementation of lean and the achievement recorded in the implementation renders the case study a win-win for all. Keywords: Lean, Value Stream Map, Leadership, People, Process, Continuous improvement Type of Paper: Case study

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

06/09/2016 : 14:00 : Room-DS1.02

Code: OR58A1769

Risk minimisation by applying lean methods in Energy Recovery Facilities.

Mr Chinedu Dibia, Prof Nick Bennet, Dr Hom Dhakal, and Dr Sarinova Simandjuntak (*University of Portsmouth*)

Risk minimisation by applying lean methods in Energy Recovery Facilities. Chinedu Bevis Dibia, Dr. Sarinova Simandjuntak, Dr. Hom Nath Dhakal, Professor Nick Bennet Contact: chinedu.dibia@port.ac.uk Author(s): Chinedu Bevis Dibia (Researcher, School Engineering, University of Portsmouth, Portsmouth, UK) Dr. Hom Nath Dhakal (Reader, School Engineering, University of Portsmouth, Portsmouth, UK) Abstract Purpose – This paper looks at the risk based management process of an energy recovery facility. It focuses on the effect of applying lean methods with this management process to increase the achievable risk minimisation. Design/methodology/approach – Case study approach used with observations combined with simulated applications of lean methods. Finding - It was seen that a knowledgeable combination of lean methods and the existing risk management methods led to increased risk minimisation. Research limitation/implication – The use of a limited number of energy recovery facilities. Thus it cannot be said conclusively that the lean methods applied are totally responsible for the observed increase of achievable risk minimisation.

Originality/Value – This research evaluates the effect of lean methods on the effectiveness and efficiency of risk based management process of energy recovery facilities. Keywords – Lean, ERF and RBM

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

06/09/2016 : 14:30 : Room-DS1.02

Code: OR58A1761

AN ASSESSMENT OF THE INTRODUCTION OF LEAN MANUFACTURING: A case study of two manufacturing companies operating in Nigeria

Dr Hom Dhakal, Mr Chinedu Dibia and Mr David Wiltshire (*University of Portsmouth*)

AN ASSESSMENT OF THE INTRODUCTION OF LEAN MANUFACTURING A case study of two manufacturing companies operating in Nigeria Chinedu Bevis Dibia, David Wiltshire, Dr. Hom Nath Dhakal Contact: chinedu.dibia@port.ac.uk Author(s): Chinedu Bevis Dibia (Researcher, School Engineering, University of Portsmouth, Portsmouth, UK) David Wiltshire (Senior Lecturer, School Engineering, University of Portsmouth, Portsmouth, UK) Dr. Hom Nath Dhakal (Reader, School Engineering, University of Portsmouth, Portsmouth, UK) Abstract Purpose – This paper looks at the challenges in the introduction and implementation of lean in Nigeria. Using the sampled organisation to demonstrate the experience from a Nigerian perspective. Design/methodology/approach – Case study approach was used with semi structured interviews, observations combined with process modelling using Enterprise Design. Findings – It was seen that existing awareness of lean does not affect the willingness to explore lean so cannot be used as a measure of readiness. Also an analysis of the projected gains of using lean management with VSM may not affect Management stance on lean introduction and implementation. Management role was seen to be important. Research limitation/implication – The sample set of case study being two manufacturing companies in Nigeria, cannot be a valid base to state conclusively the factors affecting the introduction and implementation of lean. Practical/Social implication – The paper shows that lean introduction and implementation in Nigeria is still challenging. Originality/Value – This is one research that looks at and compares lean introduction in small scale production companies in different manufacturing sectors. Keywords – Lean, VSM Paper type – Case Study

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

06/09/2016 : 15:30 : Room-DS1.02

Code: OR58A1777

Integrating Lean management and environmental sustainability with innovation; Impact on Manufacturing Firms in Improving Environmental Performance

Mr Samsad Reza and Prof Dotun Adebajo (*University of Greenwich*)

Increasing stakeholder pressure to become environmentally sustainable has led the organizations to take some decisive actions on environmental effect, waste and energy reduction and innovation to reduce the adverse effect on the society and environment. Before 2020, all industrialized countries are committed to reduce GHG emission by 18% below 1990 level (UNFCCC, 2014). Therefore, manufacturing and other partners of the supply chain need to integrate and align their cost reduction and competitive strategies such as lean production and innovation with their regulatory requirements to be sustainable. The integrated approach can offer great return where reduction of cost, waste minimization culture and environmental thinking are viewed as part of a same strategy rather than separate entity, can facilitate competitiveness and innovation in the value chain (Porter and Van darLinde, 1995; Porter and Karmer, 2011). Existing research focused on the individual paradigm (lean/green /innovation) or looked at the relationship of other variables such as marketing performance, financial performance and human resources (Yang et al. 2011; Jabbour et al. 2013; Prajogo et al 2016). Absent in the literature is the study of the integration of lean, green and innovation together so as to answer whether they can be combined and what happens when they are combined. Data is being collected from UK manufacturers to validate our conceptual model using Factor analysis and Structural Equation Modelling with latent variables. This research examines the integration of three distinct (often contradictory) paradigms to explore the fuzzy areas of integration and its subsequent effect on environmental

efficiency. Additionally, it investigates the role of innovation in lean and green integration and the impacts of the integration on environmental efficiency which would augment the theoretical boundary of lean and green integration and at the same time would provide a conceptual model for the manufacturers to implement leaner, greener and innovative manufacturing.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

06/09/2016 : 16:00 : Room-DS1.02

Code: OR58A1859

Enabling Set-based Concurrent Engineering via Physics-based Trade-off Curves

Miss Zehra Canan Araci and **Dr Ahmed Al-Ashaab** (*Cranfield University*)

There is a huge demand on innovative products which forces companies to develop new products. Lean product development is an approach to support new product development. Set-based concurrent engineering (SBCE) is a process of developing a product in a lean environment. SBCE requires a right knowledge environment which represents the physical characteristics and the performance of the product, hence the design team could achieve a robust design and shorten their time-to-market. Trade-off curves are effective tools to provide and visualise this knowledge environment. This paper presents a process of generating trade-off curves based on the understanding physics of the product. The generated physics-based ToCs are used in an industrial case study to enable two key SBCE activities: (1) comparing alternative design solutions and (2) narrowing down the set of design solutions as well as supporting the design team for decision-making and communication between the departments.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Highly

Logistics



Organiser: Maurizio Faccio

08/09/2016 : 09:00 : Room-DS1.05

Code: OR58A1794

Randomised Simulation Heuristic for Inventory Routing Problem with Stochastic Demand
Miss Chanicha Moryadee, Dr Djamila Ouelhadj and Dr Graham Wall (*University of Portsmouth*)

In this paper we study the Inventory Routing Problem (IRP) with stochastic demand that deals with direct deliveries from the supplier with and without transshipments (Inventory Routing Problem with Transshipment, IRPT) between customers in conjunction with multi-customer routes in order to increase the flexibility of the system. The work is structured around two main models: development of optimisation models for IRPT and IRP with stochastic demand, and heuristic and sim-heuristics approaches to solve the problem. Specifically, randomised Clark and Wright Saving algorithm and simulation are combined to solve stochastic IRPT and IRP problems, respectively. Computational experiments have been conducted on benchmark problems from the literature and showed very promising results. To our knowledge, this is the first time that Randomised CWS algorithms with simheuristic are used to solve IRPT and IRP with stochastic demand.

What is the nature of your talk?: Theoretical

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

08/09/2016 : 09:30 : Room-DS1.05

Code: OR58A1863

Heuristic Approaches for Location Routing Problem with a Single Depot

Mr Abdullah Almouhanna (*University of Portsmouth*), **Prof Angel Juan** (*The Open University of Catalonia (UOC, Barcelona, Spain)*), **Dr Banafsheh Khosravi** and **Dr Djamila Ouelhadj** (*University of Portsmouth*)

The Location Routing Problem (LRP) is a popular combinatorial optimisation problem which is crucial in affecting the distribution industry. As LRP is concerned with determining the optimal number, location of facilities, and the optimal set of routing from each facility to serve customers. We consider a Mixed Integer Linear Programming (MILP) formulation for the capacitated LRP with a single depot where both depot and vehicles are capacitated. We propose four heuristics, namely: Two-stage clustering, Two-stage p-median, Two-stage clustering and p-median, and Iterated heuristics. In the first stage of the first three heuristics, namely two-stage clustering, two-stage p-median, and two-stage clustering and p-median heuristics, the location problem is solved by clustering technique, p-median, and clustering and p-median, respectively. In the second stage of the mentioned three heuristics, routing of customers is done with the extended version of Clarke & Wright Savings (CWS) heuristic which is called Biased Randomise Clarke & Wright (BRCW). The BRCW introduces biased randomness into the CWS algorithm by employing a pseudo-geometric distribution which generates the probabilistic parameter used to assign a probability of selection to each pair of routes in the savings list. In the iterated heuristic, a depot is chosen randomly in the first stage, and routing is solved in the second stage using the BRCW. The heuristic, then, iterates with another randomly chosen depot until all potential depots are checked. The algorithm keeps the best result in terms of both location and routing costs. The proposed heuristics are implemented on 10 instances chosen from a well-known benchmark data set. The computational results show that the proposed iterated heuristic can provide the best result among

the suggested heuristics. This means our approach is promising for further developments in terms of quality and computation time and extending the problem in terms of complexity and number of depots.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

08/09/2016 : 11:30 : Room-DS1.05

Code: OR58A1766

KEYNOTE: Transforming Your Supply Chain for Operation and Innovation Excellence

Mr Vikram Singla (*Oracle*)

Today, leading organizations are looking at ways to transform their operations from a functional necessity to a value-driven competitive advantage based on operational and innovation excellence. What transformative strategies and technology solutions, from product design through supply chain planning and execution, will help your company achieve that goal? This session will provide an insight into how leaders like Oracle are successfully transforming their supply chain operations. When Sun Microsystems was acquired by Oracle Corporation it faced a daunting challenge of fundamentally overhauling its supply chain strategy. Leaving behind its complex make-to-stock supply chain model Sun was able to create a new, simplified 100% make-to-order model in under 12 months. You'll also discover how supply chain business leaders are:

- Designing and building breakthrough products that are profitable and compliant
- Implementing demand-driven planning to improve customer-service levels and enterprise profitability
- Profitably balancing supply with demand, incorporating real-time sales and operations planning/integrated business planning
- Optimizing supply and cutting costs with performance-driven supply management and best-in-class integrated logistics
- Reducing risk and minimizing exposure to unplanned supply-chain disruptions

What is the nature of your talk?: Very practical

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Highly

08/09/2016 : 12:00 : Room-DS1.05

Code: OR58A1641

An Efficient Mixed Integer Programming Model for Pairing Containers in Inland Transportation based on Assignment of Orders

Mr Hajem Daham and **Dr Xinan Yang** (*University of Essex*)

The inland transportation takes a significant portion of the total cost that arises from intermodal transportation. In addition, there are many parties (shipping lines, haulage companies, customers) who share this operation as well as many restrictions that increase the complexity of this problem and make it NP-hard. Therefore, it is important to create an efficient strategy to manage this process in a way to ensure all parties are satisfied. This paper investigates the Pairing of Containers/Orders in Drayage Transportation (PCDT) from the perspective of delivering paired orders on 40ft truck and/or individual orders on 20ft truck, between a single port and a list of customer locations. An assignment MIP model is formulated, which can be used for solving the problem of how to combine orders in delivery to save the total transportation cost, where both orders with single and multiple destinations exist. In opposite to the traditional models relying on network flow formulation, this model falls into the assignment problem category which is more efficient to solve on large size instances. Another merit for the proposed model is that it can be implemented on different variants of the drayage problem: only import (delivery) of orders, import-inland and import-inland-export. Results show that in all cases the pairing of containers yields less cost comparing to the individual delivery and decreases empty tours, and the proposed model can be solved efficiently (within half hour) for over 300 orders.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

08/09/2016 : 13:15 : Room-DS1.05

Code: OR58A1709

Ant Colony algorithm for Convoy Movement Problem

Prof Ram Kumar P N (*Indian Institute of Management Kozhikode*) and **Mr Alan John Maniamkot** (*IIT Bombay*)

Convoy movement problem (CMP) is the problem of routing and scheduling military convoys between specific origin and destination pairs across a limited route road/rail network while adhering to some strategic constraints. Though this problem appears to be a special case of multiple origin-destination pair shortest path problem, there are two constraints specific to this problem that make it significantly different and computationally intractable. They are no-crossing and minimum headway constraints. Situations where two convoys cross each other along the same road/rail-link is referred to as conflict. Be it peacetime or wartime, conflicts are strictly forbidden as the roads/rail-links used by the convoys may not have the load bearing ability and width to accommodate two convoys at a time. More importantly, convoys crossing each other are extremely vulnerable to enemy strikes because of the magnitude of damage that can be inflicted upon. On the similar lines, convoys are not allowed to overtake each other and are expected to maintain minimum headway time while traveling along a road/rail link in the same direction. Though smaller instances of CMP can be solved to optimality using commercial solvers, the scope for solving practical and large problem instances using conventional mathematical modeling based approaches is very limited owing to its NP-completeness. Hence, from a practical point of view, it is important to generate routes and schedules for convoys quickly even if it is at the expense of the quality of the solution. This necessitates the development of heuristics/meta-heuristics for solving the CMP. In this study, we propose an ant colony based meta-heuristic approach for solving the convoy movement problem. We intend to investigate the suitability of the proposed ant colony algorithm, in terms of computational time and solution quality, by testing it on a wide range of problem instances.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Highly

08/09/2016 : 13:45 : Room-DS1.05

Code: OR58A1728

Network Design, Fleet Deployment and Empty Repositioning in Liner Shipping

Dr Shahin Gelareh (*Universite d'Artois*) and **Dr Rahimeh Neamatian Monemi** (*University of Southampton*)

We present a new modeling for the joint problems of network design, fleet deployment and empty repositioning. In our modeling framework the service routes are not known in advance and their design is a part of decision making. The cost structures is a submodular function and cannot be accommodated in compact formulation. Our modeling framework which is based on Benders reformulation of the problem allows us to integrate the cost function as a submodular function having the properties of a convex function. Our numerical experiments show that the method is efficient in solving the problem in a very efficient manner.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Very

08/09/2016 : 14:15 : Room-DS1.05

Code: OR58A1615

Material Handling Improvement in Warehouses for the Assembly Line Parts Feeding li Case of Kitting and in Case of Different Parts Categories

Prof Maurizio Faccio (*University of Padova*), **Prof Marco Bortolini** , **Prof Mauro Gamberi** and **Dr Francesco Pilati** (*University of Bologna*)

The assembly line parts feeding is a complex problem that strongly involves the logistic activities at the warehouse. In case of kitting the handling activities within the warehouse are related to the collection of parts for each kit composition, which is called the Order Picking Problem. Improving the order picking means to minimize the total travel distance and to minimize the time spent to pick the single part once reach its position. Typically to a certain kit belong different parts categories: small parts (SP), large parts but pickable

by an operator (PLP), large parts not pickable by an operator but only using a proper equipment (NPLP) typically stored in different warehouse facilities (i.e. racks, shelves, ground). A two-level approach is proposed that determines the locations of parts in the warehouse. Once assigned to each part a proper stock keeping unit in the warehouse and the related SP, PLP, NPLP attribute the first step clusters parts into part families depending on in which zone/kit of the assembly line they are used. The general output of this phase is a different dimension of each SP, PLP, NPLP families are generated for each cluster. In the second step an optimization model is proposed to determine the optimal location of parts minimizing the total picking distance with the aim of storing the same cluster in the same aisle, considering the typical constrain that in the warehouse each isle is composed by all the three warehouse facilities to store SP, PLP, NPLP with a fixed dimension for each one and equal for all the isles. The applied algorithm can easily be modified to be used with different configurations and for parts with different categorization. A case study from a harvesting producer company is detailed reported demonstrating the applicability and the practical implication of the research.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

Making an Impact



Chair of MAI Committee – Mr John Medhurst

MAI – Speed Networking

Organiser: Louise Maynard-Atem, CORDA

07/09/2016 : 09:30 : Room-DS2.14

Code: OR58A1878

Networking – a term that usually inspires fear, dread, or some mixture of the two in the majority of conference attendees – is a key part of any/every conference that you're likely to go to. Despite its bad reputation, networking is the key to professional success both in industry and academia. It allows you to broaden your circle of contacts, share your ideas/work/problems with a wider audience and maybe even find your next job opportunity.

At this year's Making an Impact day, we'll be hosting a speed-networking event at the start of the day that will hopefully allow you to get to know your fellow delegates and stimulate some useful conversations. Some benefits to speed networking to encourage you all to attend:

- It's a really quick and easy way to make yourself known to lots of people; you'll have a limited amount of time to introduce yourself and to find out as much information as you can about your fellow networker.
- I always find that the time pressures help me to work on my so-called 'elevator pitch'. Being able to summarise who you are and what you do in a very short space of time really helps to focus the mind and should allow you to give a succinct and engaging account; speed-networking allows you to go slightly beyond this 60 second pitch and dig a little deeper beyond the 'sales pitch'.
- Last but perhaps most importantly, it's great fun and you might even make some new friends.

For more information on this part of the day, feel free to contact me on the usual channels: (E: lmaynardatem@live.co.uk, Twitter: @LMAtem – don't forget - use the hashtags #OR58 & #MAI2016).

MAI - Academic-Practitioner Bazaar

Organiser: Maria Thorpe, DWP

07/09/2016 : 10:30 : Room DS Grd Floor – The Hub

Code: OR58A1896

The Academic-Practitioner bazaar provides a forum for academic-practitioner discussion through poster presentations highlighting the latest developments across the academic-practitioner interface.

Fourteen posters will be on display in The Hub throughout the conference, but particularly from **10:30-11:00** and **16:30-17:45** when presenters will provide a short 60 second introduction to their work to spark discussion and encourage interaction with all conference attendees. This event will provide an opportunity

for academics and practitioners to better understand how they can help one another to Make an Impact; discover work outside typical sources and discuss how research and business can thrive together.

For abstract details of all posters please go to the Posters Stream further on in this handbook.

Posters this year include:

- Applying the Dominance Rough Set Approach to improve intelligence data processing and enhance situational awareness, *Salem Chakhar, Tom Baldwin, John Shimell, Sam Andrews, Edward Davies, Mark Malinowski, Tina Marklew, Djamila Ouelhadj*
- Optimising the MRO Supply Chain through Big Data, *Goutham Adithya Veerakumar*
- Measuring the impact of intelligent decision-making in military operations, *Nick Walmsley*
- A Robust simulation-heuristic for vehicle routing problem with stochastic demand, *Abdulwahab Almutairi, Djamila Ouelhadj, Dylan Jones, Juan Angel*
- A Multi-objective Model with Heuristics, Evolutionary and Simulation-Optimisation methods for Robust Dynamic and Stochastic Scheduling, *Mohanad AL-Behadili, Djamila Ouelhadj, Dylan Jones, Angel Juan*
- Who do you think you are? Exploring the identity of OR professionals, *Frances O'Brien*
- A Risk Based Ant Colony Optimisation Model for Real Time Routing in Autonomous Surface Vehicles, *Samuel Andrews, Majid Eskandarpour*
- How can OR help to tackle corruption? *Sue Merchant*
- Flu incidence: non-linear modelling of seasonal and multiannual variations in regions of Azerbaijan and USA, *Borislav Dimitrov, Boryana Ts Bogdanova, Ivan Ivanov*
- Understanding A to B: MOD's Logistics Modelling Capability, *Laura Brudenell*
- The Virtual Engineer, *David Brown, Djamila Ouelhadj*
- Randomised heuristics for deterministic and stochastic demand, *Chanicha Moryadee*
- Delivering impact for MOD through developments in decision support, *Paul Glover*
- Adjustable Robust Optimization and its Applications, *Diah Chaerani, Stanley P Dewanto, Eman Lesmana, Rufaida Nurnaini, Putri Dwi Yuniar*
- VRP for disaster relief logistics, *Mr Kiatkulchai Jitt-Aer*

MAI – Mentoring

Organisers: Ramune Sabaniene, AlixPartners and Andreas Schaefer, RBS

07/09/2016 : 11:00 : Room-DS2.12

Code: OR58A1874

Mentoring Sessions

Mr Andreas Schaefer (*Royal Bank of Scotland*) and **Mrs Ramune Sabaniene** (*Ebiquity*)

Making an Impact sessions at O.R. Society conferences, have, over the years connected many OR professionals, graduates and seasoned specialists, academics and industrial practitioners. To keep expanding each of your networks and facilitate career and personal development-specific conversations we are offering short mentoring sessions at OR58 and invite mentors to share their experiences and making impact through helping others to succeed. Mentees will have an opportunity to step back and focus on broader issues that they might be facing in their practice, career and/or personal development taking the chance to speak to someone outside their organization and get "an extra pair of ears".

Being Mentored: key to developing your successful career.

An opportunity for you to have a short, one-off mentoring session at the OR58 conference. This is designed to help you focus on broader issues you might be facing in your practice and/or career development and has several benefits:

- Gain valuable advice. Your mentor's experiences could shed a whole new light on your thinking.
- Develop your knowledge and skills. They could help you identify the skills and expertise you need to

succeed. You might receive advice on where to go for the information you require.

- See new perspectives. You could speak to someone you would not normally meet in your day to day work.
- Build your network. Try to keep in touch after your session for a follow up.
- Getting the most from your session. Nearer the conference we will share details of everyone who has volunteered to be a mentor at OR58. You will then be able to find out more about them, who they work for, their experiences and what they can help with. You will be asked to sign up in advance so that we can allocate slots for you to talk to your preferred mentor.

Mentoring: Make an Impact through helping others to succeed

Enjoy helping to develop your OR colleagues? We are running one-to-one mentoring sessions at OR58 as part of the Making an Impact stream. You might find it helps building your leadership skills or your mentee, coming from a different background and environment, might enrich communication skills since often we do not "speak the same language" from departments to organisations. By talking to someone new, you may gain a fresh perspective on issues of interest or even find out more about new developments in your area of O.R. across organisations. And last, but by no means least, comes the personal satisfaction and fulfillment when sharing your knowledge and helping someone else. We envisage mentoring sessions to last for 15-20 minutes each and typically you could expect to meet up to three people.

MAI - Meet the Editors

Organiser: Dr Djamila Ouelhadj, University of Portsmouth

07/09/2016 : 11:00 : Room-DS1.11

Code: OR58A1875

Meet the Editors Sessions

Dr Djamila Ouelhadj (*University of Portsmouth*)

We are very pleased to announce the Meet the Editors session at the MAI day at the OR58 conference. This is a new and exciting initiative for the Society's annual conference and as part of a great new 'opportunities' stream at the Making an Impact day, we are inviting a few select journal Editors to attend this session.

The aim of the **Meet-the-Editors** session is to provide advice on how to write a successful paper and should cover the following: critical issues about the journal and what they expect from successful submissions, how best to capture the interest of editors and reviewers, how to structure a paper, ways to communicate the research idea effectively, and how to respond to referees' feedback, acceptance rates, etc.

The session will be open for participants to share both positive and negative experiences of researching, writing, revising and publishing a journal paper.

We are very delighted to announce the participation of the following editors:

- Robert Dyson, Editor of EJOR
- Graham Rand, as Editor of IMPACT magazine
- Sally Brailsford, Editor of the Health Systems Journal
- Stewart Robinson, *Loughborough University and Past President of The OR Society*. On behalf of the Editors of JOS, Journal of Simulation

MAI - Problem Solving

07/09/2016 : 10:30 : Room-DS2.14

Code: OR58A1929

Public Policy: Separated by a Common Toolset?

Mr Scott Thacker and **Mr Rob Solly** (*Dstl*)

This workshop will test the hypothesis that all disciplines use the same tools but call them something different. It will explore the similarity (and difference) in the tools, models and processes used across a variety of different OR/Scientific disciplines in supporting the development of policy.

Aim: to test the hypothesis that: all disciplines generally use the same tools and techniques, but just name them and describe them differently.

Objective:

- Identify the key OR tools used in policy development
- Identify where key tools used in policy development are similar (and different) across disciplines/sectors or unique
- Develop inter-disciplinary networking
- Develop cross-disciplinarily understanding of the similarity (and difference) e.g. use of the same/ similar tools but with different names

The workshop will begin with a short engaging talk about the Legible Policy project by Anan Jain and using experiments to increase citizen engagement in policy making.

There will then be two short exercises: the first to map the tools, models and processes used; and the second will be a cross-discipline speed-dating session to contrast and compare those tools used with other disciplines. The session will finish with a facilitated discussion, to debate the hypothesis, what the workshop has discovered and the ways this can be taken forward.

MAI – Opportunities

07/09/2016 : 11:00 : Room-DS2.08

Code: OR58A1889

Making an Impact Through Working with Local Businesses

Mr David Brown (*University of Portsmouth*)

This workshop will explore the advantages of working with local businesses, using the example of Portsmouth. Ann Swift of the University of Portsmouth will set the scene and explore perspectives of impact from the Industrial and Academic point of view. There will then follow a comparative exploration of the academic and business points of view on a number of collaborative projects with industry, including collaboration with STS Defence, TrucTyre Ltd and VM Engineering and Stork Ltd. Each talk will last approximately 10 minutes, with a 20 minute summing up and round-table discussion at the end chaired by Professor David Brown of the University of Portsmouth

MAI – Techniques

07/09/2016 : 11:15 : Room-DS2.13

Code: OR58A1884

Data Visualisation

Mr Andrew Wenham, Mr Martyn Hall and Ms Claire Vinent, (*Joseph Rowntree Foundation*)

The Joseph Rowntree Foundation is a leader in the field of research communications and is renowned for its use of infographics to convey complex research. This workshop will provide attendees with the opportunity to learn how to produce data visualisation to communicate statistics and key research findings. Attendees to the workshop will be given information on how to create infographics: from identifying the key information to communicate, to advice on how to make infographics accessible for multiple audiences.

MAI – Practice

07/09/2016 : 11:15 : Room-DS2.07

Code: OR58A1886

Pro Bono O.R. Mapping the UK dog population with the RSPCA

Mrs Felicity McLeister (*The OR Society*) and **Mr Ian Seath** (*Improvement Skills Consulting*)

This workshop will give you an overview of the Pro Bono O.R. scheme as well as a chance to take part in an interactive session based on a real project with RSPCA mapping the UK dog population.

MAI – Tools

07/09/2016 : 11:15 : Room-DS2.09

Code: OR58A1882

The Art of Simulation

Mr Edward Ostlera and **Mrs Frances Sneddon** (*SIMUL8 Corporation Limited*)

Simulation is a powerful analytical technique powered by complicated mathematical and statistical algorithms. Operational simulations built have typically been validated to 99% accuracy compared to the real world, as an operation tool that's vital. But... not all simulations have to be that accurate to provide value. Simulation is an analytical tool. It is also a facilitation tool that engages everyone in problem solving. It is the lead negotiator providing an unbiased point of view that encourages cross team collaboration. It is the exploration vehicle that uncovers unknowns and sparks new ways of thinking. There is no need to be a simulation expert to build quick and easy models that add real value and insight. Join us to explore how you can leverage the soft benefits of simulation on your projects.

MAI – Problem Solving

07/09/2016 : 15:15 : Room-DS2.14

Code: OR58A1895

Grand Challenges of Portsmouth

Mr Miles Weaver (*Edinburgh Napier University*) and **Djamila Ouelhadj**, (*University of Portsmouth*)

Addressing "Grand Challenges" is very much in the history and tradition of Operational Research (O.R.), in the past saving millions of lives and protecting Britain, ultimately helping to liberate Europe. There are "Grand Challenges" facing us all in the UK and beyond, today. Lane (2010) provides an account of how O.R. has addressed these grand challenges in the past and argued that O.R. holds considerable advantages to deal with strategic issues.

However, in the area of sustainability, Weaver et al., (2013) found a limited number of contributions in ORS journals, mainly focused on environmental issues but significantly growing since the credit crisis crash in 2011.

Following on from the successful Grand Challenges exercise carried out at EURO2015, concentrating upon the challenges facing Glasgow, this session asks:

- What "Grand Challenges" face us today and into the future, in Portsmouth, in the UK and beyond?
- What contribution can the O.R. community have to address these challenges?

The Leader of the City Council for Portsmouth, Councillor Donna Jones and Admiral Nick Lambert from the Royal Navy, (a major employer in Portsmouth), will outline these challenges.

The session will aim to bring together specialists from different aspects of O.R., including those with knowledge of techniques such as Multi-Criteria Decision Analysis, Optimisation, Problem Structuring and Soft Methods; showing how the different approaches that form part of O.R. can be applied to solve these Grand Challenges.

The session will move from the challenges outlined to consider the potential customers of O.R. to address them, particularly third sector organisations who could benefit from a Pro Bono project. The Society wants more organisations to benefit from O.R. and recognises that Third Sector organisations have an even greater need to be more efficient. The aim is to help organisations reduce costs and improve utilisation of limited resources. These potential projects will be followed up by the Pro Bono service, providing access to O.R.

consultancy at the cost of expenses only and in doing so “give back” an O.R. solution that will make a lasting in impact in the host city of OR58.

MAI – Opportunities

07/09/2016 : 15:45 : Room-DS1.11

Code: OR58A1893

TALK 1: EURO Mini-Stream

Horizon 2020 – H2020 EU Funding Programme

Mr Ian Holmes (*Innovate UK*)

Horizon 2020 is the main EU funding programme for research and innovation and runs from 2014 to 2020 with a €80 billion budget. The UK is currently one of the most successful countries in winning H2020 funding and has so far pulled down more than €1,873M from the programme to date. H2020 projects must be collaborative, innovative and deliver real impact.

They cover a number of areas across a range of “Societal Challenges” :

- Health, demographic change and wellbeing
- Food security, sustainable agriculture and forestry, blue growth and the bioeconomy
- Secure, clean and efficient energy
- Smart, green and integrated transport
- Climate action, environment, resource efficiency and raw materials
- Europe in a changing world – inclusive, innovative and reflective Societies
- Secure societies – Protecting freedom and security of Europe and its citizens

There are also a number of topics in

- Information and communication technologies
- Nanotechnologies, Advanced materials, Advanced manufacturing and processing, Biotechnology
- Space

The UK is still eligible to participate in these projects. This presentation will explain where to find the opportunities to get involved in H2020 projects, understand the “brief” and provide a new number of tips and techniques to pull together a strong proposal.

07/09/2016 : 15:15 : Room-DS1.11

Code: OR58A1776

TALK 2: EURO Mini-Stream

EURO Instruments: an OR Person’s Guide to the Orchestra

Prof Richard Eglese (*Lancaster University*)

EURO is the European Association of Operational Research Societies and is a regional grouping within the International Federation of Operational Research Societies (IFORS). Its activities are organised into a series of “instruments” that are all designed to promote OR in Europe. EURO was launched in 1975 with its founding instruments of the association itself, EURO-k conferences, EURO Working Groups and the European Journal of Operational Research (EJOR). Over the years, several new instruments have been added including: EURO Summer and Winter Institutes, EURO Mini Conferences, various EURO Awards, new EURO journals and, in recent years, EURO PhD schools and EURO Advanced Tutorials in OR. The session will provide a guide to these EURO instruments with information on how to benefit from them and how to apply to take part in or help to provide EURO instruments in the future.

07/09/2016 : 15:15 : Room-DS2.12

Code: OR58A1891

Understanding the EPSRC

Ms Hannah Pearson (*EPSRC*)

The Engineering and Physical Sciences Research Council (EPSRC) is the UK's main agency for funding research in engineering and the physical sciences. EPSRC invests around £800 million a year in research and postgraduate training, to help the nation handle the next generation of technological change. Hannah Pearson will explain the process of applying for funding from the EPSRC and discuss what makes the difference between a successful bid and an unsuccessful bid.

07/09/2016 : 15:15 : Room-DS2.08

Code: OR58A1890

Catapult Centres Innovate UK: how they can support you

Mr Graham Fletcher (*Cubic Transportation Systems*)

The Catapult Centres are a network of world-leading centres designed to transform the UK's capability for innovation in specific areas and help drive future economic growth.

Catapults are not-for-profit, independent physical centres, which connect businesses with the UK's research and academic communities. Each Catapult centre specialises in a different area of technology, but all offer a space with the facilities and expertise to enable businesses and researchers to collaboratively solve key problems and develop new products and services on a commercial scale.

Whether a business is in need of a new manufacturing process, a fresh approach to digital rights protection or a new way of balancing energy demands in a future city environment, Catapults will be able to help them. Graham Fletcher, formerly of the Transportation Catapult, will chair a seminar with Sean McCarthy of the Satellite Applications Catapult and Simon Cheeseman of the Offshore Renewable Energy Catapult which will explain how OR academics and practitioners can access funding for their projects.

MAI – Techniques

07/09/2016 : 15:15 : Room-DS2.13

Code: OR58A1885

Business Analytics Methodology

Mr Giles Hindle (*University of Hull*) and **Prof Richard Vidgen** (*Professor of Systems Thinking*)

The workshop will show users how to map the business model of an organisation using the Business Model Canvas and Systems Modelling. We then show how to link this analysis to analytics and data science. Case examples will be used to illustrate the approach and attendees will be given the opportunity to work on a case study or their own organisation.

MAI – Practice

07/09/2016 : 15:15 : Room-DS2.07

Code: OR58A1888

Chartered Scientist

Ms Amy Pearce (*Science Council*)

Amy Pearce of the Science Council will give a talk on the potential professional benefits to OR Society members of Chartered Scientist status. Her talk will include a presentation on the benefits of being a Chartered Scientist and the attendant obligations and requirements. There will then be a round-table discussion on the merits of adopting Chartered Scientist status within the OR Society as an adjunct to Professional Membership.

MAI – Tools

07/09/2016 : 15:15 : Room-DS2.09

Code: OR58A1881

Workable Morphological Analysis

Mr Bruce Garvey (*Imperial College London*)

Morphological analysis (MA) systematically structures and examines the total set of possible relationships in a multidimensional, usually non-quantifiable, problem space. Such problems are complex and exacerbated by high levels of interconnectivity adding complexity. MA allows for all ideas to be considered as a first stage in the analysis process and as such is an exploratory method par excellence. The rapid explosion of alternatives early in the analysis process and the lack of effective analytical software have historically limited use of MA. This workshop will give users the opportunity to explore how the Fibonacci MA software tool can be used to structure a topical real-world problem that will be selected on the day.

07/09/2016 : 16:30 : Room-DS2.09

Code: OR58A1880

Triangle Information Management: Planning for Success in Big Data

Mr Charlie Fox (*Triangle Information Management*)

In this engaging workshop we will be looking at our experience within the defence and logistics sectors and what the keys are to planning for success in projects involving big data and reporting. We will be discussing the importance of understanding the question that you are trying to answer from a stakeholder right through to user level. We will also be examining what we can learn from past failures and how to successfully manage change. Triangle will then take you below deck as we look in depth at a case study of ours, which involved completely redesigning the way, the manufacturing process of a vessel and the big data processes that went along side were implemented. We look forward to welcoming you.

MAI – Practice

07/09/2016 : 16:30 : Room-DS2.07

Code: OR58A1887

Making a Real Difference with the OR in Schools Programme

Mrs Louise Allison and **Mrs Charlene Timewell** (*The OR Society*)

O.R. practitioners...did you know that you could refine and develop your repertoire of skills by sharing your experience within the classroom? This exclusive workshop provides insight into one of The OR Society's key strategic projects: O.R. in Schools (ORiS), which promotes Operational Research to young people and their teachers in a bid to fulfil the Society's vision that "every school child knows what O.R. is". Explore the vital role of an ORiS Volunteer, how they are supported by The OR Society, and the benefits they enjoy. Find out how O.R. practitioners from all backgrounds of experience across the UK are currently enthusing, inspiring, and motivating young people with demonstrations of and discussions about the applications of maths skills to solve real world problems and by opening their eyes to an array of career opportunities within O.R. Enjoy hands-on tasters of the most popular, interactive ORiS sessions and perhaps discover whether you have what it takes to make an impact upon the future of young people.

MAI - AC-PRAC Bazaar

Organiser: Maria Thorpe, DWP

07/09/2016 : 16:30 : Room DS Grd Floor – The Hub

Code: OR58A1875

The Academic-Practitioner bazaar provides a forum for academic-practitioner discussion through poster presentations highlighting the latest developments across the academic-practitioner interface.

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For abstract details of all posters please go to the Posters Stream further on in this handbook.

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- Optimising the MRO Supply Chain through Big Data, *Goutham Adithya Veerakumar*
- Measuring the impact of intelligent decision-making in military operations, *Nick Walmsley*
- A Robust simulation-heuristic for vehicle routing problem with stochastic demand, *Abdulwahab Almutairi, Djamila Ouelhadj, Dylan Jones, Juan Angel*
- A Multi-objective Model with Heuristics, Evolutionary and Simulation-Optimisation methods for Robust

- Dynamic and Stochastic Scheduling, *Mohanad AL-Behadili, Djamila Ouelhadj, Dylan Jones, Angel Juan*
- Who do you think you are? Exploring the identity of OR professionals, *Frances O'Brien*
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 - The Virtual Engineer, *David Brown, Djamila Ouelhadj*
 - Randomised heuristics for deterministic and stochastic demand, *Chanicha Moryadee*
 - Delivering impact for MOD through developments in decision support, *Paul Glover*
 - Adjustable Robust Optimization and its Applications, *Diah Chaerani, Stanley P Dewanto, Eman Lesmana, Rufaida Nurnaini, Putri Dwi Yuniar*

Metaheuristics



Organisers: Ender Ozcan, Andrew Parkes and Juergen Branke

06/09/2016 : 11:00 : Room-DS1.05

Code: OR58A1717

KEYNOTE: Dynamic Visualisation of Many-Objective Populations

Dr Jonathan Fieldsend (*University of Exeter*)

There has been an increase in research activity recently regarding the visualisation of many-objective populations. Two of the main drivers for this have been (i) to aid decision makers in comparing and selecting designs outputted from a many-objective optimisation run, and (ii) to help in the selection of solutions in interactive optimisation. In both of these situations there is often a dynamic element --- populations evolving over time change their relative relationships, and the quality comparison measure itself can be altered, redefining member relations. Here we first outline the multi- and many-objective optimisation problem, and some popular approaches from a high-level. We then exploit the recent data-driven documents (d3) framework to drive an open-source many-objective visualisation package. We illustrate how a number of existing visualisations from other domains may be applied to many-objective populations to aid the understanding of population relations, as well as extending some existing visualisations. The approaches discussed provide exploratory features, enabling not simply the rapid visualisation of arbitrary many-objective sets via different plot types, but also the facility to alter the quality measure used to see the effect on the population visualisation in real-time, and therefore extract further information. Additionally, d3 is inherently dynamic, and will automatically respond to any changes in the base document underpinning the visualisation, allowing the visualisation package to 'bolt-on' to any other program that can produce, and update, a JSON format file. Illustrations are provided on pre-existing many-criteria datasets, and from optimisation algorithm runs.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

06/09/2016 : 12:00 : Room-DS1.05

Code: OR58A2934

Discussion: Are Metaheuristics OR?

Prof Juergen Branke (*Warwick Business School*), **Dr Ender Ozcan** and **Dr Andrew Parkes** (*University of Nottingham*)

Metaheuristics is a large research area, but it is spread over many disciplines, ranging from OR to Computer Science and Engineering. At OR conferences, metaheuristics research often plays a relatively minor role. This session shall be used to discuss the challenges faced especially by OR researchers working on metaheuristics, such as the funding opportunities (EPSRC is currently reviewing its funding in the "Mathematics of OR" area), journal rankings (many metaheuristics journals are not listed in the ABS journal ranking, although the situation has clearly improved with the latest revision), or the problem of no clear home (metaheuristic research is done at Business Schools, in Computer Science and also Engineering, and similarly research is published in very different outlets. It also is an opportunity for the OR metaheuristics researchers to get to know each other.

What is the nature of your talk?: A mix
Does your talk require prior knowledge of the subject area?: Some
Is your talk accessible and relevant to Practitioners?: Not at all

06/09/2016 : 13:30 : Room-DS1.05

Code: OR58A1869

Ant Colony Optimisation Applied to Autonomous Surface Vehicles (ASVs)

Mr John Shimell and **Mr Samuel Andrews** (*Polaris Consulting Ltd*)

Autonomous Surface Vehicles (ASV's) have been in development for a number of years. Their potential in the defence industry is enormous, as they will allow potentially dangerous missions to be performed without risk to life. However, ASV's are currently not ready for real world exploitation. Recent efforts have been made to address this, and one area identified for potential improvement is routing. Currently, routes are generated using algorithms, such as A*, that were first developed in the late 1960's. Whilst efficient in the right environment, these algorithms ultimately fail when faced with very large spaces to traverse through. Normal heuristic approaches work by determining every possible solution and choosing the best one. In large scale problems this simply is not feasible, due to either requiring too much processing power or requiring too much time to process. A metaheuristic solves this issue by finding a solution and adjusting it so that near optimal solutions are computed. Many metaheuristics are based on natural processes that, when observed, are clearly very efficient. One such phenomena is the way ants search for food and bring it back to their nests. These ants drop pheromone for other ants to follow. Over time, the most efficient routes are converged upon, and used by all ants until the source of food is depleted. This process was translated in 1992 into what is now known as Ant Colony Optimisation. The qualities of Ant Colony Optimisation make it an ideal metaheuristic to apply to route optimisation as our recent project demonstrated, which applied it to an Autonomous Surface Vehicle (ASV) in a simulated environment. Not only were optimal routes calculated, but it was also demonstrated that Ant Colony Optimisation was ideal for the avoidance of obstacles, both stationary and dynamic, within an acceptable timeframe.

What is the nature of your talk?: Practical
Does your talk require prior knowledge of the subject area?: A little
Is your talk accessible and relevant to Practitioners?: Relevant

06/09/2016 : 14:00 : Room-DS1.05

Code: OR58A1909

A Comparative Study between Greedy Heuristic, Classical Ant Colony Optimization (ACO) and our new ACO Approach for Solving the Traveling Salesman Problem.

Ms Lilysuriazna Binti Raya and **Dr Cormac A. Lucas** (*Brunel University London*)

The Traveling Salesman Problem (TSP) is one of the most widely studied optimization problems in computational mathematics. The simplest heuristic approach to solve the TSP is the Nearest Neighbor (NN) algorithm. Bio-inspired approaches such as Ant Colony Optimization (ACO) have also been used to find better solutions to the TSP. The inspiration for ACO is drawn from the behaviour of real ants, in particular, by their foraging behaviour and the use of pheromone as a means of stimulated communication. The pheromone trails are a distributed scent which is modified by the ants to reflect their experience accumulated while looking for food. In this presentation, we introduce a new version of ACO for solving the symmetric TSP with new ways of depositing and evaporating pheromone and a different approach of global updating pheromone. The proposed algorithm is tested on a set of benchmark test problems and their results are compared to the classical ACO and a greedy method.

What is the nature of your talk?: A mix
Does your talk require prior knowledge of the subject area?: Some
Is your talk accessible and relevant to Practitioners?: Somewhat

06/09/2016 : 15:30 : Room-DS1.05

Code: OR58A1734

Problem Knowledge Information to Improve the Performance of the Genetic Algorithm

Mr Mohamed Bader-el-Den (*University of Portsmouth*), **Miss Dalila Boughaci** (*Université des Sciences et de la Technologie Houari Boumediene*) and **Mr Abdellah Rezoug** (*University Mhamed Bougara of Boumerdes*)

The 0-1 Multidimensional Knapsack Problem (MKP01) is a np-hard combinatorial optimisation problem. It has many applications such as capital budgeting, multi-unit combinatorial auctions, airplane landing, resource allocation etc. Usually in the resolution of the combinatorial optimisation problems, including knowledge about the addressed problem in the metaheuristics improves their performance. Genetic Algorithm (GA) is a meta-heuristic based on a stochastic search process largely used by researchers to solve different kinds of problems. In order to improve the performance of GA in solving the MKP01, this paper investigates the use of knowledge concerning the structure of the optimal solution. It presents a GA version - named Efficiency-Guided Genetic Algorithm (EGGA) - for the MKP01. EGGA is based on two concepts. The first is the concept of Proximate Optimality: in most cases, the best solutions have a similar structure, in other words; part of the solution may appear in all the best individuals. The second is the Core Concept for the MKP01 that provides a mathematical model for ordering the items based on a compromise between the weight and the value of each item. EGGA uses the output of the Core Concept as an additional guide for the GA's evolutionary process. EGGA is a two steps approach; first, an efficiency measurement calculates the efficiency of each item and sorts them accordingly; second, GA integrates this information in two operators: 1) each individual of the initial population is generated mainly of the best items; 2) the fitness function is expressed by the value and the efficiency of the items. To evaluate whether or not the guidance improves the GA performance, an experimental investigation is conducted using well-known benchmarks. The obtained results show a significant improvement of the effectiveness and the convergence speed of the GA.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

06/09/2016 : 16:00 : Room-DS1.05

Code: OR58A1711

A Unified View of Sequential Decision Making Problems

Mr Aman Soni, Dr Aniko Ekart and Dr Peter Lewis (*Aston University*)

Decision problems are often encountered in system design and control. If the underlying environment changes, the problem becomes dynamic, requiring new decisions on an ongoing basis. Recently a connection has been drawn between evolutionary dynamic optimisation and reinforcement learning, as subsets of a broader class of techniques for sequential decision making. Evolutionary dynamic optimisation is inspired by the observation that evolution in the natural world appears to have dealt well with changing environments. On the other hand, reinforcement learning has its roots in the theories of optimal control and the psychological theory of animal learning through trial and error. Each community has historically focussed on different forms of the sequential decision making problem, therefore, state of the art algorithms have been developed accordingly. Problem definitions contain community-specific assumptions on the resources available for execution, the information available and the measures used to compare algorithm performance. In this talk we present a unified view that allows for the formalisation of problem definitions such that these current assumptions are made explicit, and can be explored to support effective algorithm selection. Further, we present work on the moving peaks benchmark that demonstrates how algorithm performance changes when resource constraints vary. This work has immediate impact and applicability, since in many real world problems, in domains such as autonomous robots, market trading agents, smart camera control and learning in games, decisions must be made at run-time, where resources are limited.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Very

06/09/2016 : 16:30 : Room-DS1.05

Code: OR58A1846

'Plenty of Room at the Top' - The Need for Whitebox Hyper-Heuristics.

Dr Jerry Swan (*University of York*), **Dr Ender Ozcan** and **Dr Andrew Parkes** (*University of Nottingham*)

Hyper-heuristics ('heuristics to choose heuristics') were proposed around the turn of the century as a means of making generalized problem-solving available to inexperienced practitioners. We argue that much of common research practice in hyper-heuristics has lost sight of this goal, to the detriment of both practitioners and researchers. In particular, it is common practice in (selective) hyper-heuristics to employ a very restricted interface between frameworks and problems. For example, the only features exposed in the popular selective hyper-heuristic framework Hyflex are opaque indices representing solutions and (effectively randomized) operators. Therefore, hyper-heuristics using this framework are restricted to a 'black box' selection problem, with very limited possibilities for the kind of cross-domain learning which was an initial motivation. In contrast, there are many aspects of the problem domain and solution process that can be made available in a domain-independent fashion. In particular, it is possible to exploit structure/patterns in any or all of: * Problem formulation * Representations of solutions and/or operators. * State trajectories of solver mechanism and/or search process We give concrete examples of the above, motivating a whitebox re-formulation of hyper-heuristics.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Very

07/09/2016 : 09:30 : Room-DS1.05

Code: OR58A1689

Optimal Stochastic Annealing

Prof Juergen Branke and **Prof Robin Ball** (*University of Warwick*) and **Prof Stephan Meisel** (*University of Muenster*)

This paper proposes a Simulated Annealing variant for optimization problems in which the solution quality can only be estimated by sampling from a random distribution, and the aim is to find the solution with the best expected performance. Assuming Gaussian noise with known standard deviation, we derive a fully sequential sampling procedure and decision rule. The procedure starts with a single sample of the value of a proposed move to a neighboring solution and then continues to draw more samples until it is able to make a decision to finally accept or reject the move. Under constraints of equilibrium detailed balance at each draw, we find a decoupling between the acceptance criterion and the choice of the rejection criterion. We derive a universally optimal acceptance criterion in the sense of maximizing the acceptance probability per sample under the constraint of equilibrium detailed balance, and thus the speed of convergence to thermodynamical equilibrium. An empirical evaluation shows that the resulting approach is indeed more efficient than previously proposed Simulated Annealing variants that aim at obeying the detailed balance equation.

What is the nature of your talk?: Theoretical

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Somewhat

07/09/2016 : 10:00 : Room-DS1.05

Code: OR58A1733

Qualitative Information-Based Heuristic for Districting Problems

Dr Maria Barbati (*Portsmouth Business School, University of Portsmouth*) and **Dr Salem Chakhar** (*Portsmouth Business School, University of Portsmouth*)

Districting problems are of high importance in many different fields. The objective of this paper is to introduce a heuristic to solve districting problems. The proposed heuristic relies on a tree data structure, previously constructed based on qualitative information. The latter is grounded on several criteria and takes the form of a qualitative scale with a finite set of evaluation levels. The paper includes a detailed pretention of the qualitative information assessment approach, the mathematical formulation and the first implementation and resolution results.

What is the nature of your talk?: Theoretical

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

Multiple Criteria Decision Analysis



Organisers: Salvatore Greco

06/09/2016 : 11:00 : Room-DS1.08

Code: OR58A1722

KEYNOTE: Exploring Multi-Methodology Approaches for Policy Support: Case Studies and Lessons Learned

Dr Valentina Ferretti (*London School Of Economics And Political Science*)

Multimethodology interventions are being increasingly employed by operational researchers to cope with the complexity of real-world problems. The following reasons might explain the increasing interest for and use of mixed-methods approaches: they allow to cope with multi-dimensional systems, they allow to include multi-level perspectives as well as multi-actors evaluation, and they allow to use both qualitative approaches, for exploring the general problem, and quantitative approaches, for better investigating alternative options and performances. Although there is a wide scholarly discussion on mixing methods, successful real examples in environmental decision and policy making are still scarce. Moreover, so far the assumed benefits of using mixed methods have not been systematically tested. There is thus an evident need to pursue and to better communicate the benefits of mixing and the research presented in this paper is an attempt to fill in this gap. The paper will discuss advantages and limits of different mixes with reference to real world applications, ranging from the selection of the best location for a new parking area in a UNESCO site, to the regeneration of abandoned farms through community OR, to urban regeneration projects in China and in Italy. The tools being mixed in the above mentioned applications include: stakeholders' analysis, to identify the multiple interests involved in the process; concept mapping, to define the shared set of objectives for the analysis; GIS, to model the spatial dimension of the problem; SWOT analysis, to better know the decision context under analysis; MCDA, to measure the level of achievement on the previously defined objectives by the policy options under investigation; and economic evaluation based on stated preference methods, to innovatively design alternative options. Ongoing developments of this research aim to evaluate different mixes against a set of criteria in order to develop a set of guidelines.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Very

06/09/2016 : 12:00 : Room-DS1.08

Code: OR58A1796

Judgments of Importance Revisited: What Do They Mean?

Mr Tommi Pajala (*Aalto University*)

Decision makers seem to have no difficulty in making judgments on one criterion being more important than another. Even though linear models have been heavily used in choice prediction for decades, it has remained unclear whether their weights are somehow connected to the judgments of importance that subjects can so easily make. A surprisingly common assumption is that a more important criterion will tend to have a larger weight, as if weights and importance were the same thing, or at least heavily correlated. In this paper we present experimental evidence that Goldstein's (1990) idea of connecting judgments of importance to impact is more meaningful than connecting them to weights. In the experiment subjects provided their judgments of importance, and made pairwise choices with apartments defined by four criteria. Additionally, we show that

if value function weights were to be connected to judgments of importance, we would need to know the scale she has in her mind. In the absence of knowledge of the scaling factor that subject uses internally, interpreting her judgments of importance in terms of weights is not necessarily possible.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Very

06/09/2016 : 13:30 : Room-DS1.08

Code: OR58A1799

Effects of Information Representation on Decision Making

Mrs Aysegul Engin (*University of Vienna*)

Many scholars are interested in the decision making process for human decision makers. Bounded rational human actors show individual differences in their decision processes. According to the recent research these differences can originate from different information representations, as differences in decision makers' numeracy and fluency have an effect on their subjective experiences with information. In our work we argue that one possibility to trigger such individual differences is through different representations of the same objective information transferred prior to the decision making. With this work, we search for experimental evidence, if different representation forms can lead to differences in decision making. In the literature, multiple studies concentrate on the representation forms. Main areas that these studies focus are; performance differences between words and numbers, tables and graphs, tables and graphs with respect to probability judgements and performance differences between different graphs. Mixed evidence from those studies motivated the cognitive fit model. Current study extends the cognitive fit model by cognitive styles using an experimental setting. 227 business administration students take part in the experiment and are rewarded with extra course credits. Participants' goal is to order the depicted lotteries in the descending order with respect to their expected payoffs. In the experiment same lottery sets with different labels and representation forms are used. The measure of correctness is the errors made by false lottery orders. We found significant differences in the error rates made by participants, who were in the matching case, from the cognitive style perspective, and the mismatching case.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Relevant

06/09/2016 : 14:00 : Room-DS1.08

Code: OR58A1821

How to Define, Analyse and Evaluate Coalitions of Projects: A Case Study of Urban Regeneration

Dr Valentina Ferretti (*London School of Economics and Political Science*), **Prof Alberto Colorni** and **Prof Alessandra Oppio** (*Politecnico of Milano*)

Over the past thirty years minimal and widespread interventions known as urban catalyst have emerged as an innovative bottom-up planning practice against large urban development projects that have shown critical issues related to the implementation phase. The concept of urban catalyst refers to small size interventions that can be built in a short time and that are able to create synergies among existing interventions, functions, resources and actors. Under the perspective of feasibility analysis and evaluation, this new idea of planning seems to be promising since it requires lower initial investments, shorter horizon time and simpler administrative procedures, but it rises an evaluation challenge related to both the selection, the analysis and the evaluation of coalition of elementary projects within a multidimensional decision context. Given these premises, this study aims to propose an evaluation model for the selection, the analysis and the evaluation of feasible coalitions of projects in the context of the current planning practice by combining a Multi Criteria Decision Aiding (MCDA) approach with the traditional Operational Research. The proposed evaluation framework allows decision makers to select different combinations of projects and to evaluate their feasibility according to a multidimensional perspective. Most of the attention is paid to the modelisation of the concept of urban catalyst both from a theoretical and operational perspective. A first test of the evaluation model on a pilot case study of urban regeneration in the city of Milan (Italy) is proposed. This study aims to fuel the

current debate about the feasibility analysis of urban development plans by exploring the use of MCDA and Operational Research.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

06/09/2016 : 14:30 : Room-DS1.08

Code: OR58A1913

Eliciting Preferences from Pairwise Comparison Judgements Using Stochastic Analysis of Spanning Trees Preference Vectors

Dr Sajid Siraj (*University of Leeds*), **Prof Salvatore Greco** (*University of Catania*) and **Dr Michele Lundy** (*Dublin City University*)

We propose a multiple criteria decision aiding methodology based on pairwise comparison matrices related to the evaluation of alternatives with respect to a set of considered criteria as well as to the evaluation of the importance of the criteria themselves. The spanning trees approach is a recently emerging idea for use with the pairwise comparison method where the entire set of prioritization vectors that are compatible with the originally provided information, are generated and analysed. Taking an approach similar to Stochastic Multi-criteria Acceptability Analysis, we propose using this entire set of prioritization vectors to determine the probability that any alternative is ranked in any given position. Since the number of spanning trees increases exponentially with the number of alternatives and the number of criteria, the number of compatible prioritization vectors can be extremely large and so analysing these vectors can become intractable. We propose a random sampling procedure to address this issue and demonstrate its usefulness through a practical case study.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Very

06/09/2016 : 15:30 : Room-DS1.08

Code: OR58A1754

Interactive Multiobjective Optimization guided by Dominance-based Rough Set Approach for Portfolio Facility Location Problems

Prof Salvatore Greco and **Dr Maria Barbati** (*University of Portsmouth*)

We consider the Multi-Objective Portfolio Facility Location (MOPFL) problem in which a set of facilities has to be located attaining acceptable levels for a set of criteria like travel distance, cost, equity, profit and coverage; several constraints can be added for modelling different applications.

Many approaches can be used for handling MOPFL problems. The majority of the methodologies converts the multi-objective problem in a single objective problem; alternatively a set of the Pareto Optimal solutions are proposed as solutions for the problem; moreover, when the problems are very complex, multiobjective evolutionary algorithms are implemented. We propose a new approach based on the interaction with the decision maker. We propose a non-dominated set of portfolio facilities to the decision maker and she is expected to indicate indirect preferences expressed in the form of 'if ..., then...'. We use these preferences in a Dominance-based Rough Set Approach in order to guide the search of the "best compromise" non-dominated set of facilities thanks to the definition of decision rules. This way we can focus on the part of the non-dominated set most preferred by the DM. The iteration terminates when the decision maker is completely satisfied with one portfolio of facilities.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Highly

06/09/2016 : 16:00 : Room-DS1.08

Code: OR58A1867

'Doing the Right Things': Portfolio Definition in the Royal Navy using Multi-Criteria Decision Analysis and Decision Conferencing

Mr Malcolm Cree (*Catalyze Ltd.*)

Over the last 3 years the Royal Navy has run a major Change Programme to implement the new delegated Defence operating model, following Lord Levene's Defence Reform report. One of several aims was to embed P3M disciplines. Whilst much of the effort in Defence has been to establish programmes on sound MSP® principles and to set up the Portfolio Office to manage Portfolio Delivery – 'doing things right', increasingly the focus of the Operating Board, in the face of significant financial and other challenges, has been on Portfolio Definition: 'doing the right things'. MCDA and Decision Conferencing brought the whole thing to life.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Highly

06/09/2016 : 16:30 : Room-DS1.08

Code: OR58A1908

Decision Rules Aggregation in Rough Set Approximation

Dr Salem Chakhar (*Portsmouth Business School*)

The Dominance-based Rough Set Approach (DRSA) is a case-based classification method that uses a set of assignment examples as input to infer a set of "if [condition] then [consequence]" decision rules. The conventional DRSA assumes a single decision maker. This may be restrictive mainly when the decision making problem needs to take into account different opinions of different decision makers. The objective of this paper is to propose an aggregation algorithm to coherently combine different sets of decision rules obtained by different decision makers. The aggregation algorithm contains four steps: (i) transformation of overlapping rules, (ii) eliminating of redundant decision rules, (iii) computing a minimal set of decision rules, and (iv) sorting decision rules. The objective of the first step is to transform overlapped decisions rules into non-overlapping ones by removing conflicting constraints. The objective of the second step is to eliminate redundant rules, i.e. rules that exist more than one time, or rules fully covered in another more general rules. The objective of the third step is to generate a minimal set of decision rules by eliminating decision rules partially included in other rules. Finally, the objective of the fourth step is to sort decision rules from the most to the least relevant based on the quality of classification and rules strength. The paper includes some additional algorithms devoted to identify a reduced set of decision rules to be used in a given decision problem. These algorithms are useful when there is a high number of decision rules.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Very

07/09/2016 : 09:30 : Room-DS1.08

Code: OR58A1663

Outsourcing, Public-Private Cooperation and Healthcare Organisation's Performance: A Network Model Integrating ANP with BSC

Mrs Gabriella Marcarelli (*University of Sannio*)

Since the nineties, the Italian laws have intended to promote a more efficient and effective public health service management by the decentralization and the introduction of a managerial vision. The need to improve quality and variety of services and contain costs, the complexity of service management and technological innovations have led healthcare organizations (HcO) to outsource some activities or services, and focus on the activities representing their main source of competitive advantage, in a more streamlined and flexible organizational context. Decision making about outsourcing of services is complex because many quantitative and qualitative interrelated factors have to be considered. The outsourcing depends on the management attitude to innovation and change and may involve some risks, such as loss of motivation for employees and transaction costs (e.g. activation of procedures for the supplier's selection and control) and, when clinical services are involved, qualified and substantial investments. This paper analyzes the effect of outsourcing and

public-private cooperation on the performance of an Italian HcO through a network model which integrates the Analytic Network Process (ANP) with the Balanced Scorecard (BSC) approach. Three alternatives are considered: insourcing, outsourcing or sharing of a given service. Benefits and costs associated with each alternative are evaluated, by the different BSC perspectives, in order to choose that which improves the performance of HcO. Obviously, the most appropriate supplier may be selected based on conditions, such as costs, reputation, previous experience in outsourcing or sharing activities. This paper shows that outsourcing can lead to benefits both for the HcO and the patient, involving greater control and lower spending, and enhancing service quality and flexibility in human resources management. In conclusion, it may be a strategic key to facilitate public and private integration (e.g. cloud services) and improvements in performance of HcO and personal well-being.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

07/09/2016 : 10:00 : Room-DS1.08

Code: OR58A1676

MCDA Applied to Health Care: A Systematic Review

Miss Annabelle Glaize, Dr Christine Di Martinelly, Dr Alejandra Duenas and Dr Isabelle Fagnot
(IESEG School of Management)

Object: The aim of this practical study is to inform researchers and decision makers on how Multi Criteria Decision Analysis (MCDA) methods are applied in the health care area. Method: A systematic review of the literature was performed to find applications of MCDA methods in health care. Four databases (Embase, Medline, Web of Science and PubMed) were searched from 1980 to December 8th 2014 and an ad hoc search was performed in 2016. This systematic review only analyzed case studies as the objective was to understand how MCDA methods were applied. Results: 768 publications were identified through the database search and only 65 case studies were selected for review. The area of application was first studied through three aspects (type of health services, type of intervention and type of health care area). The review showed that MCDA models were suitable in a public health service context (n=53) and when the decisions were related to treatment interventions (n=38). With regard to the type of health care area, results show a majority of MCDA applications at a clinical level (n=19). The second part of the results analysis focused on the application process based on a proposed six-step framework: 1) identify the problem, 2) structure the problem, 3) select the appropriate method, 4) follow the preference measurement stage, 5) build the MCDA model and 6) develop an action plan using findings from the model (this last step is however out of the scope of this analysis). For the method selection step, results showed that value measurement models were the most used; in particular, the Analytic Hierarchy Process (AHP) was preferred for its simplicity. Conclusion: This systematic review provides a global overview of the area of application as well as a structured analysis of how MCDA methods are applied in the health care area.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Very

08/09/2016 : 09:00 : Room-DS1.08

Code: OR58A1833

A Critical Analysis of Multi-Criteria Models for the Prioritizations of Health Threats

Prof Gilberto Montibeller (Loughborough University), **Dr Victor del Rio Vilas** (PAHO) and **Mr Pratik Patel** (UCL)

There is an increasing use of multi-criteria assessments to support the prioritization of health threats. The use of multi-criteria evaluations in this context is welcome, as it allows the consideration of multiple impacts of such threats, the use of expert judgment to complement and amalgamate the evidence available, and the modeling of policy makers' priorities. However, these assessments often lack a clear multi-criteria conceptual framework, in terms of both axiomatic rigor and adequate procedures for preference modeling. They are thus ad hoc from a multi-criteria decision analysis perspective, despite the strong health technical knowledge and health expertise used to build up the models. In this paper we critically examine some key modeling

assumptions and modeling choices that are being made in this type of applications, comparing them with the best practices of multi-attribute value analysis. We also simulate the impact of some of these modeling choices made in such health applications, using two recent studies available in the health domain, and analyze how much these modeling choices can impact the overall ranking of health threats. We found severe impacts in our simulations, which could cause changes to the ranking of threats being assessed and thus lead to distinctive policy recommendations than those suggested by these studies. These results confirm the importance of carefully designing multi-criteria evaluation models for the prioritization of health threats.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Highly

08/09/2016 : 09:30 : Room-DS1.08

Code: OR58A1834

With Common Sense towards Common Ground? Understanding Synchronous Collaborative Visualization for Joint Decision Development

Dr Katharina Burger (*University of Portsmouth*) and **Prof Leroy White** (*University of Warwick*)

It has been claimed that visual reasoning is more universal than verbal reasoning. Indeed, many MCDMs recognise the need for visualisations during the process of supporting decision making to involve decision makers and in order to help their interactions and outcomes. In such progressive learning phases of MCDM interventions, groups of decision makers may benefit from visual scaffolds to become aware of their own subjective values, to illuminate controversy, and to facilitate debate to build common ground. Yet, our understanding of the efficacy of epistemic processes of reasoning with visualisations is still not well developed. Hence, this paper takes a practice-based view to address the question: How is the creation of common ground for action accomplished through real-time, interactive visualisation of participants' contributions? Grounded in an activity-theoretical framework, we develop an exploratory approach to understand visualisation affordances and processual demands for visualisation-enabled coordination. Video data was collected during a traditional group model building workshop to capture the participants' multimodal conceptual reasoning processes involved in encountering, constructing, exploring and questioning low-tech visualisations. It is hoped that the proposed approach to understand visualisations for learning with decision-makers provides a conceptual resource for the reflective design of multi-stage MCDM interventions.

What is the nature of your talk?: Theoretical

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Somewhat

08/09/2016 : 11:30 : Room-DS1.08

Code: OR58A1692

AHPSort-GAIA : A Visualisation Tool for the Sorting of Alternative in AHP

Prof Alessio Ishizaka (*University of Portsmouth*) and **Dr Sajid Siraj** (*University of Leeds*)

Although Multi-Criteria Decision Making methods have been extensively used, mainly for choice problems, their descriptive use has been rarely considered. In this paper, we add the descriptive method GAIA as an extension to the AHPSort method that helps policy makers to gain insights into their decision problems. The proposed extension has been implemented in an open-source software that allows the users to visualise the different performance of suppliers within a review process and to give feed-backs for improvements.

What is the nature of your talk?: Theoretical

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Very

08/09/2016 : 12:00 : Room-DS1.08

Code: OR58A1719

Solving the Group Sorting Problem with an AHP-Based Approach

Dr Francesco Lolli and **Prof Rita Gamberini** (*University of Modena and Reggio Emilia*), **Prof Alessio Ishizaka** (*University of Portsmouth*) and **Prof Bianca Rimini** (*University of Modena and Reggio Emilia*)

Multi-criteria decision making represents an extended branch of decision sciences which is highly applicable to several real settings. In particular, the question of ranking has attracted wide attention from researchers in the last few decades, through approaches based on different multi-criteria methods. However, ranking alternatives does not solve the question of sorting them into priority classes. When alternatives need to be classified into ordered classes, a sorting method has to be applied, but much less attention has been paid to investigating this kind of problem, especially in the case of multiple decision-makers asked to give subjective scores to different alternatives based on qualitative criteria. In this paper, a new AHP-based group sorting method is defined, with the aim of achieving ordered classification without asking the decision-makers to provide limiting profiles. The resulting group sorting approach is validated with a numerical example.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Relevant

08/09/2016 : 13:45 : Room-DS1.08

Code: OR58A1731

Variable Consistency Model of ORSA

Dr Salem Chakhar (*Portsmouth Business School, University of Portsmouth*), **Prof Salvatore Greco** (*Department of Economics and Business, Catania University*), **Prof Alessio Ishizaka** and **Prof Ashraf Labib** (*Portsmouth Business School, University of Portsmouth*)

The Outranking Based Rough Set Approach (ORSA) is a new method inspired by the philosophy of the Dominance-based Rough Set Approach (DRSA), which is a well-known multicriteria sorting method. The ORSA maintains the foundations of DRSA whilst allowing the use of criteria weights. The first investigation of the ORSA shows that for some decision problems, the application of ORSA identifies large differences between lower and upper approximations of the unions of decision classes and, moreover, rather weak decision rules, i.e., supported by few objects from lower approximations. This is due to the inconsistency, in the sense of outranking principle, between objects that often characterize the input data. The aim of this paper is to present a generalization of ORSA to Variable Consistency Model (VC-ORSA). This extension enables relaxation of the conditions for assigning decision objects to the lower approximations by accepting a limited proportion of negative examples.

What is the nature of your talk?: Theoretical

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

08/09/2016 : 14:15 : Room-DS1.08

Code: OR58A1752

Requirements Prioritisation, Approaches and Suitability for Agile Web or Database Development

Mrs Zoe Hoy and **Dr Andrew Lee** (*University Of Portsmouth*)

The research critiques and compares prioritisation approaches used for agile software development to determine which approaches are suited to particular types of software. In agile software development, software is developed incrementally in short cycles by self-empowered teams which include the customer. The decision over which software features are implemented in each development cycle is a joint decision made within the team, using prioritisation approaches to inform this decision. Many prioritisation approaches have been identified for prioritising requirements. However, there has not been a comparative study across the top 5 prioritisation approaches to identify which prioritisation approaches are suited to particular types of software, for instance agile front-end web development software or back-end database software. This research addresses two gaps. Firstly, qualitative thematic analysis was used to determine a set of criteria for agile web development and database development, from a literature review. Secondly, the top 5 most frequently used and cited requirements prioritisation approaches were compared against the criteria. The outcome of the research was a prioritisation approach appropriate for agile web development and database

development. The results indicated that the planning game was appropriate for front end web development. For back end database development, the planning game or QFD were appropriate.

What is the nature of your talk?: Theoretical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Very

08/09/2016 : 14:45 : Room-DS1.08

Code: OR58A1854

Structuring Problems for Multicriteria Decision Analysis

Prof Valerie Belton (*University of Strathclyde Business School*), **Dr Judit Lienert** and **Dr Mika Marttunen** (*EAWAG*)

The importance of problem structuring for MCDA has long been acknowledged and there is a growing literature offering advice and describing practice across a range of application areas. At the same time, increasing interest in behavioural aspects of OR has highlighted the potential motivational and cognitive biases that can influence the structuring of multicriteria problems and the analyses that follow. This presentation will describe and report the findings to date of programme of work which is seeking to: • better understand and learn from reported practice in problem structuring for MCDA, in particular the extent and benefits of use of a range of problem structuring approaches (from OR and more widely) • explore the extent to which previously identified objectives hierarchy related biases occur in practice • develop a framework for building concise objectives hierarchies The first part of this research is based on a literature review of papers published between 2000 and 2015 describing the combined use of a PSM and MCDA and the second part draws on a meta-analysis of 60 published case studies describing the use of MCDA in practice in environmental and energy applications. The third component builds on this research and the authors' experiences to propose a framework and associated methods to support the building of concise objectives hierarchies for MCDA.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

Optimisation Under Uncertainty



Organiser: Tri-Dung Nguyen

06/09/2016 : 13:30 : Room-DS1.11

Code: OR58A1653

Facility Delocation Under Uncertainty

Dr Diego Ruiz-Hernandez (*University College for Financial Studies*) and **Dr Nalan Gulpinar** (*Warwick Business School*)

Firms face the need to incur important managerial changes in order to maintain their profits or to restore loss profitability in an adverse economic environment. Among these changes, facility delocation has become widely accepted as a valuable mechanism for reducing costs, recovering competitive advantage and, in general, dealing with an unfavourable business environment. In this paper we address the capacitated facility delocation problem under demand uncertainty. The problem is formulated as a stochastic programming problem where the decision maker should decide either to close certain facilities and/or to modify the capacity of others in order to deal with changing market conditions. Some computational results are presented to illustrate the performance of the model.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

06/09/2016 : 14:00 : Room-DS1.11

Code: OR58A1721

Determining the Adjustable Robust Counterpart For Uncertain Spatial Optimization Model Of Water Supply Allocation Problem

Dr Diah Chaerani, Dr Stanley Dewanto, Mr Ahmad Dinu Haq and **Mr Eman Lesmana** (*Universitas Padjadjaran*)

Consider the spatial optimization model for water supply allocation (SOMWSA) proposed by Murray et al. The problem is modeled as a linear optimization problem in order to optimally water across multiple water across multiple district with objective to minimize the total population affected by deficits in the regions. In this paper, we discuss a modified model of the SOMWSA by considering the possibility of uncertain data in demand, and we present the robust counterpart model as promote by Ben-Tal and Nemirovski. Furthermore by considering the SOMWSA as a multistage decision problem, the decision variables now become the wait and see decision variables, thus we have to use the adjustable robust counterpart, since the water flow for a region i depends on the water flow of region $i-1$.

What is the nature of your talk?: Theoretical

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

06/09/2016 : 14:30 : Room-DS1.11

Code: OR58A1729

Newsvendor Games with Ambiguity in Demand Distributions

Dr Dung Nguyen (*University of Southampton*) and **Dr Vinh Doan** (*Warwick Business School*)

We investigate newsvendor games whose payoff function is uncertain due to ambiguity in demand distributions. We discuss the concept of stability under uncertainty and introduce the concepts for robust payoff distribution when the payoff function is uncertain. Properties and numerical schemes for finding the robust solutions are presented.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Somewhat

06/09/2016 : 15:30 : Room-DS1.11

Code: OR58A1652

Capacity Planning for a Network of Stem-cell Donation Centres

Ms Elvan Gokalp, Dr Vinh Doan and Dr Nalan Gulpinar (*University of Warwick*)

Stem-cell transplantation is the last chance for patients of many blood-related diseases. Stem-cell donation centres admit patients requiring a stem-cell transplant donation and search for a perfect match between the patients and donors. The initial donor matches are subject to the blood DNA-typing test that is a time-consuming and expensive process. On the other hand, these patients have critical health conditions and require a transplantation as soon as possible. In this paper, we are concerned with stochastic capacity planning problem for a network of stem-cell donation centres that share the same capacity budget. We develop a scenario-based stochastic optimization model that maximizes total number of transplantations in the presence of budget restrictions by taking into account the donor search operations of the centres during a finite horizon. A data-driven robust approach is adopted for a safe approximation to the waiting times in the blood testing service. The computational experiments are designed to show the performance of the model using the generated data. A sensitivity analysis is conducted to show the impact of various model parameters on the optimal capacity decisions.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Somewhat

06/09/2016 : 16:00 : Room-DS1.11

Code: OR58A1839

Compare the Customer: Dynamic Price Optimisation in the Motor Insurance Industry

Mrs Hazel Davis (*AXA UK Insurance*)

The UK motor insurance market is notoriously competitive. The rise of price comparison websites allows customers to shop around for the best deal, and puts insurers under pressure to drop prices to appear at the top of the screen. The profitability of any insurance contract is inherently uncertain at point of quote. You may or may not sell the policy. If purchased, the income and expenses depend on the covers chosen, the payment frequency, and future renewals. And unsurprisingly, the occurrence and cost of claims are unpredictable by nature. In light of this uncertainty and customer price sensitivity, insurance companies have adopted Dynamic Price Optimisation (DPO) to adjust customer premiums to maximise expected profit and deliver growth. We will consider a case where Generalised Linear Models (GLMs) have been built to predict customer product selection, expected customer lifetime and expected claims costs. Customer elasticities are derived from these behavioural models and market data. The profitability of potential customers is also modelled and trended. Proprietary software delivers optimised results in real-time, making use of up to date external data. We will discuss practical challenges of implementing a solution compatible across comparison websites, and designed to optimise over a multi-year time frame, including: · How far can we push the price? · How to establish the size of the prize? · What time horizon should be considered?

What is the nature of your talk?: Very practical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Highly

Appraising the Effectiveness of Aggregate Production Planning Policies in Presence of Uncertainty

Mr Aboozar Jamalnia, Prof Dong-Ling Xu and Prof Jian-Bo Yang (*Alliance Manchester Business School, The University of Manchester*)

The present study proposes a novel stochastic nonlinear multi-stage multi-objective decision making model to APP which considers multiple objectives such as total revenue, total production costs, productivity costs, total costs of the changes in workforce level, customer services, etc. subject to bounds on inventories, backorders, subcontracting, workforce level, and so forth where the forecasted demand acts as the main source of uncertainty. In the first phase, a comprehensive stochastic nonlinear multi-objective mathematical programming model is developed under the primary mixed strategy which integrates chase, level and demand management strategies to provide a holistic view of the APP. The improved version of the the WWW-NIMBUS software will be used to solve the constructed large scale stochastic nonlinear nonconvex non-differentiable multi-objective optimisation model for the APP problem. The solution will determine the optimal values of the production in regular time and overtime, backorders, inventory, subcontracting, workforce hired and laid off in regular time and overtime, product prices, and so on over the planning horizon for the company under study in presence of uncertainty. A sensitivity analysis will be conducted by changing different parameters and regarding various demand patterns. Then, the relevant models for other APP strategies including the pure chase, the pure level, the modified chase, the modified level and the demand management strategies are derived from the fundamental model developed for the mixed chase, level and demand management strategy. The same procedure, as described above, follows to solve the models constructed for these strategies with respect to the aforementioned objectives/criteria in order to provide business and managerial insights to operations managers about the effectiveness and practicality of various APP policies under uncertainty. Multiple criteria decision making methods such as TOPSIS and ELECTRE are also used besides multi-objective optimisation to assess the overall performance of each APP strategy.

What is the nature of your talk?: Very practical

Does your talk require prior knowledge of the subject area?:

Somels your talk accessible and relevant to Practitioners?: Highly

OR Consultancy and Case Studies



Organiser: John Medhurst

08/09/2016 : 11:30 : Room-DS2.08

Code: OR58A1779

The Impact of System Dynamics (SD) Based Workforce Modelling at the Centre for Workforce Intelligence (CfWI)

Dr Siôn Cave (*Decision Analysis Services Ltd*), **Dr Graham Willis** and **Dr Andrew Woodward** (*CfWI / DH*)

This presentation provides a historical reflection on the application of System Dynamics (SD) for health and social care workforce modelling at the Centre for Workforce Intelligence (CfWI). Between July 2010 and March 2016 the CfWI was a key contributor to the planning of future workforce requirements for health and care in England. The Department of Health, as well as Health Education England and Public Health England, engaged the CfWI to inform national and local workforce planning and policy decisions. In 2012 CfWI transitioned to using System Dynamics software for much of its modelling work, and aligned its development approach with the System Dynamics method. This paper discusses the role of consultancy over this period, the transition to System Dynamics based modelling, the impact that the System Dynamics based studies had, and lessons learned from building a System Dynamics capability.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Very

08/09/2016 : 12:00 : Room-DS2.08

Code: OR58A1792

Falkland Islands Demining – An Application of Multi-Criteria Decision Analysis

Mr Peter Bailey (*DSTL*)

As part of its responsibilities under the Ottawa convention, the UK is required to clear all its sovereign territory of landmines or similar munitions. The next deadline to meet as part of this obligation is 2019, when it will be asked to report how much of the Falkland Islands have been cleared of minefields, of which there are currently 83 separate known minefields. It is not expected that all of the minefields will be cleared in this time, but strong progress must be shown. The order in which the minefields are cleared was the subject of much discussion, across multiple stakeholders with competing views and priorities. A decision on this ordering was required, in order to allow an Invitation to Tender (ITT) for contractors to be developed and published. Dstl support was sought to provide an objective, auditable and transparent evidence base on which to base this decision. This paper will outline the decision to be supported, the analytical approach to the problem, which was based upon the Multi-Criteria Decision Analysis method, and summarise the advice given during the course of this task.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Highly

08/09/2016 : 13:15 : Room-DS2.08

Code: OR58A1812

Design of Experiments to Identify Critical Train Service Performance Parameters

Mrs Irina Elvin and **Mr Christos Papadimitriou** (*Network Rail*), **Dr Tim Davis** (*Timdavis consulting*) and **Mrs Marize Fourie** (*Network Rail*)

Purpose This case study investigates the relationship between output and input from Network Rail (NR) TRAIL Reliability Modelling simulation software with a view to discovering parameters that can be used to optimize Train Service performance. The work is extended to look at timetable robustness.

Design/Methodology/Approach In this article we use statistical experimental design techniques - primarily Definitive Screening Designs (DSDs) - to investigate the output of NR Systems Analysis Team Simulation Models. In each experiment we construct a mathematical model that connects the simulation outputs to the set of planning parameters via a simple transfer function (2nd order or lower), with features of the output as the response variable. Traditional analysis sometimes varies only one factor at a time and assumes additive effects between factors. DSD and Regression Analysis allows us to estimate 1st order (main effects), 2nd order (2-factor interaction) and quadratic terms between multiple factors. **Findings** The case study-through two experiments has identified factors that impact train performance and examined possible interactions between the factors. In addition the generalized logistic function was used to represent the simulation model output. **Practical Implications** The results will support NR Systems Modelling function. Systems Analysis Team runs a discrete event simulation model to estimate train performance based on a myriad of input variables and running multiple years of operation. With the use of Statistical Experimental Design train performance can be represented as a function of the main impacting factors and multivariate factors, i.e. a simplified expression of the detailed simulation model. This can significantly reduce the number of run cases and simulation time, and provide insights into the factors which drive performance. By screening the choice of factors and executing the appropriate experimental design (DSD or otherwise), we can fit an equation to a point on the performance graph or fit a model to the performance curve.

What is the nature of your talk?: Very practical

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Very

08/09/2016 : 13:45 : Room-DS2.08

Code: OR58A1915

Reducing the Size of the UK Ministry of Defence Workforce - Application of Analysis to Inform Decision-Making

Mr Philip Jones (*Ministry of Defence*)

As part of the 2015 Strategic Defence and Security Review the UK Ministry of Defence (MoD) committed to reducing its Civil Service workforce by 30% in 5 years. I will describe the analytical processes used to: understand the MoD workforce; assess the uncertainties in ongoing change programmes; assess the potential for change and inform the development of tailored targets and actions. I will describe the range of data analytics, visualisation and benchmarking approaches used and the challenges of trying to characterise a very complex workforce in a way that would promote constructive discussion and decision making. I will also share my experiences of operating in a complex and challenging stakeholder environment.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Highly

08/09/2016 : 14:15 : Room-DS2.08

Code: OR58A1627

A Case Study of How to Measure Customers' Probabilities to Return to Zooplus

Ms Yu Lin and **Mr Sascha Herrmann** (*Zooplus AG*)

As the leading online retailer for pet supplies in Europe, Zooplus faces the problem of efficiently contacting more than 4 million active customers. To maintain a high customer loyalty and retention level, we use targeted mailing with coupons to customers who are about to churn as one of the stimulations. For more accurate targeting, we developed a quantitative model to cluster and calculate the churn rates for each cluster of customers. Our analysis consists of three steps. First, massive orders of active customers are analyzed, and

several clustering methods are used based on customers' and their orders' attributes. Results are then evaluated visually together with stakeholders. Eventually a proper clustering method is selected that produces significantly distinguishing patterns among different order clusters. Second, for each cluster we analyze the lead times of customers' historical orders. Quantiles of order lead time are then selected to categorize different ranges of customers' churning risk. For easier communication the churn categories are labelled in colors. Finally, a customer's probability of returning is predicted based on historical thresholds of calculated churn categories. Namely, each customer is assigned to one cluster by their last order. Based on the age of the last order and the thresholds in cluster, the customer is labelled to a category. Using this information the Marketing department sends personalized mailings to customers in different categories to encourage another order. The calculation is automated as an in-house application, scheduled to re-calculate the thresholds for different colors regularly. This is then used as a base to update customers' color label daily. The stakeholder is happy of this new tool, as it helps target more accurate customer segments. In addition, we will share how we use sampling to identify a flaw in the clustering and improve it. Some interest findings will also be presented.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Highly

08/09/2016 : 14:45 : Room-DS2.08

Code: OR58A1680

The Use of Systematic Sampling to Measure UK Border Permeability: Operational Research Approaches and Challenges

Mr Guy Griffiths (*Dstl*)

Border Force have responsibility for stopping illegal/controlled goods from entering the UK. They know a great deal about what they have stopped in the past, and use this knowledge to inform their ongoing targeting activity. However they know little about how much they miss. This means they do not know how well their intelligence and risk profile based system is performing – in other words, what proportion of all illegal goods are successfully interdicted. A joint BF/HO/Dstl programme was established to devise methods allowing this to be estimated. The main approach developed has been a systematic sampling regime outside of the normal targeting process in order to make inferences about total threat flow. This is being rolled out via a series of mode-based pilots which will then mature into business as usual functions. Various challenges presented themselves during the pilot design and implementation process: - A complex border threats picture: diverse modes and ports, multiple threat types to be accounted for. - Sampling strategies: how to stratify and build up a large enough sample size, including account for rare-event phenomena, whilst limiting the impact on the front line. - Contextual data issues, mainly related to itemising overall flow. - Accounting for displacement and agile, responsive adversaries. - Human factors – changing mind sets. Challenges were addressed through a combination of soft and hard OR approaches. This has included extensive port visits and workshopping, data gathering, analysis and presentation, and Neyman allocation approaches to make the best use of limited sample sizes. Outputs are beginning to inform changes to targeting activity, thereby increasing yields. A number of finds from sampling have also led to new methods and routes being uncovered.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Relevant

OR in Education

Organiser: Jana Ries

08/09/2016 : 09:00 : Room-DS1.04

Code: OR58A1696

Applying TOC-TP tools in Higher Education (HE): Exploring the Core Dilemmas in Learning and Teaching

Prof Victoria Mabin and **Prof John Davies** (*Victoria University of Wellington (VUW)*) and **Dr Sarah Kimani** (*Catholic University of Eastern Africa*)

In the new millennium, there has been growing global application of the Theory of Constraints thinking process (TOC–TP) tools across many industry sectors including healthcare, services and education sectors. Within education, the TOC–TP tools have been applied with success in south-east Asia, the Americas, the Middle East, Europe, and Africa. Users have indicated that the TOC–TP tools are straightforward to use and easy to integrate into education settings. For example, in addition to reports of improved curriculum design and delivery, these tools have not only been useful in building cognitive skills, improving student behavior and academic learning, but also improving school management and governance (www.TOCfE). Whilst most applications have been in the primary and secondary school sector, there is growing evidence of successful application of TOC-TP tools to address a range of matters in tertiary or higher education (HE). We report on research exploring the quality of experiences of learning and teaching (L&T) in HE using TOC methodology to investigate causes of less-than-ideal L&T experiences from the perspectives of students, teachers and academic management. The research was conducted in two business schools, one each in Kenya and New Zealand. Specific TOC tools were used to guide data collection, analysis and to develop proposals for change. These tools included the Goal Tree, focused Current Reality Tree, Evaporating Clouds and Future Reality Trees. The paper will give a brief overview of the research process and findings, and comment on the particular combination of TOC tools used. The study has demonstrated the value of the TOC methodology in producing useful insights about the root causes of undesirable quality of L&T in the HE sector. Its findings are consistent with prior research in other contexts, suggesting that issues, research methods and remedies may be of wide interest.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Very

08/09/2016 : 09:30 : Room-DS1.04

Code: OR58A1864

Full Steam Ahead for O.R. and Design?

Dr Geoff Royston and **Dr Alexander Komashie** (*Engineering Design Centre (EDC)*)

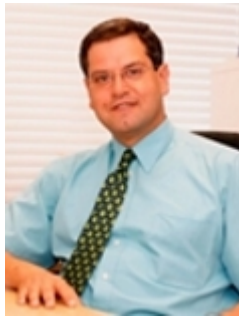
At least since the observations of Herbert Simon and Russell Ackoff, connections have been made between the work of operational research and the task of design. In the last two or three years there has been some renewed interest shown in these links. There have been publications in the O.R. literature and the OR Society has held two well-attended one-day events (jointly with the Design Society) exploring the connections. The risks of not attending to design issues in O.R. work are significant – risks of focusing on tools more than problems, of over-emphasising analysis compared to synthesis, and of under-attending to challenges of innovation and implementation, all of which threaten achievement of O.R.'s core task of system improvement. On the other hand, to design complex systems that work, designers could make more use of techniques used in O.R. to help predict and provide insight into operational performance. To address the challenges of the future the two fields need each other, however, on the O.R. side at least, little seems to be being done to bridge the gap by re-shaping the education and training of O.R. and management science professionals so that concepts are understood and skills are developed in design as well as in analysis. This can be seen to be part of a wider educational challenge, of moving on from the vital development of STEM (Science, Technology, Engineering and Mathematics) skills, to boosting creative, innovative and communicative skills by including an Arts dimension – for which there is a growing movement, carrying the acronym STEAM. Recent research has demonstrated the value of STEAM skills to the UK economy. This paper reviews these developments and suggests how STEAM could provide a foundation for education and training in O.R. for the future.

What is the nature of your talk?: A mix.

Does your talk require prior knowledge of the subject area?: None.

Is your talk accessible and relevant to Practitioners?: Very

OR Modelling for Humanitarian Operations Management (HOM)



Organisers: Ashraf Labib, Richard Teeuw and Reza Abdi

08/09/2016 : 09:00 : Room-DS1.01

Code: OR58A1856

Risk Perception and Safety in Risk Based Management

Dr Hom Dhakal, Mr Chinedu Dibia, Mr Oluwasoye Mafimisebi and Dr Sarinova Simandjundtak
(University of Portsmouth)

Contact: oluwasoye.mafimisebi@myport.ac.uk Author(s): Oluwasoye Mafimisebi (Researcher, Business School University of Portsmouth) Chinedu Bevis Dibia (Researcher, School Engineering, University of Portsmouth, Portsmouth, UK) Abstract Purpose - This paper considers challenges, effects and impacts of risk perception and safety on RBM. Their relationship with each other using a case study to illustrate and demonstrate the Nigerian experience. Design/methodology/approach – Case study approach was used. Findings – It was observed that risk perception is pertinent in proper risk communication to get stakeholders to properly evaluate their impact on risk based management. Informing their approach to safety, its importance and impact. Research limitation/implication – The case study being in Nigeria. Practical/Social implication – The paper observes that proper risk perception and safety in Nigeria is still challenging. Originality/Value – This is a research that looks at the impact of risk perception and safety by stakeholders in the Nigerian oil and gas sector as regards risk based management of process generated environmental waste. Keywords – Risk perception, Safety and Risk based management Paper Type – Case Study

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Relevant

08/09/2016 : 09:30 : Room-DS1.01

Code: OR58A1860

Under Threats: Misconception, Perception and Trust Deficit in Security and Terrorism Crises **Mr Oluwasoye Mafimisebi, Dr Andreas Hoecht and Dr Sara Thorne** (University of Portsmouth)

Purpose – The purpose of this paper is to argue that current conventional models and strategies of dealing with security and terrorism crises are under threats due to the dilemma of strategic incoherence. For decades, major incidents responders and decision-makers have sought to unravel best practices in handling security and terrorism related crises. Despite the increasing number of empirical and conceptual studies investigating these phenomena, unconventional security threats and terrorism appear to be intensifying; and there has been little research done on their self-inflicted nature. Of practical importance, the burgeoning risk issues can be best explained within the context of misconception, perception and trust deficit among different players (stakeholders) in crisis. Design/methodology/approach – A systematic review of literature. Findings – It illustrates how the linkages among the constructs of misconception, perception and trust are playing pivotal roles in shaping conventional security and counterterrorism approaches but undermine the effectiveness of risk strategies. It is shown that reliance on all-inclusive strategies in dealing with unconventional security and terrorism crises can be problematic, not only because stakeholders' perspectives are discounted and crisis context ignored but also due to strategic incoherence dilemma. In fact, it was found that the more risk models and strategies are introduced, the more polarised the effectiveness of such approaches become. In turn, we

show that these risk models become strategically incoherent and incompatible to manage unconventional security and terrorism crises. Research limitation/implication – Theoretical rather than empirical. Practical/Social implication – A management tool is developed for risk managers and major incidents responders to aid decision-making during ill-structured and ambiguous situations. Originality/Value – A critique of the risk and crisis management literature and a call to risk managers to be aware about the dilemma of strategic incoherence when confronted with unconventional terrorism crises. Paper type – Conceptual paper

What is the nature of your talk?: Theoretical

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Highly

08/09/2016 : 11:30 : Room-DS1.01

Code: OR58A1620

Why Fukushima? A Historical Analysis of the Location Choice of Nuclear Power Plant

Prof Kazuhiro Seki-Taniguchi (*Keio University*)

This paper examines why Fukushima Prefecture was chosen as a site for establishing Fukushima Daiichi Nuclear Power Station (Fukuichi), which led to the nuclear disaster comparable to Chernobyl after the great earthquake and the unforeseen tsunami occurred in March 2011. We take the location choice problem seriously to understand the cause of the Fukushima nuclear disaster with particular emphasis on the early history of nuclear development in Fukushima. First, a network of Fukushima natives including Zenichirō Satō (the governor of Fukushima Prefecture), Kazutaka Kikawada (top management of TEPCO, i.e., the Tokyo Electric Power Company), and Morie Kimura (the governor of the prefecture after Satō) emerged to facilitate the regional development of Fukushima. Second, at the beginning, there was a huge land in Futaba District. Actually, TEPCO did not have a broad range of options. Third, being too ambitious and hasty prevented TEPCO and the manufacturers such as Toshiba and Hitachi from developing good capabilities for running the nuclear power plants. Finally, TEPCO that did not necessarily have the capabilities indispensable for operating the nuclear power plant as it had to rely on GE's capabilities by signing a turnkey contract and thus accepting its BWR specifically designed to the U.S. environmental conditions, which has to often cope with hurricanes rather than earthquakes and tsunamis such as is the case of Japan. We conclude that a nuclear power plant was introduced to Fukushima in the name of regional development, although the plant badly designed and the electricity company not eligible for operating it because of the lack of capabilities ruined regional development eventually.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Somewhat

08/09/2016 : 12:00 : Room-DS1.01

Code: OR58A1624

Modelling Learning (and Unlearning) from Failures: A Comparison of Fukushima and Bhopal Disasters

Prof Ashraf Labib (*University of Portsmouth*)

The paper will argue that organizations and individuals learn more effectively from failures than from past successes, and that failures contain valuable information, but organizations vary at learning from them, and that organizations vicariously learn from failures and near-failures of others. It will also be argued that any disaster can be analysed as a case of a Black Swan and present the concept of learning from failures. We will share work based on previous related research in this field in terms of recent published journal papers and the related published book (Labib, 2014). The concept of high reliability organizations (HRO) will be presented. The case studies of Fukushima nuclear disaster, and Bhopal disaster will be compared using a model of triple-loop learning.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Highly

08/09/2016 : 13:15 : Room-DS1.01

Code: OR58A1793

Vehicle Routing Problem for Disaster Relief Logistics: Thailand Tsunami

Mr Kiatkulchai Jitt-Aer, Prof Dylan Jones and Dr Graham Wall (*University of Portsmouth*)

Natural disasters, which include tsunamis, hurricanes, floods, mudslides and earthquakes, are collectively increasing in frequency across the world. Relief supplies such as food, shelter, and medicine must be sent from the relief distributor to the affected areas efficiently and impartially to support rescue operation and alleviate suffering people. The challenge in disaster response, therefore, is to deliver the appropriate relief supplies to the right place, at the right time, with the right demand. In this research, we consider such a shipment delivery problem in the tsunami-prone areas in Thailand, and the problem is formulated as a capacitated vehicle routing problem with deterministic demand. The aim of this model is to minimize travel time between the main distribution centre to the evacuee locations in Phuket which is a prime tourist area with numerous beach resorts, and was one the most severely areas affected by the 2004 Asian tsunami. To solve the proposed model, the Clarke and Wright savings algorithm is developed to generate the computational results that are conducted to demonstrate the applicability of the proposed model and solution algorithm.

What is the nature of your talk?: Theoretical

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

08/09/2016 : 13:45 : Room-DS1.01

Code: OR58A1809

Evidence-Based Hybrid OR Models for Cases of Humanitarian Operations Management

Prof Ashraf Labib (*University of Portsmouth*)

This paper is based on research related to two major disasters and use OR models grounded by data obtained from three case studies. It provides a framework of learning from disasters in the context of HOM. The cases studies are concerned with a purely natural disaster of Hurricane Katrina to and a purely industrial disaster of Bhopal. The operational research (OR) models chosen include fault tree analysis (FTA), reliability block diagram (RBD) and multiple criteria decision analysis (MCDA) using analytical hierarchical process (AHP) plus a hybrid approach of using multiple OR tools to examine the effects of influencing causes and explore critical success/failure factors and criteria on the HOM decision making process. The case studies are then compared with respect to their causes and affects along with the OR models adapted to support HOM.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Very

08/09/2016 : 14:15 : Room-DS1.01

Code: OR58A1906

Seasonal Influenza Risk Assessment: An Innovative Approach Combining Simulation, S-OLAP Technology and Multicriteria Classification

Dr Salem Chakhar (*University of Portsmouth*), **Prof Omar Boussaid** (*University of Lumière Lyon 2*), **Dr Djamila Hamdadou** (*University of Oran 1 Ahmed Ben Bella*), **Prof Alessio Ishizaka** (*University of Portsmouth*) and **Dr Fatima-Zohra Younsi** (*University of Oran 1 Ahmed Ben Bella*)

Seasonal influenza is a contagious disease with a highly transmissible virus that causes significant morbidity and mortality during yearly seasonal winter epidemics. This particularly concerns the elderly and those with underlying medical conditions. The public health professionals, government officials, humanitarian agencies, emergency services and any other individuals and organizations that are concerned by preparedness and mitigation of populations from infectious diseases such seasonal influenza need to have at hand an appropriate epidemiological surveillance decision tool. The main objectives of the epidemiological surveillance are the monitoring and preventing the spatiotemporal spread of epidemic diseases. The objective of talk is to present the design, implementation and validation of a three-layer decision support system for seasonal influenza risk assessment. The key advantage of the proposed tool is the integration of a collection of powerful and complementary tools, namely simulation, social network analysis, data warehouse, S-OLAP analysis capabilities and multicriteria analysis, offering thus an integrated decision support for public health

officials. The proposed framework has been applied and validated through a real-world case study in Oran region in the North-West of Algeria. The case study concerns the seasonal influenza but the system is generic enough and can easily adapted for a wide range of other infectious diseases characterized by a latency period, including tuberculosis, measles, meningitis, and many others.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Very

08/09/2016 : 14:45 : Room-DS1.01

Code: OR58A1808

Project Risk Management Using Integrated Fuzzy Multi Criteria Decision Models:

Mr M Reza Abdi (*University of Bradford*), **Prof Ashraf Labib** (*Portsmouth University*) and **Mr Morteza Yazdani** (*Universidad Europea de Madrid*)

Risk management is the activity of defining sources of uncertainty (risk identification), estimating the consequences of uncertain events/conditions (risk assessment), generating response strategies in the light of expected outcomes (risk response) and finally, based on the feedback received on actual outcomes and risks emerged, carrying out and implementing risk strategy, monitoring plan for new risks and handling change management process (risk response control). The proposed model evaluates construction projects based on risk variables through three phases. In phase I, a team of experts work together to define the attributes (risk factors and sub-factors), decision alternatives and level of complexity. In phase II, a fuzzy Analytical Network process (ANP) model is developed to evaluate weights of the risk factors and sub-factors through linguistic scales. In addition, the initial risk matrix for scoring alternative projects is obtained through using a fuzzy failure mode and effect analysis (FMEA) with linguistic scales. The outputs fuzzy ANP and fuzzy FMEA will be aggregated and defuzzified to rank the alternatives projects using evaluation based on distance from average solution (EDAS). The EDAS results are compared with other multiple criteria decision-making (MCDM) tools that include simple additive weighting (SAW), technique for order of preference by similarity to ideal solution (TOPSIS), complex proportional assessment method (COPRAS), weighted aggregated sum product assessment (WASPAS) and stability of projects ranking is verified with minor differentiation across the techniques.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Somewhat

OR and Public Policy



Organiser: Robert Solly

06/09/2016 : 11:00 : Room-DS2.14

Code: OR58A1840

KEYNOTE: Supporting Climate Adaptation Decision Making: The Netherlands Experience

Dr Jan Kwakkel (*Delft University Of Technology*), **Dr Marjolijn Haasnoot** (*Deltares*) And **Prof Warren Walker** (*Delft University of Technology*)

A changing climate and ongoing socio-economic developments are putting severe stress on water management practices in many deltaic countries in the world, including the Netherlands. To address this, the Dutch initiated a new Delta Program, which aimed at developing a strategy for keeping the Netherlands safe from floods and droughts during this century. The challenge faced by the Delta Program is how to proactively address deep uncertainty in the long-term management of the Dutch Delta. Future climatological conditions, socio-economic developments, land use patterns, and social preferences are deeply uncertain, interconnected, changing dynamically over time, and co-evolve with each other and any water management actions that are taken. In light of this, existing predictive and scenario-based approaches were deemed inadequate. Instead, an adaptive planning approach called dynamic adaptive policy pathways emerged. This approach explicitly considers that adaptation decisions are taken over time. Therefore, we need to explore the future and sequences of decisions (adaptation pathways). It emphasizes that any plan should commit to short-term actions, specify a range of long-term options, and establish a monitoring framework for guiding the implementation of these options if and when necessary. In order to develop such adaptation pathways, the way in which models are used is changed from prediction to exploration. This adaptive approach, applied in the Netherlands under the label of Adaptive Delta Management, is now being adopted in a wide variety of countries. In this talk, we will introduce the adaptation pathways approach and discuss how it emerged in the Netherlands. We will also present various examples of how the design of adaptation pathways, and the decision making using them, can be supported using exploratory modeling approaches, simulation gaming, and game structuring techniques. Examples will be drawn from the Netherlands as well as from other countries.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Relevant

06/09/2016 : 12:00 : Room-DS2.14

Code: OR58A2931

The Future of National Infrastructure

Dr Scott Thacker and **Prof Jim Hall** (*University of Oxford*)

Infrastructure forms the economic backbone of modern society. It is a key determinant of economic competitiveness, social well-being and environmental sustainability. Yet infrastructure systems (energy, transport, water, waste and digital communications), in multiple contexts globally, face a range of serious challenges. There have been many calls for a more strategic, long-term approach to national infrastructure in the UK and elsewhere around the world. Whilst appealing in principle, in practice developing a national infrastructure strategy poses major challenges of complexity and uncertainty. The UK Infrastructure Transitions Research Consortium (ITRC) has set out a systematic methodology for long term analysis of the

performance of national infrastructure systems, which deals with each infrastructure sector (energy, transport, digital communications, water supply, waste water and solid waste) in a consistent framework and assesses the interdependencies between infrastructure sectors. The methodology is supported with the world's first infrastructure system of systems model (NISMOD), which has been developed for long term decision analysis in interdependent infrastructure systems. Following an introduction of the ITRC and NISMOD, this presentation provides details of a number of applications of the model to the UK and beyond. In doing so, it provides examples of how system-based modelling is being used to support decision making within government and industry at a range of scales.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Highly

06/09/2016 : 13:30 : Room-DS2.14

Code: OR58A1911

An MCDA Framework for Evaluating and Appraising Government Policy for Psychoactive Drugs

Prof Lawrence Phillips (*LSE*)

How best can government policy reduce the harm from the misuse of drugs? Should cannabis be legalised? To what extent should governments control alcohol? Public health arguments about these drugs have focused on different types of harm, physical, psychological and social, with no consensus emerging from the debate. This talk presents an MCDA framework developed by a group of experts drawn from European countries in two one-day decision conferences. The framework consists of 27 criteria, clustered under seven themes that capture aspects of the world-wide debates against which drug policies could be evaluated and appraised. The group distinguished four policy regimes, absolute prohibition, decriminalization, state control and free market, which served as options that could be applicable to any given drug. The results of applying the framework for alcohol and cannabis will be reported.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Very

06/09/2016 : 14:00 : Room-DS2.14

Code: OR58A1619

Addressing Overcrowding of Buses in Delhi

Dr Nomesh Bolia and **Mr Hemant Suman** (*IIT Delhi*)

Traffic externalities such as congestion, pollution, and parking issues are growing continuously in Delhi as well as many cities worldwide due to continued growth in the share of personal motor vehicles and decline in the share of public transport. One of the ways of addressing these traffic externalities is making public transport more attractive, especially bus transport. Buses have the potential to provide better services as compared to other modes of transport at much lower cost. Buses are perceived as highly overcrowded and that is the major reason of not using buses by potential bus users in Delhi and other cities worldwide. Thus, reducing crowdedness by providing comfortable standing or sitting space is a key intervention to make buses more attractive. This work develops mathematical models that evaluate current level of services provided by existing buses and allocate these buses optimally to various routes such that the overall overcrowding is minimized. The results reveal that during peak hours the buses are not even able to meet the existing demand of 50% stops of the route network in Delhi. Further, optimal allocation of buses to routes can improve the comfort level of passengers by more than 3-times during off-peak hours and more than 10-times during morning peak hours. The models developed here are easy to understand for policy makers and computationally tractable. They provide policy support to the state transport department for better comfort levels of passengers and consequently can also be the drivers for increased mode share of buses without additional funds. While these results are for Delhi, where the data was collected, the models can be applied in other cities facing the problem of overcrowding in buses.

What is the nature of your talk?: Very practical

Does your talk require prior knowledge of the subject area?: Some
Is your talk accessible and relevant to Practitioners?: Highly

06/09/2016 : 14:30 : Room-DS2.14

Code: OR58A1912

MoD Civilian Business Improvement Review: A Case Study in the Use of Visual Analytics to Aid the Implementation of Government Policy.

Miss Katharine Etheridge (*Dstl*)

The Business Improvement Review resulted from the planned reduction in the United Kingdom Ministry of Defence (MOD) civilian workforce. The review focusses on where Defence activities can be delivered more efficiently and effectively, through examining the activities currently undertaken by Civil Servants, to ensure evidenced-based implementation of policy. Dashboards and innovative visualisations have been used as part of the review which has had a hugely significant impact: transforming the stakeholders' understanding of the key issues by presenting data in an informative and engaging way. The visualisations have gone a long way to helping seniors across MOD understand their civilian workforce. This presentation will summarise: (i) the purpose of the review and the timescales in which we had to work (ii) how visualisations were created and presented to a wide range of stakeholders (iii) how visual analytics aided the identification and landing of findings and recommendations.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Relevant

06/09/2016 : 16:00 : Room-DS2.14

Code: OR58A1625

How to Innovatively Design Public Policies?

Dr Valentina Ferretti (*London School of Economics and Political Science*), **Dr Irene Pluchinotta** and **Prof Alexis Tsoukiàs** (*LAMSADE - CNRS*)

Most scholar articles in Decision Analysis and Operational Research, when introducing the problem formulation they talk about, start with a claim of the type "given a set A of alternatives". Both researchers and practitioners know that in reality the set A of alternatives is rarely "given", it is rather constructed during the decision aiding process and most of the times defined several times during that same process. Surprisingly, this topic has been almost ignored in the specialised literature. With the notable exception of Keeney (1992) who stated the principle that decision making should start considering "values" and not "alternatives", very few contributions are available. To the knowledge of the authors the topic has been partially considered in behavioural and cognitive sciences studies analysing how real decision makers handle alternatives construction. This topic is particularly relevant in the context of public policy making, where policy design represents a crucial step in the overall process since it determines the quality of the alternative policies being considered. This talk addresses the problem of how to support creativity in policy design using formal analytic tools. The talk uses two recent real case experiences from Southern Italy, one dealing with a planning problem in a UNESCO site and the second one dealing with water management in an agricultural system. Based on these experiences, the talk suggests how decision analytic methods can be used in order to help policy innovation.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

06/09/2016 : 16:30 : Room-DS2.14

Code: OR58A1910

Creating the Basis For Decision, Then and Now: The Practice and Potential of Operational Research in 1964 and 2016.

Mr Ian Mitchell (*Department for Business Innovation & Skills*)

The earliest Operational Research (OR) concerned public policy design. The abundance of data offers great potential for impact for analytical techniques, including OR. OR's distinctive strengths in problem structuring This presentation introduces perspectives from the 1964 BBC Documentary series "Basis For Decision". It

explains how members of the OR Society rediscovered this lost OR History and restored it to modern media. It reviews the case studies captured by the programmes Cutting The Queue, Playing It Through and The Human Factor, considering how the OR Method was applied to Public Policy Design issues. It identifies the challenges to the use of OR. The presentation compares these with the proceedings of the 2016 Data Science and Government Conference, It notes the progress made on some issues, the challenges remaining and ideas for how OR can continue to provide a Basis for Decision.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Highly

08/09/2016 : 09:00 : Room-DS2.14

Code: OR58A1928

Natural Gas and Israel's Energy Future: Near-Term Decisions from a Strategic Perspective

Dr Steven Popper (*RAND Corporation*)

With a developing country's demographic growth combined with an industrial economy's energy intensity, Israel's electric-power system needed new capacity to meet growing demand. This required major decisions on investing in new base-load generating capacity. Planners and policymakers needed to consider likely future levels of demand, the costs and availability of sources of supply, security of supply, reliability, environmental effects, and land use in the face of many deep uncertainties stemming from market, technological and geopolitical factors beyond planners' control. This presentation discusses how the opportunities and risks of shifting to a greater reliance on domestic and imported natural gas were evaluated. The analysis was designed to assist authorities in designing and implementing managed change by choosing robust strategies that minimized potential consequences of relying more heavily on natural gas. It did so by applying to these assessments newly developed methods for strategic planning and decisionmaking under deep uncertainty. In particular, the study applies an innovative, quantitative robust decisionmaking (RDM) approach to the central question of how large a role natural gas should play in Israel's energy balance. Rather than relying on the typical planning method of trying to develop plans around a small number of "most likely" scenarios, RDM helps planners discover strategies that are robust — i.e., strategies that perform well across a large range of plausible futures. Given that we cannot predict the future, we use RDM to examine the available alternatives and ask which series of short-term decisions would be consistent with long-term policy goals. The results of the analysis prompted a desire to shift national energy planning processes to an approach based on the principles elucidated in the study.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Highly

08/09/2016 : 09:30 : Room-DS2.14

Code: OR58A1758

Modelling for Decision Support in UK Energy Policy

Dr Chris Dent (*Durham University*)

Computer modelling has been used increasingly for decision support in UK energy policy in recent years. Prominent examples include the recent electricity market reform process and its implementation, and the GB Electricity Capacity Assessment Study (better known informally as 'the risks of the lights going out'). This presentation will begin by describing current key issues in energy policy and the class of mathematical models used to study them, ranging from security-of-supply assessments of relatively confined scope where key challenges might be in building statistical models of supply resources, through to very complex models used for projecting the evolution of the entire energy economy. Examples will be given of technical methods for e.g. wind resource modelling and uncertainty quantification linking the results of more complex modelling to the real world. However the majority of the presentation will describe more strategic issues in how modelling is used for decision support, such as communication of results to non-modellers; the ongoing debate over the appropriate choice of decision criterion in planning timescale optimisation problems; and how one might design modelling studies to maximise learning about the real world problem under study.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: None
Is your talk accessible and relevant to Practitioners?: Very

Outsourcing & Offshoring



Organisers: Vijay Pereira and Surender Munjal

07/09/2016 : 11:00 : Room-DS1.02

Code: OR58A1753

A Model for Selecting E-banking Service Channels' Outsourcing Strategy

Dr Payam Hanafizadeh and Mr Ahad Zare Ravasan (*Allameh Tabataba'i University, Tehran, Iran*)

Outsourcing is a good strategy for firms in general and banking institutions in particular to reduce operating costs and improve competitiveness, but it remains complex for firms to scientifically select the appropriate outsourcing strategy. Some efforts have been made regarding outsourcing problems, but these efforts referred to a limited number of factors in outsourcing decision, which is over-simplification of multi-faceted real world problems. In this paper, after doing in-depth literature review, 25 factors are identified as influencing factors on e-banking service channels' outsourcing decision. To validate the research hypotheses, the Partial Least Squares (PLS) technique is utilized. The results of this study illustrated that 19 out of 25 assumed factors influence such decisions. After that, a Fuzzy TOPSIS model using validated factors is proposed to prioritize the outsourcing alternatives. Throughout this study, we use data from a real Iranian banking case to demonstrate the applicability of the method for supporting outsourcing decision for five ATM, POS, tele-banking, mobile, and internet-banking service channels.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Highly

07/09/2016 : 11:30 : Room-DS1.02

Code: OR58A1726

A DST-based Approach for Outsourcing/Offshoring Decision Making

Dr Abdulmaten Taroun and Dr Laila Kasem (*The University of Worcester*)

Outsourcing is an established strategy that originated in the 1950s and became widely adopted by various organisations during the 1980s. Although cutting cost was originally the main driver behind this phenomenon, outsourcing decision is believed to be multi-criteria-based. Reviewing the literature suggests that researchers have developed various theories and tools to aid the outsourcing decision making, amongst which Fuzzy Sets Theory (FST), Analytical Hierarchy Process (AHP) and Analytical Network Process (ANP) have been particularly popular. Although the existing decision support approaches are well-established, they have their own limitations. Interestingly, despite its wide range of applications, Dempster-Shafer Theory of Evidence (DST) has not been used in this domain. This paper presents a DST-based approach for aiding outsourcing/offshoring decision making. Decision criteria are grouped under two main categories: benefits and risks. Monetary equivalents are used for assessing the performance of alternative actions against the specified benefit and risk criteria. Rather than providing single figures, decision makers can provide their assessment in distributed formats through expressing their degrees of belief in predefined assessment grades. This unique assessment method yields realistic assessments based on the available amount of information making it a very effective way of accounting for ignorance (lack of information), leading thereby to reducing the liability of foreignness of organisations making outsourcing/offshoring decisions. Overall risk and benefit levels are obtained by aggregating individual assessments. The evidential reasoning (ER) algorithm is deployed as an aggregation mechanism instead of the averaging procedure which may have limited applicability. Finally, the "overall"

risk and benefit levels are utilised to develop a preference score that can be used for comparing different actions/strategies. The paper concludes that the DST has a great potential for facilitating outsourcing/offshoring decision making and can offer a viable alternative to existing tools. Investigating its qualities would enrich the literature of outsourcing/offshoring decision making.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Very

07/09/2016 : 12:00 : Room-DS1.02

Code: OR58A1642

The Phases of Operational Outsourcing Relationships and Their Progression: A Theoretical Framework

Mr Paul Lyons and **Prof Louis Brennan** (*Trinity College Dublin*)

Successful services outsourcing arrangements depend on the maintenance of effective relationships between service provider and client organisations. Many studies have documented the high incidence of outsourcing arrangements conceived in a spirit of optimism, but where the relationship deteriorates and ultimately fails. The literature contributes a number of life-cycle models charting the major phases of outsourcing, including strategy, contract negotiation, operation and termination. However, little research attention has been applied to the question of how these relationships develop during their lengthy operational phase as both parties seek benefits and adjust to changing business conditions. Traditional theoretical insights into inter-organizational relationship evolution are limited when applied to this context as they do not recognize the integrated nature of these arrangements, and the structural bonds limiting the flexibility of the parties to redefine the relationship or terminate it prematurely. This paper addresses this deficit through a qualitative longitudinal study of three Business Process Outsourcing cases at varying degrees of strategic importance to their clients. The methodology involved in-depth interviews with 38 client and provider executives who were closely involved in these arrangements over their lifetimes, which ranged from nine to 11 years. The case chronologies that were documented from these interviews highlighted a pattern in how these relationships evolved. The paper develops an integrated theoretical framework describing common relationship phases and the transitions between them. The phases identified show that in each case a period of initial optimism (Ambition) was followed by one of friction (Antagonism) as expectations changed. Once expectations were re-set (Acceptance) these relationships either progressed to a more fruitful phase (Adaptation), or ineffective progression until termination (Annulment). The framework developed advances inter-organizational relationship theory as applied to this context. Decision-makers designing outsourcing governance processes will also benefit from the insights provided into the prerequisites for sustainable operational relationships.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Highly

08/09/2016 : 09:00 : Room-DS1.02

Code: OR58A1591

KEYNOTE: Outsourcing and Offshoring Strategies in a Globalised World

Dr Vijay Pereira (*University of Portsmouth Business School*)

Keynote abstract: Globalisation has led to spatial division and disaggregation of work across the globe, leading to the evolution of new and novel forms of work organisation such as co-working and co-creation. Such novel forms of work organisation have developed in response to the increased fragmentation of tasks brought about by offshoring and outsourcing. Offshoring (a location decision) has brought many new countries and cities into the realm of global value chains (GVCs). Outsourcing (an internalisation/externalisation, make or buy decision) has resulted from the fine-slicing of business processes and has brought competitive pressure to bear on all the internalised activities of firms in all industries and all locations. Whilst there are many advantages of scale and scope associated with these work design forms, there are also many problems and challenges. This keynote presents and examines the intersection of globalisation, technology, innovation, human capital and work organisation. We need answers to questions such as the choice of locations; what 'core' segments of the value chain are to be retained in-house; what

could be optimally dispersed geographically, to allies and contractors; should these decisions be tactical, strategic and transformational etc. Thus, this stream/track keynote talk of operational research (OR) will aim to talk about five important decision making questions that need to be addressed which are- why firms choose to 'buy' instead of 'make'; what to outsource; where to outsource; how outsourcing is undertaken; and lastly a fifth area, that of when to outsource.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

08/09/2016 : 09:30 : Room-DS1.02

Code: OR58A1827

Offshoring of R&D activities by Multinational Corporations

Dr Shlomo Yedidia Tarba (*University of Birmingham*), **Dr Mohammad Faisal Ahammad** (*Sheffield Hallam University*), **Dr Assylbek Nurgabdeshev** (*Almaty Management University*) and **Dr Peter Rodgers** (*University of Sheffield*)

Offshoring of high value activities is a rather recent phenomenon that has become increasingly important in the last decades. According to international business theories, companies must exert control over their high value activities, such as research and development (R&D) and information technology (IT), that give them competitive advantage over other firms. This paper attempts to extend the current understanding of the R&D offshoring process with specific focus on determinants of location choice for R&D activities. The literature dealing with the determinants of location choice is largely fragmented and hence this paper attempts to integrate the various prevalent perspectives. Drawing on transactional cost economics, resource-based view and eclectic paradigm, this paper adopts a multi-level approach to explore the country, firm and project level factors influencing the location choice decision. Moreover, this study examines the difference between the degree of innovativeness and routineness of R&D activities offshored to developed and emerging countries. In addition, it also looks at the difference between the degree of innovativeness and routineness of R&D activities offshored to foreign affiliate and non-integrated suppliers. In order to attain the objectives of our study self-administered questionnaire was distributed to 941 Multinational Corporation located in UK and 126 responses were collected. Furthermore, Multinomial Logistic Regression was adopted for the analysis which was also supplemented with PLS modeling to validate the measurement and structural models separately. The analysis indicates that country level determinants such as cost, human capital, national innovation system (NIS), country risk and cultural difference significantly affect the location choice decision of R&D offshoring. The analysis also demonstrates that the characteristics of projects, such as speed, quality, interactivity, innovativeness, and routineness, also affect the location choice decision.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Very

08/09/2016 : 11:30 : Room-DS1.02

Code: OR58A1628

Implementing Offshoring in High-Technology Service Firms: The Role of HRM in Creating an Ambidextrous Context

Dr Vijay Pereira (*University of Portsmouth*), **Ashish Malik**, (*University of Newcastle, Australia*), **Prof CHRIS ROWLEY** (*City University*) and **Dr PARESHA SINHA** (*The University of Waikato*)

This paper focuses on how MNCs and Indian IT services providers deal with the challenges of offshore outsourcing. On the one hand firms must continue to get better at exploiting their existing strengths and capabilities, on the other hand they must also continuously seek to explore new knowledge and learning to survive in the highly volatile, competitive, uncertain and agile business environment. There is now an increasing body of research on organisational ambidexterity that suggests that firms that are able to simultaneously engage in the processes of exploitation of existing knowledge and routines as well as explore and experiment with new ideas to generate new knowledge are better placed to design and deliver innovative products and services as well as maintain or enhance their competitive position. While firms engage in several forms to achieve ambidextrous learning, the literature suggests two key designs: structural and contextual

ambidexterity. While the former focuses on physical separation of exploitative and explorative learning activities, the latter assumes simultaneity is achievable through behavioural designs wherein employees are given the choice and freedom to apportion their time in a way that supports the creation of an ambidextrous context. Although several mechanisms are identified in each design, there is little understanding of how this occurs in the context of offshore outsourcing, particularly in the case of India's high-technology service firms. Research is sparse on the role of HRM practices in creating an ambidextrous context. Employing a qualitative case study design, this paper presents evidence from India's IT-BPO sector wherein a three-tier human resource management architecture comprising of: (a) senior management team, a differentiated operations structure; (b) strong leadership and information sharing; and (c), strong quality and market-based organisational learning capabilities facilitate an ambidextrous context. Implications for offshore –outsourcing theory and practice are also discussed.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Highly

08/09/2016 : 13:15 : Room-DS2.14

Code: OR58A1685

What are the Determinants and Consequences of Shared Service Centers? A Meta-Synthesis of Empirical Literature

Mr Philipp Richter and **Prof Rolf Brühl** (*ESCP Europe Business School*)

Shared service centers (SSC) are important and complex organizational models that occupy a central place in multinational companies' attention. Recognizing that previous studies produced rich albeit fragmented insights, we aim to synthesize these findings and develop a two-dimensional SSC model. In essence, this meta-synthesis extracts, analyzes and synthesizes qualitative case study findings to elucidate determinants that influence SSC outcomes and decisions. In line with economic, strategic, and socio-organizational theories, we capture findings as pairs of independent and dependent variables. Results show that a large number of independent variables, aggregated in 13 categories, affect 41 dependent variables of SSCs. Our findings contribute to understanding SSC effect relationships that supports the building of theories about SSC phenomena in future research.

What is the nature of your talk?: Theoretical

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Highly

08/09/2016 : 13:45 : Room-DS2.14

Code: OR58A1714

Towards a Methodology to Improve Supply Chain Performance through the Analysis of Outsourcing Production Processes: Application to Aeronautics Sector

Miss Denis Olmos Sanchez and **Prof Jean-Claude Bocquet** (*Laboratoire Genie Industriel, CentraleSupélec, Université Paris-Saclay*)

Aeronautics is the first export sector of the French economy which markets are growing with high demand, creating various issues such as economic, technological and social. Also, a specificity of this sector with low production rate and high safety level is that 80% of the value added is produced by the subcontractors and distributed at different levels. Therefore, in order to achieve a better operations performance, companies need to understand how to improve their supplier's performance. To do so, we propose a methodology that consists of three phases: 1: A systemic modelling of the Supply Chain is presented through the SCOS'M method (Systemic for Complex Organizational Systems Modelling), helped by MDM matrices (Multiple Domain Matrix), to ensure the achievement of the expected value creation. The sub-system "Production Outsourcing" is thus identified, in which the high priority indicator "Supplier On Time Delivery (SOTD)" is chosen to be improved thanks to a consensus by industrial experts. 2: To do so, we propose the following treatment of this indicator: first, we analyse the computation of SOTD to understand which variables and industrial parameters are involved, which helps us identifying Root Causes (RC) explaining the sources of bad performance of SOTD; we then categorize and quantify how RC impact the SOTD. Second, we study RC's consequences through Monte Carlo Simulation technique: the modelling used is defined (the inputs as RC impacts based on real

data of a company, and the output as the SOTD) and next, the simulation is performed by generating purchase orders. A sensitivity analysis is finally realized to sort RC's depending on the importance of their impact on the SOTD. 3: We finally design a decision support tool helping the implementation of an action plan relevant to priorities previously defined in 2 and reducing RC's impact to finally improve SOTD's performance.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Very

08/09/2016 : 14:15 : Room-DS1.02

Code: OR58A1815

Evolving Power Relations in Knowledge Transfer: Outsourcing High End IT Services from Sweden to India

Dr Dr. Sunrita Dhar-Bhattacharjee and **Dr Swetketu Patnaik** (*Anglia Ruskin University*)

India is the global choice for IT service offshoring, with a market share of 59 per cent (UN 2012). When the Indian markets were opened up to world trade in early 90's, investment in the software industry was encouraged. The government created a powerful incentive to concentrate on export by not taxing export profits (Dossani and Kenney 2007). Though the high tech sector accounts for only 0.2 per cent of employment (Friedman 2005), software and IT services make up an important part of the Indian economy and of the image of the new India. Sweden, on the other hand, has a long history of being open to the world; in 2010 it was ranked as the second most competitive country in the world next to Switzerland. Offshoring of ICT services has been a trend in Sweden since the last few years and nothing points towards a decrease, rather the contrary. Costs, market and competence, competitive pressure, increased speed to market and access to new markets are all important driving forces, (Hafstrom et al, 2010), though an increased emphasis on cost efficiency is the main incentive. In this paper, we aim to build on insights from resource dependency view (Hilman et al., 2009) to explore the evolving nature of the power relations between vendor and the vendee, particularly in the context of transfer of knowledge and ownership across (inter) organisational and national boundaries. We present emerging findings from a large research project involving 4 separate case studies involving ICT companies (2 small start-ups and 2 MNCs) in India and Sweden. As part of the broader research project, which was funded by the Swedish Research Council and Swedish Council for Working life and Social Research, we have interviewed approximately 200+ members

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Very

08/09/2016 : 14:15 : Room-DS2.14

Code: OR58A1660

The Paradox of Making the HR Outsourcing Decision

Dr Charmi Patel (*University of Edinburgh Business School*), **Prof Pawan Budhwar** (*Aston Business School*) and **Miss Alissa Witzemann** (*Swiss Re*)

Coupled with the constant need to seek opportunities which would facilitate an organisation's competitiveness, outsourcing of Human Resources (HRO) is being regarded as a potential contributing force in the process of improving HR's performance. Extensive literature explores the reasons as to why companies make the decision to outsource HR as well as the impact of 'transferring' employees who have been affected by this practice. Yet, this study contends that there exists a dire need for more research so as to adequately assess the way in which organisations make the decision to outsource HR. In this respect, the study attempts to expound upon the processes by which decisions to outsource HR are made, followed by the processes implemented once the decision has been made and its effects on the remaining in-house HR employees as well as assessing the effects on HR's strategic position. Using an ethnographic approach and twenty-five semi-structured interviews within a German subsidiary of a US MNC, we provide a framework of HR processes seeking to achieve standardisation in terms of harmonisation of HR activity across their subsidiary. Making the HR-outsourcing decision as part of the organisation's strategy in terms of focusing on global efficiency increases and simplification opportunities found additional importance in this study. Best results were achieved in so far as both the decision making/processes implemented subsequently concerned embedding

diversity and working cross-functionally with interdisciplinary teams. Perhaps representing some new contribution to the literature, effects of outsourcing on in-house HR showed a decrease in flexibility of the HR function, a slowdown in processing time of transactional HR as well as a decrease in satisfaction and work intensification for HR managers. Further results demonstrated that it remains questionable as to whether the function of human resources was able to enhance its strategic position through the outsourcing.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Highly

08/09/2016 : 14:45 : Room-DS1.02

Code: OR58A1632

Advertising Creativity: The Offshoring Phenomenon

Prof Pawan Budhwar (*Aston Business School*), **Dr Liza Howe-Walsh** (*University of Portsmouth*) and **Dr Sarah Turnbull** (*University of Portsmouth*)

Creativity is a valuable resource for organisations. Advertising creativity can greatly enhance the effectiveness of an advertising campaign, increase recall and purchase intention. Most multinational firms outsource their advertising creativity to advertising agencies and in some cases creativity is sourced outside the country. Outsourcing advertising creativity provides objectivity, access to expertise and creative talent and allows firms the flexibility to buy in specialist skills when needed. While the criteria used to choose an agency has been well documented, less is known about the reasons for offshoring creativity. Using Mental Model theory to understand the cognitive filters used by decision-makers, this study explores the phenomenon of offshoring creativity by firms in the United Arab Emirates, a developing economy. Using in-depth interviews with senior advertising practitioners the research examines why advertising creativity is offshored and explores how the choice of offshore location is determined. Findings are analysed using NVivo to provide a thematic analysis of the Mental Models used by industry professionals. These models guide how they interpret the offshoring phenomenon and how they manage the decision process in sourcing advertising creativity. The study contributes to the growing body of knowledge on the offshoring phenomenon and implications for the global and local creative industry are discussed.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Highly

Posters (Ac-Prac Sessions) MAI

Organiser: Maria Thorpe, DWP

06/09/2016 : 10:30 : Dennis Sciama Ground Floor – The Hub

The Academic-Practitioner bazaar provides a forum for academic-practitioner discussion through poster presentations highlighting the latest developments across the academic-practitioner interface.

The posters will be on display in The Hub throughout the conference, but particularly from **10:30-11:00** and **16:30-17:45** when presenters will provide a short 60 second introduction to their work to spark discussion and encourage interaction with all conference attendees.

This event will provide an opportunity for academics and practitioners to better understand how they can help one another to Make an Impact; discover work outside typical sources and discuss how research and business can thrive together.

In no particular order the Poster abstracts are as follows: -

Adjustable Robust Optimization and its Application - OR58A1927

Diah Chaerani, Stanley P Dewanto, Eman Lesmana, Ms Rufaida Nurnaini and Ms Putri Dwi Yuniar, (Universitas Padjadjaran)

The development on Robust Optimization (RO) grows fast, since 2004, a new approach of RO called Adjustable Robust Optimization (ARO) is introduced to handle uncertain problems when the decision variables must be decided as a "wait and see" decision variables. Different with the classic Robust Optimization (RO) that models decision variables as "here and now". In ARO, the uncertain problems can be considered as a multistage decision problem, thus decision variables involved are now become the wait and see decision variables. In this paper we present applications of ARO on Spatial Optimization Problem for Water Supply Allocation, Water Distribution Problem and Transportation Problem with Discount Factor. We present briefly all results to strengthen the importance of RO and ARO in many real life problems.

Developments in Decision Support - OR58A1924

Mr Paul Glover, Dstl

At a time of austerity, value for money is a key concern when designing decision support that delivers the impact that our customers require. This stimulates innovative approaches that can supplant or enhance current practice. This poster describes the methodological strands my project is working with.

In order to deliver I need to understand:

- The evolving contextual requirement
- What is technically achievable
- The complex systems options space where the 'art of the possible' meets the evolving military need
- The key research strands include:
 - Developing advice for analysis
 - Exploiting data sciences to develop understanding
 - Analysing decision options given deep contextual uncertainty through applying complexity science to identify choices that are both resilient and agile
 - The role of exploration through gaming and analysis
 - Developing effects based rather than activities driven simulation, built on mission planning algorithms, within a framework for efficiency

The Virtual Engineer - OR58A1923

Dr Djamila Ouelhadj and Prof David Brown, (University of Portsmouth)

In the dairy industry, high-product volume and high machine efficiency are of paramount importance and most bottle filling machines operate 24/7. There is little spare capacity, so unscheduled maintenance and failures must be avoided as they can create a logistical and financial nightmare. The consortium expanded upon a previous KTP to develop a Condition Based Predictive Maintenance (CBPM) strategy that includes monitoring vibration levels in real-time so failures can be predicted, and engineers actions and schedules can be optimized

Random CWS for IRP - OR58A1922

Miss Chanicha Moryadee, (University of Portsmouth)

In this paper we study the Inventory Routing Problem (IRP) with stochastic demand that deals with direct deliveries from the supplier with and without transshipments (Inventory Routing Problem with Transshipment, IRPT) between customers in conjunction with multi-customer routes in order to increase the flexibility of the system. The work is structured around two main models: development of optimisation models for IRPT and IRP with stochastic demand, and heuristic and sim-heuristics approaches to solve the problem. Specifically, randomised Clark and Wright Saving algorithm and simulation are combined to solve stochastic IRPT and IRP problems, respectively.

The DRSA to Improve Intelligence Data Processing - OR58A1905

Mr Tom Baldwin, Mr John Shimmell, Mr Sam Andrews, Mr Edward Davies, Mr Mark Malinowski and Mrs Tina Marklew, (Polaris Consulting Limited), Dr Salem Chakhar and Dr Djamila Ouelhadj, (University of Portsmouth)

Processing intelligence data is a crucial task in which analysts are overwhelmed by the quantity of information that they continuously receive from different sources and with different formats. An innovative system to process military intelligence data is proposed here. The core of this system relies on the Dominance Rough Set Approach (DRSA) which permits to capture the intelligence experience and extract if-then rules that can be used to prioritise existing and incoming data. To validate the proposed system, we conducted an experiment involving different intelligence analysts. Participants in this experiment were organized into two groups; one using the DRSA to classify intelligence reports and another without the DRSA. The results show that the DRSA significantly improves the analyst's ability to extract critical intelligence, greatly enhancing situational awareness.

MRO Supply Chain - KTP Impact Poster - OR58A1904

Mr Goutham Adithya Veerakumar, (University of Portsmouth)

In Sep 2015, Innovate UK awarded a knowledge transfer grant of £87K for Entec Global Group and the University of Portsmouth in support of our big data (MRO supply chain opportunity) project, that develops a unique multi-level MRO supply chain network. The partnership is established along with major clients and suppliers, to conduct the data mining project requiring access to significant usage, procurement, inventory, demand, asset life-cycle and production data. The analysis of which inform a proposal to reorganise MRO inventory within complex global markets. Entec now has increasing access to usage and inventory data across multiple clients and recognised strategic opportunity to go beyond single client inventory rationalisation and multi-echelon inventory system. This project enabled Entec to continually evolve and meet strategic objectives, delivering innovative MRO management solutions, the poster details how the company developed the required knowledge and capabilities relating to the implementation of data mining techniques to develop a robust value/risk through model, the knowledge transfer partnership (KTP).

Impact of Decisions in Military Operations - OR58A1903

Dr Nick Walmsley, (Dstl)

Command, Control, Computers and Communications Intelligence Surveillance and Reconnaissance (C4ISR) is the enabler that provides the intelligence to support the successful outcome of military campaigns. It encompasses the decision making process, including provision of information to commanders, as well as the underlying means to transfer information, including dissemination of decisions.

In the current economic climate where financial investment is subject to increasing scrutiny, it is important to demonstrate value, whatever Defence investment decision needs to be made. Historically, justification of investment in enablers such as C4ISR has been challenging to determine and quantify, due to the inherent tenuous link between such an enabler and campaign success.

This work explores a possible framework of alternative technical approaches to achieve a more robust evidence-based decision-making process to better inform future balance of investment decisions.

The poster describes C4ISR effects and metrics and seeks to establish a framework of methods to describe the link to campaign outcome in terms of their impact and assessment.

Robust Sim-Heuristic VRP with Stochastic Demand - OR58A1902

Mr Abdulwahab Alumutairi, Dr Djamila Ouelhadj and Prof Dylan Jones (*University of Portsmouth*) and **Dr Angel Juan Perez**, (*Open University of Catalonia*)

In this paper we consider the Vehicle Routing Problem with Stochastic Demand (VRPSD) in which customers demands are stochastic. We propose to model and solve the VRPSD by developing a robust optimisation model with a simulation-heuristic solution method that allow us to minimise the transportation cost while satisfying all demands in a given bounded uncertainty set. The simulation-heuristic algorithm combines Monte-Carlo Simulation with classical Clarke and Wright heuristic in order to efficiently solve the VRPSD combinatorial optimisation problem. Computational experiments have been conducted on benchmark problems from the literature. The results validate the efficiency of the robust optimisation model with the simulation -heuristic solution method in generating very good quality solutions compared to those in the literature.

Models, Heuristics, Evolutionary and Sim for PFSSP - OR58A1900

Mr Mohanad Al-Behadili, Dr Djamila Ouelhadj and Prof Dylan Jones (*University of Portsmouth*) and **Dr Angel Juan Perez**, (*Open University of Catalonia*)

A multi-objective optimisation model for the dynamic/stochastic permutation flow shop problem is proposed and examined. The model considers utility, stability, and other measures related to robustness. To solve the aforementioned model, we propose PSO, IG, biased randomized version of IG and sim-optimisation method. Our approaches are able to generate robust schedules in the presence of different real time events and, in fact, the methods have been evaluated under different types of disruptions, including: stochastic processing times, machine breakdowns, and new job arrivals. The results have shown that using the proposed model and solving methods give better results than a bi-objective model that considers utility and stability, as well a more classical model which only considers minimising the makespan.

Who Do You Think You Are? - OR58A1873

Dr Frances O'Brien, (*Warwick University Business School*)

When you talk to other people about what you do, how do you describe your role? Do you see yourself as an OR professional with a strong sense of professional identity? Perhaps you avoid using the term OR and use other words to describe your profession. The literature on professional identity suggests that an individual's identity is not static, but something that changes and develops as they progress through their career with the different roles that they undertake. Your choices and experiences influence your sense of professional identity and thus it is worth investing time into reflecting about them, particularly as you look to your future career. This poster will explore a number of factors that influence the identity of OR professionals and hopefully it will give you food for thought in reflecting about your own career and the choices you have made and have yet to make.

Risk Based ACO for ASV's - OR58A1871

Mr Samuel Andrews, (*Polaris Consulting Limited*) and **Dr Majid Eskandarpour** (*University of Portsmouth*)

Autonomous Surface Vehicle (ASV) systems are attracting growing attention among researchers due to an increasing military interest and a growing maturity of the technology. Effective path panning, along with collision avoidance maneuvers, are still in their infancy. Whilst they currently produce optimal results in

smaller search spaces, they become very time consuming when applied to larger problems. Outdated and inefficient routing algorithms could potentially jeopardise a mission due to their inability to handle complex situations as future applications must be able to cope with anything, from independent travel over large distances to avoiding obstacles, all within a reasonable computation time. This poster illustrates the implementation of the metaheuristic known as Ant Colony Optimisation and its successful navigation through a large search space representing the Portsmouth Solent. It describes an implementation within MATLAB, and how elements of risk have been incorporated whilst including the avoidance of dynamic and static obstacles.

How Can OR Help to Tackle Corruption? - OR58A1870

Mrs Susan Merchant, (*Blue Link Consulting/Jigsaw*)

In many countries, for OR to flourish and develop efficient and effective solutions to problems in business and government, corruption in those countries must first be greatly reduced. This is of course much easier said than done, but a first step might be to put some expert OR brains together to analyse the root causes of corruption and explore ways in which these might be tackled. IFORS' developing countries committee is thinking of arranging a problem structuring workshop at the ICORD immediately prior to the IFORS conference in Quebec in July 2017, and would like ideas on suitable methods for the workshop.

Flu Incidence: Seasonal and Multiannual Variations - OR58A1773

Dr Borislav D Dimitrov, (*University of Southampton*), **Dr Boryana Ts Bogdanova** and **Prof Ivan Ivanov**, (*Sofia University "St. Kliment Ohridski"*)

Seasonal and multiannual (multicomponent) patterns in flu (influenza) incidence variations were found earlier (e.g., cycles of 1, 2-3, 5-6 and 11 years). We aimed at modelling cyclicity and obtaining best non-linear estimates for flu incidence in Azerbaijan, 1976-2000 (Grand Baku, 300 months) and USA, 1993-2007 (South census region, 180 months) as being situated at similar north latitudes (at about 40°N). We used autocorrelation, periodogram regression (PRA), ARIMA and wavelet analyses (SPSS, SAS, MATLAB). We found seasonal (1 year) and multiannual cycles (periods $T = 2-3, 6-8$ and $12-14$ years). We confirmed complex cyclicity of flu incidence variations in both countries, including transyears and a "break"; we also provided robust estimates and hypothesised similarities with environmental factors of cyclical nature.

Understanding A to B: MOD's Logistics Modelling Capability - OR58A1765

Miss Laura Brudenell, (*Dstl*)

The UK Ministry of Defence (MOD) uses a considerable number of models and tools in order to assess its logistics capability. In order to provide clarity over the capability and availability of these models the Defence Science and Technology Laboratory (Dstl) created the Logistics Model Catalogue (LMC).

The LMC provides a source of information regarding the extant logistics models available to MOD that could support logistics research and procurement activities. This ranges from the modelling of the end-to-end medical support chain during deployment, to the resupply of naval platforms whilst at sea. The LMC contains details of models owned by the MOD, industry partners and aims to include specific international partners in the future. The catalogue contains detailed information on the capability of each model, giving details of which Defence Lines of Development are covered, the type of logistics considered and a point of contact for each model, should the modelling capability wish to be exploited and utilised and much more.

VRP for disaster relief logistics - OR58A1765

Mr Kiatkulchai Jitt-Aer, (*University of Portsmouth*)

The challenge in disaster response is to deliver the appropriate relief supplies to the right place, at the right time, with the right demand. In this research, we consider such shipment delivery problem in the tsunami-prone areas in Thailand, and the problem is formulated as a capacitated vehicle routing problem with deterministic demand. The aim of this model is to minimize travel time between the main distribution centre to the evacuee locations in Phuket where is a prime tourist area with numerous beach resorts, and was the most severely area affected by the 2004 Asian tsunami. To solve the proposed model, Clarke and Wright savings algorithm is developed to generate the computational results that are, in turn, transformed to geographical solutions.

PRESIDENT'S MEDAL PRESENTATIONS

07/09/2016 : 13:30 : Richmond Building, Lecture Theatre

The President's Medal is awarded for the best **practical application of O.R.** submitted to the competition (a wide definition of O.R. is used). Entries are accepted from both academics and industry-based O.R. workers and consultants. One of the main qualifications for entry is that the work has been implemented before submission.

Criteria for judging include:

- The level of demonstrable benefit
- The intellectual and novel content of the solution
- The likely longevity of the solution
- The excellence of the O.R. process

Conference delegates attending the President's Medal plenary session will have the opportunity to express their views as to their preferred candidate. The judges are required to take into account the views of the audience, but are free to arrive at their own decision. Ballot papers will be distributed at the start of the session.

Presentations

07/09/2016 : 13:30 : Richmond Building, Lecture Theatre

Leveraging OR Techniques for a Smarter Field Operations

Dr Gilbert Owusu, Dr Sid Shakya, Dr Anne Liret, Dr Raphael Dorne, Mr Ali McCormick and Dr Ahmed Mohamed, (BT PLC)

BT is continually investing in making the Digital Britain vision a reality by creating a faster, more flexible network and associated Internet services. To support this investment and large scale network infrastructure programmes, such as the Broadband UK, BT requires an efficient, responsive mobile field service operation. BT's 23K field engineers serve geographically dispersed and diverse customers including ISPs and end users. The deployment of our engineers has significant impact on delivering customer experience, travel and CO2 emissions. The question is how can we send the right engineer with the right skill to the right location to deliver the right service? Addressing this challenge will lead to (i) reduction in CO2 emissions, (ii) improve engineer utilisation, and (iii) customer experience through improvement in engineer productivity. To address the aforementioned challenges, BT Research exploited OR techniques such as simulation, resource planning and scheduling in developing two systems for (i) resource planning, and (ii) resource scheduling and allocation. These systems are in operational use have underpinned improvements in service delivery and operational efficiencies.

07/09/2016 : 14:00 : Richmond Building, Lecture Theatre

Optimising the Efficiency of the National Police Air Service through the application of Simulation Modelling Tools

Mrs Gail Ludlam (West Yorkshire Police)

The National Police Air Service (NPAS) was a ground breaking concept, the first truly national police collaboration. The 2010 Comprehensive Spending Review caused Police Forces to fundamentally re-examine their methods of delivering service. This, coincided with the development of NPAS as the single provider of police aviation. NPAS have been interested in using quantitative methods to identify how these savings can be achieved while still delivering the level of service required. NPAS commissioned a detailed and objective

simulation model to test the anticipated performance and the viability of alternative base numbers and locations.

The simulation model was built in Witness covering various aspects of providing air support, for example, selection of an appropriate aircraft to respond, time in maintenance, and flying time limitations. The model explored various options including changes to the number of bases and locations, the fleet mix, type of aircraft at each base, and base operating hours. The different options presented information on the indicative impact on time to respond to demand with a different amount and allocation of resources. This model has provided NPAS and the National Strategic Board with quantitative analysis to base their decisions on rather than purely relying on professional judgement. This analysis was essential in securing and maintaining the trust and confidence of the many stakeholders, which led to an agreed operating model with an approximate 14% saving. The model is still being utilised to consider the benefits of introducing a mixed fleet of aircraft as well as the potential to support other Government agencies.

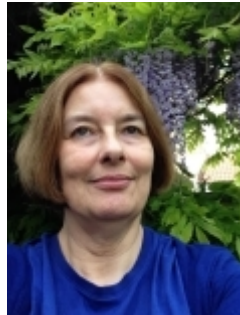
07/09/2016 : 14:30 : Richmond Building, Lecture Theatre

Providing the Evidence-base for the UK's P-8A Poseidon Aircraft Acquisition

Mr Andrew Robertson (*Dstl*)

As announced in the government's Strategic Defence and Security Review in 2015, the UK intends to acquire nine Boeing P-8A Poseidon Maritime Patrol Aircraft. This decision was comprehensively underpinned by analysis and operational research conducted by the Defence Science and Technology Laboratory (Dstl), and clearly demonstrated the worth of informed, objective evidence within a fast-paced, high-value programme. The OR touched on all aspects, from informing the requirements to assessing candidate options to determining areas of opportunity and risk. A mission-based approach was adopted, drawing on a blend of techniques, from judgmental methods to harder analysis via modelling, but with a watchword of simplicity throughout and an absolute focus on end-user needs. The pace of the programme required a high degree of interaction between the OR activity, and military and scientific Subject Matter Experts (SMEs); this allowed analysts and SMEs to quickly 'get on the same page' and meant a progressive understanding of the issues and implications could be imparted to the stakeholders. Whilst the individual techniques used may not get the pulses of OR theoreticians racing, the body of evidence generated proved central to the business case, and neatly encapsulates the value of real-world OR.

Problem Structuring



Organisers: Alberto Paucar-caceres, Christine Welch and Amanda Gregory

06/09/2016 : 11:00 : Room-DS1.10

Code: OR58A1681

KEYNOTE: Moving Beyond Value Conflicts: Systemic Problem Structuring in Action

Prof Gerald Midgley (*Centre for Systems Studies, Business School, University of Hull*)

Value conflicts can become entrenched in a destructive pattern of mutual stigmatization, which inhibits the emergence of new understandings of the situation and actions for improvement. In extreme cases, such patterns can even lead to violence. This paper offers a new systems theory of value conflict, which suggests the possibility of three different strategies for intervention using problem structuring methods (PSMs): supporting people in transcending overly narrow value judgements about what is important to them; seeking to widen people's boundaries of the issues that they consider relevant; and attempting to challenge stigmatization by building better mutual understanding. Each of these three strategies is illustrated with practical examples from operational research projects on natural resource management in New Zealand. These involved a dialogue on the use of genetically modified organisms in food production; preventing a potential conflict over the introduction of irrigation into a dry land farming area; a feasibility study for a new water storage dam; intervention to address a thirty year long conflict over water conservation measures between the Council of a small seaside town and its community; brokering dialogue in the face of a media-fuelled conflict over the transmission of food poisoning bacteria from dairy cattle to humans; and ending a twenty five year old conflict over competing water management priorities (environmental protection versus economic production). The PSMs used in these projects were Causal Loop Diagramming (from System Dynamics), Strategic Choice, Issues Mapping, Scenario Planning, Soft Systems Methodology, Qualitative Q-Sort and Community Evaluation Meetings. Further research is needed to look at how uses of other PSMs can be aligned with the systemic model of conflict. Also, reflection on this model might inform the design of entirely new PSMs.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Very

06/09/2016 : 12:00 : Room-DS1.10

Code: OR58A1630

Trends of Themes and Concepts of Management Sciences/ Operational Research Over the Last 40 years: Surveying the Top Six Journals

Prof Alberto Paucar-Caceres (*Manchester Metropolitan University*)

This paper presents a study of the development of Management Science/Operational research (MS/OR) using a text-mining tool for visualizing the structure of concepts and themes populating the field over the last 40 years. We mapped and analysed MS/OR concepts and abstracts in six top MS/OR Journals between 1980-2014. More than 20,000 abstracts published in: (1) European Journal of Operational Research (EJOR); (2) Interfaces; (3) Journal of operational Research Society (JORS); (4) Management Science; (5) Omega; and (6) Operations Research were mapped and key themes over the last 3 decades analysed using leximancer. Findings were contrasted with a theoretical framework containing three paradigms through which the

development MS/OR is described: (1) Positivist/Normative (1950-1970); (2) soft/interpretive (1980-); and (3) critical/pluralistic (1990-). We report on the initial findings of current MS/OR trends populating one of these paradigms. From an initial mapping of the 20,000 abstracts of the above six top MS/OR journals we identified and count the number of articles adhering, in general, to the paradigms. Results seem to indicate strong links between paradigms and the particular scope/editorial advocacy of each journal. US based journals show a strong bias towards a positivistic paradigm whereas UK and other European journals veer towards the interpretative and critical/pluralistic camp. Conclusions based on the links between editorial preferences and MS paradigms and the likelihood (or otherwise) of possible changes are discussed and point for further the research are proposed.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

06/09/2016 : 13:30 : Room-DS1.10

Code: OR58A1843

Aproximation to the Problem of Pathogenic Waste Management, in Hospitals. Combining both Hard and Soft Methodologies

Dr Alberto Paucar-Cáceres (*Manchester Metropolitan University*), **Ms Alejandra Castellini, Ms Daniel Alberto Pontelli** and **Dr José Luis Zanazzi** (*Universidad Nacional de Córdoba*)

In hospitals, pathogenic waste management constitutes a complex problem, because it is generally related to different participants and roles, different types of wastes, variety of criteria to make decisions and multiple resource constraints. Under these conditions, the solutions proposed from the technical point of view may fail, if they not consider the relevant social variables of the problem. Given this reality, the work proposes to apply a combination of methods. Soft System Methodology and Cognitive Mapping help us to understand the characteristics of the hospital, with relevant relationships and restrictions; also it contributes to identify the necessary changes, so that the technical solution works acceptably. Process Approach is applied in group, to review and improve technical solutions, involving the included personnel. Also, practices of group decision making are developed, to discuss issues of interest. To this end, the criteria to use in each decision-making process were elicited with Repertory Grid, through interviews with stakeholders. The studied case corresponds to a large public hospital, which generates a significant variety and quantity of such waste. The paper summarizes principal results of the application made. The conclusions highlight the convenience of studying these problems with a methodological approach that considers both technical and social aspects.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Very

06/09/2016 : 14:00 : Room-DS1.10

Code: OR58A1743

Citizen Science and Problem Structuring Methods

Dr Amanda Gregory (*University of Hull*)

The term Citizen Science suggests more than a form of science in which citizens are actively engaged; it also suggests a form of science that is undertaken in pursuit of citizen interests. As such, it may be argued that co-generative learning, involving a mutual learning and developmental process between citizens (with an 'inside' and micro frame of reference) and professionals (with an 'outside' and macro frame of reference), is essential. Through such a form of engagement, knowledge is generated which serves to address both citizens' practical concerns and professionals' concerns for the development of theory. It is not surprising, therefore, to find that most Citizen Science engagements are presented as 'win-win' and rhetoric is growing up around Citizen Science that relates it to civil society and good citizenship. In this paper, we look to get beyond the rhetoric to question the underlying ideology of Citizen Science. Such a process of critical questioning compels us to not only recognise alternative perspectives and values but also to create a space in which problem structuring methods may be used to good effect when a claim to Citizen Science is invoked.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little
Is your talk accessible and relevant to Practitioners?: Very

06/09/2016 : 14:30 : Room-DS1.10

Code: OR58A1790

A Multi-Methodological Systemic Framework for Reverse Logistics Urban Harvest Food: A Brazilian Case

Prof Alberto Paucar-Caceres (*Manchester Metropolitan University*), **Mrs Priscila Renata Barros Cardoso** (*Mechanical Engineering, Instituto Tecnológico de Aeronautica, Brazil*), **Mrs Toni Burrowes-Cromwell** (*Manchester Metropolitan University*) and **Prof Carmen Neyra Belderrain** (*ITA – Instituto Tecnológico de Aeronáutica, Bolsista CNPq - Brasil*)

This paper proposes a framework for structuring and improve the reverse logistics urban harvest operations of a Brazilian organization committed to combat the social problem of malnutrition. The framework advanced in this paper, contributes to multi-methodology practice in Operational Research. This paper proposes the use of Dialogue Mapping (DM), to capture and to connect participants unfolding conversations in mapping format. Dialogue Mapping can be used to support decision-making, highlighting key features and displaying the information obtained through interviews with stakeholders. The multi-methodological framework this paper advances harnesses DM into a modified version of Checkland's Soft System Methodology (SSM) developed by Georgiou (2015). Additionally, the framework features Strategic Options Development and Analysis (SODA) methodology as a tool to select the most relevant transformation detected during the SSM application, Georgiou (2012). Through the application of the proposed framework, we aim to highlight the role of OR methodologies in helping to improve the efficiency of social and humanitarian projects, in particular projects that seek to alleviate food waste and food distribution to combat great poverty and social associated problems in Brazil. We report on the application of the framework on the operations of a Brazilian NGO that aims to alleviate the food waste/distribution problems in an area of Brazil. We describe the current situation of the company and the stakeholders associated with its operations, we assess the alternatives and provide a systematic plan of action to improve the reverse logistics operations involved.

What is the nature of your talk?: A mix
Does your talk require prior knowledge of the subject area?: Some
Is your talk accessible and relevant to Practitioners?: Relevant

06/09/2016 : 15:30 : Room-DS1.10

Code: OR58A1855

Can Systems Thinking and 'Soft' OR Support SMEs Transition to Circular Economy and Sustainable Development?

Mrs Toni Burrowes-Cromwell (*Manchester Metropolitan University*), **Mrs Priscila Renata Barros Cardoso** (*ITA*), **Prof Mischel Carmen Neyra Belderrain** (*ITA*) and **Prof Alberto Paucar-Caceres** (*Manchester Metropolitan University*)

Designing out waste and decarbonizing business are among key action areas towards a UK Circular Economy (CE) and sustainable development. They are essentially 'learning by doing' principles, with the potential for innovative changes in business planning, processes and delivery. This paper investigates how the range of systemic methodologies developed from the field of management science/operational research (MS/OR) might enable adoption of these action principles. The paper is part of a project that aims to support business transition to Circular Economy among SME manufacturers in the UK. We aim to use systems thinking approach and Problem structuring methods (PSM) to enact the CE principles into SMEs process and practices. In particular, the paper reports on the use of the initial stages of SSM: Rich Picture; identifying the stakeholders; Root definition and CATWOE analysis to make sense of the challenges SMEs will face when trying to adhere to the CE principles; the aim of the project is to inform operational 're-design' of SME business processes. This is the first stage of a 'work in progress' project. In a second stage, we will explore systemic frameworks drawn from a range of PSMs to improve resource management and, to promote waste to resource approaches among a sample of Manchester/NW manufacturers. We aim to provide systemic skills and methodological guidance to: business leaders, staff teams, policy makers, environmental consultants and other specialists. Thus, this project will help in cascading wider awareness of CE activity that links SME manufacturing to Waste to Resource Business.

What is the nature of your talk?: A mix
Does your talk require prior knowledge of the subject area?: Some
Is your talk accessible and relevant to Practitioners?: Relevant

06/09/2016 : 16:00 : Room-DS1.10

Code: OR58A1662

Role of Problem Structuring Methods and Complexity Theories in Shaping Change Initiatives
Dr Richa Joshi and **Dr Amanda Gregory** (*University of Hull*)

We live in an age of organized complexity and problem structuring methods have informed the process of shaping complex real world problems for decision-making for more than four decades. Drawing on an evaluation of a change initiative in a pharmaceutical organisation in India, this paper proposes a multi-level approach to planning, implementing and managing change that employs complexity theories and problem structuring methods. Insights are provided on how the mental models and language of those involved in such initiatives needs to be sufficiently complex to capture and express different perspective of the change. It also proposes how these efforts need to be supported by a methodology that embraces complexity thinking to capture the multidimensional nature and multiple interactions at work in a complex system.

What is the nature of your talk?: A mix
Does your talk require prior knowledge of the subject area?: None
Is your talk accessible and relevant to Practitioners?: Relevant

06/09/2016 : 16:30 : Room-DS1.10

Code: OR58A1649

Landscaping Change – Looking through Flood’s Four Windows.

Dr Christine Welch (*University of Portsmouth*) and **Dr Tammi Sinha** (*University of Winchester*)

Change is endemic to organizational life. As philosopher Heraclitus pointed out ‘no man can step in the same river twice – for it is not the same river and he is not the same man’. Businesses grow in size, move into new markets, develop product portfolios or embrace technological advances; non-change is not an option if they are to remain sustainable. Many models have been devised that are designed to smooth the path of change for managers, but they often give a false impression that complexities of organizational life can be reduced and uncertainties diminished. Often, the emphasis is upon a top-down approach, driven by champions who need to gain ‘buy-in’ from other stakeholders. However, an organization can be seen as a dynamic, open system that subsists from one moment to another as an emergent property of the interactions of human beings who are its members. As such, its inherent complexities defy description and reductionist approaches to planned change very often fail. Organizational systems are bounded in space and time, but their boundaries cannot be treated as given. Change agents need to conduct critical examination of boundaries, to gain an appreciation of problems to be structured and interested actors whose perspectives will be significant in sustaining the organization’s relationship to its environment. Planning models should give place to holistic cycles of appreciation, in which stakeholder perspectives can be encouraged to emerge, contextually-dependent understandings can surface, and accommodations suitable to the horizons of change can be negotiated. It is suggested that Flood’s four windows may provide a helpful vehicle for appreciation, enabling actors to harness a range of collaborative tools and techniques to explore their landscapes of change. Illustrations will be provided from the work of a Community of Inquiry of improvement professionals that meets regularly in the local area.

What is the nature of your talk?: A mix
Does your talk require prior knowledge of the subject area?: A little
Is your talk accessible and relevant to Practitioners?: Relevant

07/09/2016 : 09:30 : Room-DS1.10

Code: OR58A1921

Developing an Analytical Approach to Business Modelling

Dr Giles Hindle (*University of Hull*) and **Prof Richard Vidgen** (*University of New South Wales*)

The notion of ‘business model’ has received increasing attention from both academic and practitioner communities dating from around 1995. It is emerging as a new unit of analysis, but unfortunately its systemic and organization-level nature has led the literature to become fragmented within disciplinary silos. The

current research seeks to address the following question: how can organizations expose, define, and possibly innovate or reinvent their business models? To pursue this agenda we have adopted an action research framework with a range of private, public and third sector organisations. The approach we have developed is novel, drawing on Osterwalder and Pigneur's business model canvas in combination with soft systems methodology. The presentation will outline the application of this approach in two case studies.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Highly

08/09/2016 : 09:00 : Room-DS1.10

Code: OR58A1810

Dissent: Let's Agree to Disagree

Mr Fred Cameron (*OpAnalytics.ca*), **Dr Jeffrey Appleget** (*Naval Postgraduate School*) and **Dr Geoffrey Pond** (*Royal Military College of Canada*)

A common belief is that once all the facts are on the table, complete agreement within a group will rapidly ensue. Similarly there is a view that only facts should count, and opinions should be rejected as not credible or without value. Once the participants are aware of all of these facts, there might be no need for problem structuring methods at all. But knowing that this is rarely so, we must anticipate facts may be missing, and further that many facts may have to be replaced by opinions -- such facts may be unknowable. Then, once we are in the realm of opinion, humans being human, unanimity may seem a fruitless objective. Step 1 is to acknowledge dissent where it lurks. Beyond this we should be ready to deal with dissent in a problem structuring context. Don't despair! A former president of the OR Society walked this ground before us. Sir Maurice Kendall, developed in 1939 (with Bernard Babington Smith) a coefficient of concordance -- a statistical measure to test if there is a "communality of judgments" (in Kendall's words). Even more valuable than Kendall's method was his willingness to consider how to proceed when we anticipate there will not be unanimity, or even consensus. In a problem structuring context, Kendall's measure of concordance and several other statistical techniques can determine the nature of agreement and disagreement between participants. This presentation will provide some methods for determining if dissent exceeds a reasonable threshold, whether dissenters may form minority schools of thought, and how a facilitator might deal with dissenters to improve the developing structure of a challenging problem.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Highly

08/09/2016 : 09:30 : Room-DS1.10

Code: OR58A1823

Conflict Analysis and Scenario Planning in a Military Operational Planning Setting

Mr Jan Frelin (*Swedish Defence Research Agency*)

The traditional approach for addressing uncertainty in military operational planning is to consider possible adversary options, usually the most dangerous and the most likely adversary course of action. In the described case, the planning team developed a conflict analysis of the situation at hand, and, based on this conflict analysis, developed four different scenarios describing possible future contexts. This approach allowed the planning team to test their courses of action against a wider scope of qualitatively different possible challenges

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Very

08/09/2016 : 12:00 : Room-DS1.10

Code: OR58A1667

The Application of Virtual Personal Assistants in Soft Operational Research

Mr Peter Imrie and Dr Peter Bednar (*University of Portsmouth*)

Intelligent personal assistants are becoming more and more commonplace on people's personal devices, such as smartphones and tablets. As this technology is developed further these systems could become potentially useful as a Problem Structuring Method (PSM) as a Virtual Personal Assistant (VPA). Intelligent systems with natural language processing capabilities have the ability to learn from interactions with their users and use this information to form relevant but varied responses. The user can discuss an ambiguous and ill-defined complex problem space with the system, to allow it to develop its own perspective of that problem space drawing upon its learning about the user's situation and preferences. With this information the VPA could propose different solutions of the problem based on its own perspective. With VPAs ability to vary their potential outputs, it is possible that different VPAs with the same information and the same problem space could build unique perspectives and potentially provide different solutions to the problem. These different solutions are then available for the user to make a "best guess" based upon their exploration of the problem space. Effectively, the VPA is used as an intelligent scenario builder for the user, helping to structure a particular problem space, taking into account its learning of contextual information. In principle, utilising VPAs in this way is akin to using multiple SATNAVs to plan a route. Some may propose the shortest distance, others the route less likely to have traffic and others proposing routes only suitable for certain vehicles, and so on. With multiple possible solutions available the user is able to make a decision based upon their perspective of what is best in context.

What is the nature of your talk?: Theoretical

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Relevant

08/09/2016 : 13:45 : Room-DS1.10

Code: OR58A1633

Using the Soft Systems Methodology as a Vehicle for Social Inquiry: Addressing a Lacuna of Method.

Dr Lynn Day (*Portsmouth Business School*)

The presentation relates to an example of social inquiry using SSM. The Soft Systems Methodology has been used in a huge variety of problem situations since its inception in the early 1980's. Its creator, Peter Checkland, proposed it as a Singerian system for inquiry providing a formal means to initiate and consciously reflect upon a social process of appreciation. SSM draws upon Vickers' notion of appreciation, i.e. judgements of value that give meaning to judgements of reality and therefore shape our perceptions of relationships. SSM is said to be idiopathic, i.e. focused upon interaction with, and learning about, a problematical situation, rather than proceeding from assumptions of what is already known. For researchers contemplating a social research project from an interpretive perspective, this is invaluable since it supports a process of embracing uncertainty and learning the way to what they want to know, without formulating clear objectives in advance. SSM is flexible in use, as investigators create their own, unique frameworks for inquiry. It can be used to structure an investigation, and/or to inquire into the content of the problematical situation. However, among critics of SSM are those who point to a lacuna of method. SSM provides robust guidelines for a process of inquiry, but it lacks guidelines on approaches to be used to elicit data from research participants. This gap (or flexibility) in the system for use of SSM requires each researcher to design the means to operationalise SSM in the context of a particular inquiry. A dilemma arises as to how to elicit a response without conveying the researchers' own appreciative settings, introducing bias. This presentation will discuss one example of design of a framework for practical inquiry into widening of participation in UK Higher Education. Design thinking and visualisation techniques adopted will be elaborated with illustrations.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

08/09/2016 : 14:15 : Room-Ds1.10

Code: Or58a1631

A Systems Thinking Approach to Improving Project Performance

Mr Paul Summers (*Southampton Solent University*)

This paper describes the approach taken in an UK unitary authority to improve project performance. The organisation commissioned projects across multiple disciplines e.g. transport schemes, constructions, change programmes, business improvements using IT and bridge replacements. The organisation was rated as poor at project management by the Audit Commission and the author became responsible for improving project performance. The approach taken involved canvassing and embracing multiple perspectives, understanding the 'appreciative settings' of stakeholders who often had competing goals. Ackoff's concept of dissolving problems has applied to this scenario. The author was in the role of pracademic acting as a boundary spanner so that theory and practice informed each other in a continuous spiral. A model incorporating three elements was introduced into the organisation based on Systems Thinking. the three elements were governance, learning and a Community of Practice. Over time project performance improved and delegates on the development programmes gained in confidence. The presentation has value for both academics and practitioners and shows how a Systems Thinking approach to problem solving can have a significant impact on organisational performance.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Relevant

08/09/2016 : 14:45 : Room-DS1.10

Code: OR58A1770

An Operational Action Research: Using Viable System Model for Problem Structuring and Complexity Management in the process of Knowledge Sharing

Miss Salimeh Pour Mohammad and **Dr Angela Espinosa** (*University of Hull*) and **Prof Richard Vidgen** (*University of New South Wales*)

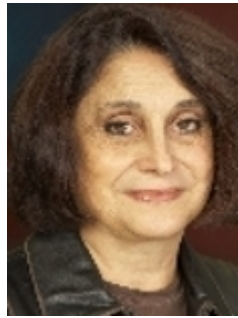
There is general agreement about Soft OR tools' advocative solutions for problem structuring and complexity management in organisation. However, the literature on using soft OR tools such as VSM to deal with complexity of knowledge sharing projects is very scarce. In addition, there is very little account of research in using VSM and social network analysis (SNA) to specifically design the knowledge sharing projects. This paper fills these gaps, presenting an exploratory action research where the authors facilitate a practice-led process of knowledge sharing in non-hierarchical and collaborative fashion with a pragmatic philosophical approach. We use Viable System Model (VSM) and Domains of Viable Knowledge (DVS) for variety management in a social network of knowledge. Implementing distinctive features of VSM, the intervention encourages participants to embark on engineering specific types of variety. We reflect on the distinctiveness of the methods used and their contributions to research in Soft OR and variety/complexity management for knowledge sharing projects.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Highly

Project Management



Organisers: Gary Bell, Rosane Pagano, Jonathan Warwick and Gary Bell

07/09/2016 : 09:30 : Room-DS2.01

Code: OR58A1629

Getting Value from Your Projects the Solent Way.

Mr Paul Summers (*Southampton Solent University*)

The Solent way is a ground breaking model for gaining value from projects designed and implemented in a Unitary Local Authority situate on The Solent. This presentation based on the research undertaken shows how a systemic model was tested in a Unitary Local Authority and produced significant improvement in project performance. The model comprised three elements, governance, learning and development and a community of practice. The principle underpinning this model was a focus on realising benefits from the projects rather than simply delivering a product. This approach is a departure from historical approaches involving tools, techniques and processes, so that project staff developed an understanding and mastery of the requirements enabling them to adapt as events occurred and thus still achieve the business results required. Following the implementation of the model project performance improved in the organisation so that projects were achieving a good return on investment and business results as expected. This improved performance has been sustained since the commencement of the work in 2008. The main contribution to knowledge of this research project is the results of applying into practice an approach based on the realisation of benefits. A secondary contribution is the impact upon staff behaviours of a development environment with an emphasis on mastery rather than training in the use of tools and techniques. The research potentially has implications for other organisations to improve the business results from their projects and this University for Knowledge Transfer activities.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Highly

07/09/2016 : 10:00 : Room-DS2.01

Code: OR58A1643

Learning Beyond the Golden Triangle: Key Drivers of the Lessons-Learned Process

Mrs Sue McClory (*University of Portsmouth*)

Projects can be defined in terms of output, outcome, or benefit, and can generally be considered a success if they achieve the objectives according to the specified criteria within an agreed timescale and budget. The Association for Project Management (APM) Body of Knowledge indicates that our traditional Golden Triangle factors of schedule, finance, and quality are joined by three other key process areas: scope, risk, and resource management. In addition the APM lists five high-level project success factors: defining clear goals and objectives, maintaining a focus on business value, implementing a proper governance structure, ensuring senior management commitment, and providing timely and clear communication. Also, the updated Competence Framework (2015) includes four core skills for project managers: team management, reviews, capability development, and benefits management. By drawing these themes together it is clear that a project can no longer be considered as a process of passing a plan to the manager, turning the handle and expecting the result to emerge from a production line. The complexity and uniqueness of individual projects requires a

focus on knowledge management and organisational learning in order to achieve project success. Therefore, we must place these outcomes within the project requirements and review the lessons-learned process – which although now central to a few large organisations, remains largely ignored. The present study reviews the recent development of the Learning Legacies, which are fundamental aspects of several major UK infrastructure projects, to create a proposed framework for project learning. Working across the three levels of individual, project, and organisation, the project learning framework combines the business case with benefits management and risk management to provide learning action plans as a key driver of the lessons-learned process.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Very

07/09/2016 : 11:00 : Room-DS2.01

Code: OR58A1925

KEYNOTE: Can Projects be Made Resilient?

Dr Mark Hall (*University of Birmingham*)

It is well known that projects of all sorts (large and small; public and private sector) are plagued by failures leading to cost and time overruns and, frequently, suboptimal quality and performance of the end product or service. A way of viewing project failure is to regard it as the realisation of risk and uncertainty. A concept that has emerged over the last few years is organizational resilience, which is seen by many academics and practitioners alike as a key approach that organizations should adopt if they wish to more effectively deal with emerging risk and uncertainty and recover more effectively in the aftermath of failure and disaster. Drawing on theory and exemplar organizations, the concept of resilience and reliability is explored and possible applications to project environments are discussed.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

07/09/2016 : 12:00 : Room-DS2.01

Code: OR58A1917

The Utility of Problem Structuring Approaches for the Management of Projects

Dr Gary Bell and **Prof Jon Warwick** (*London South Bank University*)

This paper explores the utility for Problem Structuring Approaches (PSA) for the Management of Projects (MoP). Organisations have to continuously adapt and create value in a dynamic business environment. Successful change can be manifested through the introduction of an innovation offering (e.g. new product), which meets the requirements of an organisation. The offered innovation can lead to the inception of a project. However, projects are associated with cost overruns, schedule slippage and poor quality. Further, symptoms are emerging such as - limited understanding of project impact. Hence, the emergence of MoP, which has three levels - namely, level 1 (the technical core), levels 2 (the strategic wrap) and level 3 (the institutional level), and are briefly outlined. MoP can be viewed as a dimension that has three distinctive levels of associative complexity and uncertainty. Morris asserts 'projects are built by people, for people, through people' – thus, the managing and development of a new product is a social process. PSAs can assist with the unfolding social process of shaping, defining and executing a successful project. Furthermore, we assert PSAs are important tools to assist project managers to become more effective. We highlight practical examples of the application of PSAs and link them to the appropriate MoP level in order to support our assertion. Moreover, PSAs can be combined with other soft methods or hard techniques, which have connectivity with multi-methodology. A multi-methodological framework for mapping interventions and methodology is identified, and we discuss its applicability to MoP. Finally, it is contended that there is a need for more practical examples which would further demonstrate PSAs effectiveness in realising successful projects and business change.

What is the nature of your talk?: Theoretical

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Very

08/09/2016 : 09:00 : Room-DS2.01

Code: OR58A1659

Flawed Project Definitions: How Your Projects Fail to Deliver Value

Mr Paul Summers (*Southampton Solent University*)

Projects have been defined as temporary undertakings to produce outputs or products to cost, time and quality for around 50 years. This definition has been largely unchallenged throughout this period despite widespread project failures. The few academics who challenge the definition are mainly ignored by practitioners and the project management associations. There are 50+ project management associations all with their own bodies of knowledge and certification routes. Additionally, the UK government for 30 years mandated PRINCE2 or its antecedents again with a certification route. Despite there being worldwide around one million people certified in project management, projects continue to fail to deliver real value to the business. This paper suggests that current definitions of projects are epistemologically flawed, so that actions which flow from this flaw lead to errors. The whole project management discipline is predicated upon this flawed definition leading to methodologies which must fail. Our understanding of the reasons for project failure must also be re-examined as these are also epistemologically flawed flowing as they do from the definition of outputs to cost and time. A number of authors such as Dalcher, Turner, Morris, Winter, Anderson amongst others have urged us to rethink, reinvent or reconstruct project management. However, this paper suggests we need to redefine projects to include the totality of a project purpose - to create value for the business, and move away from the current narrow boundary imposed by project definitions which simply produce an output. The sole measure of project success should be the business results not six measures which are superfluous to the true purpose of a project. There are implications for future research looking at projects from the perspective of the business and how a new definition will produce better project performances.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Relevant

08/09/2016 : 09:30 : Room-DS2.01

Code: OR58A1695

Critical Chain Project Management: An Abductive View

Prof Victoria Mabin and Dr Maryam Mirzaei (*Victoria University of Wellington (VUW)*)

Critical Chain Project Management (CCPM) has been a controversial topic with extreme opinions on its merits. While there are many reports of dramatic improvements in many project contexts, there have also been claims that it does not apply to all projects. This paper sets out to articulate where and why CCPM is applicable by carefully examining its assumptions and reconstructing its underpinning model of reality. Such examination required an in-depth analysis of both the theoretical assumptions of CCPM and the empirical reality of projects. This research used an abductive process adopting an iterative learning loop between theory and practice. Theoretical data was drawn from analysis of a comprehensive database comprising 600 scholarly publications on CCPM. Empirical data was obtained from a total of 10 projects from a diverse range of industries using semi-structured interviews and project documents. CCPM literature describes a project's goal as predefined output with fixed value. Not all projects conformed to this characteristic and some projects were found to be constrained by various aspects of scope formulation. The CCPM solution also requires agreed priorities for the project and elimination of deterministic start dates. These imply unity of purpose and a global definition of efficiency. CCPM portrays project work as a baton passing sequentially between project actors. While this was observable in some projects, in others a dedicated team shared carrying the baton throughout the project. When a project is executed by a non-dedicated team, the constraint is the longest chain of dependent activities. However, in a dedicated team, the system 'is' the team and therefore its weakest link is the most constrained resource. CCPM literature also implies a high level of urgency which was not observed in all case projects. These characteristics can guide practitioners both in choosing and/or tailoring CCPM for their particular projects.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Very

08/09/2016 : 11:30 : Room-DS2.01

Code: OR58A1727

A DST-based Approach for Construction Project Appraisal

Dr Abdulmaten Taroun (*The University of Worcester*)

Project appraisal is essential for composing project portfolio, comparing different procurement options or examining the feasibility of a project before bidding. Despite its wide range of applications, Dempster-Shafer Theory of Evidence (DST) has not been used for construction project appraisal yet. This paper presents a DST-based approach for construction project appraisal where project attributes are grouped under two main categories; risks and benefits. Decision criteria are grouped under two main categories: benefits and risks. Monetary equivalents are used for assessing the performance of alternative actions against the specified benefit and risk criteria. Rather than providing single figures, decision makers can provide their assessment in distributed formats through expressing their degrees of belief in predefined assessment grades. This unique assessment method yields realistic assessments based on the available amount of information making it a very effective way of accounting for ignorance (lack of information). Overall risk and benefit levels are obtained by aggregating individual assessments. The evidential reasoning (ER) algorithm is deployed as an aggregation mechanism instead of the averaging procedure which might not be applicable/suitable in all cases. Finally, the "overall" risk and benefit levels are utilised to develop a preference score that can be used for comparing different projects and ranking them from the most to the least favourable. A decision support system was devised to facilitate the proposed approach. Four validation case studies were conducted to examine the viability of the proposed approach. Senior managers in different British construction companies tested the tool and found it useful, helpful and easy to use. The paper concludes that the DST has a great potential for facilitating project appraisal and can offer a viable alternative to existing tools; investigating its qualities may enrich the literature of construction project appraisal and decision making.

What is the nature of your talk?: Very practical

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Very

08/09/2016 : 12:00 : Room-DS2.01

Code: OR58A1785

Management of Projects in the Creative Industries: Problem Structuring Methods in Play Directing Projects

Dr Rosane Pagano and **Dr Garry Blair** (*Manchester Metropolitan University*)

The development of Project Management (PM) as a distinctive discipline in its own right implies transferability and applicability of a body of knowledge to a wide range of situations, that is, to projects quite varied in nature and embedded in different contexts. Yet, the literature is very scarce with regards to reporting project experience and lessons learned in the context of the so-called creative industries. Managing projects in this area appears to be implicit knowledge 'locked' inside the 'artist' mind and bundled with the creative process. In this paper we apply the lenses of the project management discipline to a play directing project, with the view of eliciting the PM body of knowledge and competences involved in this process. In so doing, we also advocate the suitability and value of problem structuring methods (PSMs) to projects of this nature. PSMs can assist argumentation between director, as the project manager, and the actors. A method such as collaboration analysis – a 'softer' transformation of game theory – can, with its notions of 'character', 'position' and 'fall-back', facilitate mutual understanding of multiple perspectives on a stage situation. It supports the enactment of six recognised types of dilemma and potential resolution. In as much as there is often no single uncontested representation of what will constitute the outcome of a creative-industry project – the creation – it is appropriate to consider PSMs to assist in the characters' negotiation of this outcome. Mapping PM constructs onto the elements of play directing opens a number of possibilities to practitioners. The creative-industry case discussed in this paper contributes to enrich project management education. It makes explicit a context where PM discipline can be applied, and which seems to be off the main stream PM literature.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

Renewable Energy and Sustainability



Organisers: Dylan Jones and Afzal Siddiqui

08/09/2016 : 09:00 : Room-DS2.07

Code: OR58A1797

Examining the Benefits of Load Shedding Strategies using a Stochastic Mixed Complementarity Equilibrium Model

Dr Mel Devine and **Prof Valentin Bertsch** (*Economic and Social Research Institute*)

Many governments have adopted policies that are increasing the amount of electricity generated from renewable sources. To accommodate this, electricity markets need to become flexible in order to deal with the intermittency of renewable energy. Load shedding, where electricity consumers' load is reduced at times of high demand, is one mechanism to achieve this flexibility. Traditionally, priority based strategies have been used, whereby the system operator chooses the consumers that must shed their load. However, ongoing technological developments are providing the basis for smarter load shedding strategies, enabling more efficient load shedding. In this work, we examine the costs and strategies associated with such mechanisms by modelling an electricity market with significant load shedding ability. We undertake a game theory approach to model a competitive market with conventional generators and different types of consumers. Some consumers provide flexibility to the market through load shedding only while others additionally have the ability to generate their own electricity. Each player has their own constrained optimisation problems. The different optimisations are solved simultaneously and in equilibrium using a stochastic mixed complementarity problem. As load shedding is of greatest significance in times when demand is high and supply is low, we initially assume one of the conventional generators is unavailable for generation and the time when it will return online is the model's main source of uncertainty. We find that a non-priority based strategy leads to reduced consumer costs and that allowing consumers to provide generation to the whole market results in minimal benefits. In addition, the presence of market power was found to increase costs to consumers. Finally, we also study the optimal amount of foresight that should be given to players modelled in such electricity markets and how this is affected by the uncertain outage time of a generator.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Very

08/09/2016 : 09:30 : Room-DS2.07

Code: OR58A1828

Dynamic Maintenance Scheduling and Routing Framework for Offshore Wind Farms

Mr Chandra Irawan, **Prof Dylan Jones** and **Dr Djamila Ouelhadj** (*University of Portsmouth*), **Mr Iver Bakken Sperstad** (*SINTEF Energy Research*) and **Mr Magnus Stålhane** (*Norwegian University of Science and Technology*)

An optimisation model framework for dynamic maintenance scheduling and routing at offshore wind farms is proposed. The framework combines maintenance scheduling and routing models. The maintenance scheduling model finds the optimal schedule for maintaining the turbines, and the routing model determines the optimal routes for the crew transfer vessels to service the turbines along with the number of technicians required for each vessel. The maintenance scheduling model is aimed for a medium term horizon (30 days)

and determines the turbines that need to be maintained for each day. This model only considers the turbines that need preventive maintenance. The routing model aims to solve one-day maintenance and routing problem for both preventive and corrective maintenance. The model determines the best route for vessels to service/visit the turbines that need preventive maintenance, which is determined by the previous model, and the turbines that need corrective maintenance due to failure. Mathematical models using mixed integer linear programming (MILP) are developed for both models (for scheduling and routing problems), which are solved using an exact method on CPLEX.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

08/09/2016 : 11:30 : Room-DS2.07

Code: OR58A1763

Probabilistic Risk Modelling for Electricity Security of Supply Analysis

Dr Chris Dent (*Durham University*)

A reliable supply of electric power is vital to the functioning of a modern economy and society. This is reflected in the dominant position in public and industrial policy debates of security of supply within the so-called energy "trilemma" (also including affordability and sustainability). This presentation will describe models which are used to assess whole-system electricity security of supply risk, including how the principal components of conventional generation, renewable generation, interconnection and demand are represented. Recent research on underpinning statistical modelling (key issues being joint modelling of wind and demand as an input to the risk calculations), and appropriate risk metrics and decision approaches for decisions on generation resource procurement, will be reported. Finally additional key areas for research will be discussed, including consideration of modelling uncertainty in decision processes, and representation of interconnection to other systems.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Very

08/09/2016 : 12:00 : Room-DS2.07

Code: OR58A1780

A Goal Programming Model for the Renewable Energy Mix Problem with Specific and Generic Storage

Dr Dylan Jones and **Dr Graham Wall** (*University of Portsmouth*)

This seminar presents a goal programming model for determination of the optimal mix of energy from a number of renewable sources and a conventional source. The model works on a 120 hour planning period in which the weather conditions and predicted energy demand can be estimated. The predicted maximum energy production of each of the renewable sources is also estimated. The model assumes the availability of a limited amount of source specific and generic storage is available. Goals relating to minimising energy shortfall, maximising renewable source usage, and avoiding over production are considered. Different weighting schemes, levels of capacity and the trade-off between goals in the model are considered. Conclusions are drawn with respect to future renewable energy storage practice.

What is the nature of your talk?: Theoretical

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Somewhat

08/09/2016 : 13:45 : Room-DS2.07

Code: OR58A1735

Sequential Investment in Emerging Technologies under Policy Uncertainty

Dr Michail Chronopoulos (*University of Brighton*) and **Mr Lars Sendstad** (*Norwegian School of Economics*)

Investment in emerging technologies is particularly challenging, since, apart from uncertainty in revenue streams, firms must also take into account both policy uncertainty and the random arrival of innovations. We assume that the former is reflected in the sudden provision and retraction of a support scheme, which takes the form of a fixed premium on top of the output price. Thus, we develop an analytical framework for sequential investment in order to determine how price, technological, and policy uncertainty interact to affect the decision to invest sequentially in successively improved versions of an emerging technology. We show that greater likelihood of subsidy retraction lowers the incentive to invest, whereas greater likelihood of subsidy provision facilitates investment. However, embedded options to invest in improved technology versions raise the value of the investment opportunity, thereby mitigating the impact of subsidy retraction and making the impact of subsidy provision more pronounced. Additionally, by allowing for sequential policy interventions, we find that the impact of policy uncertainty becomes less pronounced as the number of policy interventions increases.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

08/09/2016 : 14:15 : Room-DS2.07

Code: OR58A1718

Strategic Issues for Marine Renewable Energy in the English Channel Region: An Overview of the Channel MOR Project

Dr Graham Wall (*University of Portsmouth*) and **Dr Michel Leseure** (*University of Chichester*)

Channel MOR (Marine Offshore Renewables) was a one year project, running from January 2014 to February 2015, 100% financed by the European Regional Development Fund (ERDF Interreg IVa France-Channel-England Programme). It was delivered by 12 French and English partners (including the University of Portsmouth and University of Chichester) and was aimed to ensure the economic growth of marine renewable energy (offshore wind, wave and tidal) both sides of the Channel and to support businesses, with emphasis on SMEs, in engaging and collaborating with this sector. The presentation will give an overview of the scope and content of the project along with its key outputs and recommendations. The work includes a strategic factor mapping exercise using AHP as a diagnostic tool of the regions in the Channel area in order to see how prepared they were to capitalise on the economic opportunities available.

What is the nature of your talk?: Very practical

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Highly

08/09/2016 : 14:45 : Room-DS2.07

Code: OR58A1651

KEYNOTE: Keeping Options Open When Only One Can Be a Winner: When to Continue or Abandon Projects in an R&D Portfolio

Prof Daniel Ralph (*University of Cambridge*) and **Dr Rutger-Jan Lange** (*Erasmus University Rotterdam*)

Given several, costly R&D projects that aim for the same goal (eg, low carbon electricity generation), when should be any be abandoned to eventually pick a single winner? We study parallel competing projects where the performance of each project is governed by a general Ito process, while opportunities to drop underperforming options (or select the winner) follow a Poisson process. We are interested in a policy that optimises the average outcome so that at each decision opportunity, the decision maker can decide to either continue all current projects or abandon any particular project whose continuation cost outweighs its potential value added. We provide a new, constructive, method whereby the option value can be found as (the limit of) an increasing sequence of lower bounds. The multidimensional option theory developed here underlies many complex real-world stopping decisions that are often solved sub-optimally.

What is the nature of your talk?: Theoretical

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Somewhat

Risk Crisis & Resilience Management



Organiser: Sara Thorne

**PLEASE NOTE THAT THIS STREAM HAS MERGED WITH
OR Modelling for Humanitarian Operations Management (HOM) Stream**

Scheduled talks on Thursday 8 Sept 2016

Simulation



Organisers: Angel Juan, Stewart Robinson and Christine Currie

06/09/2016 : 11:00 : Room-DS1.07

Code: OR58A1592

KEYNOTE: Simheuristics: A Method of First Resort for Solving Real-Life Combinatorial Optimization Problems

Dr Angel Juan, Dr Manuel Chica, Dr Jesica De Armas and Dr W. David Kelton (*University of Cincinnati*)

A number of decision-making processes in real-life transportation, logistics, or production applications can be modeled as NP-hard combinatorial optimization problems (COPs). These real-life COPs are frequently characterized by their large-scale sizes and the need for obtaining high-quality solutions in short computing times. This imposes some severe limitations on the use of exact methods, and alternatives such as metaheuristics are required instead. Still, metaheuristics usually assume deterministic inputs and constraints. This is a strong assumption which is not usually in accordance with modern systems, typically characterized by high levels of dynamism and uncertainty. By combining simulation techniques with metaheuristics, simheuristic algorithms allow coping with real-life uncertainty in a natural way. Simheuristics also facilitate the introduction of variability analysis during the evaluation of alternative solutions to stochastic COPs and, in this sense, they constitute a 'method of first resort'.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Very

06/09/2016 : 11:30 : Room-DS1.07

Code: OR58A1598

Proposing Self Adaptive Discrete Event Simulation (SADES)

Dr Kathy Kotiadis (*University of Kent*)

Systems that benefit from the ongoing use of simulation, often require considerable input by the modeller(s) to update and maintain the models. This presentation will consider automating the evolution of the modelling process for discrete event simulation (DES) and therefore limiting the majority of the human modeller's input to the development of the model. This mode of practice could be named Self-Adaptive Discrete Event Simulation (SADES). The research is driven from ideas emerging from simulation model reuse, automations in the modelling process, real time simulation, dynamic data driven application systems, autonomic computing and self-adaptive software systems. The talk explores some of the areas that could inform the development of SADES and will propose a modified version of the MAPE-K feedback control loop as a potential process. The expected outcome from developing SADES would be a simulation environment that is self-managing and more responsive to the analytical needs of real systems

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Very

06/09/2016 : 12:00 : Room-DS1.07

Code: OR58A1617

How to Implement Collaborative Tour Planning in a Data-Driven Simulation Model

Ms Astrid Klueter and **Prof Markus Rabe** (*Technical University Dortmund*)

Road transport in Europe is undergoing a fundamental change. The overall transport volume is expected to continue to increase. It is a major challenge to manage this traffic, since the space to develop road networks is often limited or nonexistent. Given these ongoing developments, the decisions and activities of logistics specialists result in a great social responsibility. The logistics must adapt to change, to ensure a durable economic competitiveness and to optimize its processes under the given conditions. Collaborations represent an excellent concept for managing challenges of city logistics and their impact on both the environment and the road networks. A promising and innovative research topic in the field of collaboration tries to effectively link the distribution logistics of several companies. The special issue here is that these companies are not partners of a supply chain (SC), but they compete with each other in the final stage of different SCs. Since this so-called horizontal collaboration is a relatively new concept in research, we try to show its benefits with the aid of discrete-event simulation. Through the collaboration, the number of operating vehicles, the number of required drivers, and the total covered distance can be reduced. We present an approach to model collaborative tour planning in a data-driven supply chain simulation model by using the well-known savings algorithm for both collection of the goods and urban delivery.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Very

06/09/2016 : 14:00 : Room-DS1.07

Code: OR58A1597

Facilitation in the Post-Model Coding Stages

Dr Kathy Kotiadis (*University of Kent*) and **Dr Antuela A Tako** (*Loughborough University*)

Research on facilitation in discrete event simulation (DES) is gathering pace with most of the research focused on facilitation in the initial stages of the simulation modelling process. In this presentation we focus on the postmodel coding stages of facilitated DES modelling, which are experimentation and implementation. We will first describe the process followed and then introduce tools that can be used during these stages to support workshop activities. We use a real case study to describe the sequence of the interactions undertaken in the workshops. Extracts from the transcripts are also used to explain the stakeholders' involvement and their mood during the workshop. Lastly, we conclude with a discussion on the implications of undertaking a facilitated DES approach.

What is the nature of your talk?: Very practical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Highly

06/09/2016 : 14:30 : Room-DS1.07

Code: OR58A1607

Facilitated-Mode Model Coding in Simulation Projects using the FaRe Approach

Dr Nathan Proudlove (*University of Manchester*), **Dr Stephan Onggo** (*Lancaster University*), **Dr Nathan Proudlove** (*University of Manchester*), **Dr Stefania Bisogno**, **Dr Armando Calabrese** and **Prof Nathan Levialdi Ghiron** (*University of Rome "Tor Vergata"*)

A general problem for operational researchers is convincing stakeholders to implement the recommendations produced by our models. The literature highlights that this is a particularly notable problem in simulation projects in healthcare in the UK. One widely-acknowledged barrier is stakeholder engagement, with facilitated modes of modelling advanced as a remedy. Therefore researchers have been pursuing fully-facilitated modelling, i.e. involving the stakeholders in all phases of modelling. In discrete-event simulation (DES) the 'model coding' phase (building and open-box validation of the computer model) is a particular challenge, since converting conceptual models to working computer models is a time-consuming and technically-skilled task. We have been experimenting with using the Business Process Model and Notation (BPMN) standard for flow mapping and DES modelling in hospitals in Italy and the UK. We called this the

“FaRe” (facilitated and requisite) approach. Available through a number of free software packages, BPMN has many powerful features for this task. BPMN files can link with DES through standards such as BPSim or be imported into commercial DES software. Free software packages that incorporate both BPMN and BPSim and have commercial-level interfaces make it possible to pass through the model coding phase seamlessly. We will give an example of a successfully-facilitated Conceptual Modelling – Model Coding – Experimentation project in a fairly simple healthcare situation. However, BPMN was not designed for this type of process mapping, and BPSim (and import to commercial DES packages) have some limitations. Consequently we have encountered technical barriers to using this tool for more-complex flows, as frequently encountered in modelling of inpatient flows. These arise principally from conceptual limitations with BPMN. We conclude therefore with suggestions and research directions for developing BPMN and its interfacing with DES to make this potentially very powerful tool fit to enable fully-facilitated modelling in a wider range of problem situations.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Very

08/09/2016 : 09:00 : Room-DS1.07

Code: OR58A1841

Using Simulation Modelling to Maximise the Capacity of a Busy Metro System

Dr Felix Dux (*London Underground Limited*)

Metro systems comprise diverse subsystems, which range from track layout and signalling, through the power supply network to the management of crowding on platforms and in trains. The busier the metro, the tighter the coupling between these subsystems. London Rail & Underground is one of the busiest and most complex metro systems in the world, carrying 1.305 billion passenger journeys per year - a figure which is projected to grow by 60% by 2050, while pressure is increasing to reduce costs and emissions and to improve service reliability. Hence, there is a continuing incentive to find measures to improve capacity, ranging from optimisations to the existing service to major capital investments in new infrastructure and technology. Modelling is a crucial tool in evaluating these measures. The diversity of outputs, interventions and subsystems necessitates employing a range of modelling approaches. This paper sets out the central role played by detailed, high-fidelity, simulation models within this framework.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Very

08/09/2016 : 09:30 : Room-DS1.07

Code: OR58A1858

Using Simulation to Solve the Vehicle Ferry Revenue Management Problem

Dr Christine Currie, Dr Christopher Bayliss, Prof Julia Bennell, Dr Antonio Martinez-Sykora and Dr Mee-Chi So (*University of Southampton*)

We propose a simulation based optimisation approach to the vehicle ferry revenue management problem, where the aim is to maximize the revenue by varying the prices charged to different vehicle types. Each vehicle type occupies a different amount of deck space and will have a different willingness-to-pay associated with it. Arrival of customers into the booking system follows a random process and prices are assumed to vary during the selling season. The optimization problem can be solved using dynamic programming but the possible states in the selling season are the set of all feasible vehicle mixes that fit onto the ferry. This makes the problem intractable as the number of vehicle types increases. We propose a state space reduction, which uses a vehicle ferry loading simulator to map each vehicle mix to a remaining-space state. The loading simulator features a parameterised loading algorithm that can be optimised, or tuned to mimic expert loading personnel. Using the simulator reduces the state space of the dynamic program, enabling it to be solved rapidly. In this talk, we will present simulations of the selling season to validate the method.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Relevant

08/09/2016 : 11:30 : Room-DS1.07

Code: OR58A1638

A Multi-Objective Simulation-Optimisation Model for Robust Stochastic Scheduling in the Presence of Uncertainty

Mr Mohanad Al-Behadili (*University Portsmouth*)

In this paper, a multi-objective simulation-optimisation model for the stochastic permutation flow shop problem (SPFS) is proposed and examined. The model considers utility, stability, and other measures related to robustness. To solve the aforementioned model, we propose a solving method that hybridizes Monte Carlo simulation with a biased randomised version of the Iterated Greedy algorithm (BRIG). Our approach is able to generate robust schedules in the presence of uncertainty and, in fact, the method has been evaluated under different types of disruptions, including: stochastic processing times, machine breakdowns, and new job arrivals. The results have shown that using the proposed model and solving method gives better results than a bi-objective model that considers utility and stability, as well a more classical model which only considers minimising the makespan.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

08/09/2016 : 12:00 : Room-DS1.07

Code: OR58A1686

A Multi-objective Simulation-Optimisation Model for Robust Stochastic Scheduling in the Presence of Uncertainty

Mr Mohanad AL-Behadili (*University of Basra*), **Prof Dylan Jones** (*Portsmouth University*), **Dr Angel Juan** (*Open University of Catalonia*) and **Dr Djamila Ouelhadj** (*Portsmouth University*)

In this paper, a multi-objective simulation-optimisation model for the stochastic permutation flow shop problem is proposed and examined. The model considers utility, stability, and other measures related to robustness. To solve the aforementioned model, we propose a solving method that hybridizes Monte Carlo simulation with a biased randomised version of the Iterated Greedy algorithm. Our approach is able to generate robust schedules in the presence of uncertainty and, in fact, the method has been evaluated under different types of disruptions, including: stochastic processing times, machine breakdowns, and new job arrivals. The results have shown that using the proposed model and solving method gives better results than a bi-objective model that considers utility and stability, as well a more classical model which only considers minimising the makespan.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

08/09/2016 : 13:15 : Room-DS1.07

Code: OR58A1601

The Stochastic Portfolio Optimization Problem: a Formulation and a Hybrid Methodology

Dr Renatas Kizys (*Portsmouth Business School, University of Portsmouth*), **Miss Laura Calvet**, **Miss Jana Doering**, **Dr Angels Fito** and **Dr Angel Juan** (*Open University of Catalonia*)

The Portfolio Optimization Problem is a relevant and complex problem with a high number of real-life applications. It has been extensively studied in the last few decades. The classical version of this problem consists in designing a portfolio of assets (i.e., determining the assets to include and their weight) minimizing the risk for a given expected return. As the number of assets increases and additional constraints are considered, the problem becomes NP-hard. Consequently, approximate methods such as metaheuristics are required for solving large problem instances. Our work addresses a realistic version of the problem that accounts for stochastic uncertainty by modelling returns and covariances as random variables. We present a mathematical formulation and a solving methodology based on a simheuristic algorithm, which combines the variable neighbourhood search metaheuristic and Monte Carlo simulation. While the former searches for promising solutions, the latter assesses their performance. Computational experiments and statistical analyses are performed on adapted benchmark instances to illustrate the use of the proposed approach and to explore how the solutions change depending on factors such as the level of stochasticity and the minimum

required return. Results show that our approach provides solutions in short computing times, which allows real-time decision making.

What is the nature of your talk?: Very practical

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

08/09/2016 : 13:45 : Room-DS1.07

Code: OR58A1775

Test-Driven Simulation Modelling

Dr Stephan Onggo (*Lancaster University*)

The verification and validation of a simulation model is an important step in simulation modelling. One of the most recent approaches to the verification and validation of a simulation model is Test-Driven Simulation Modelling (TDSM). TDSM applies techniques from Test-Driven Development in software engineering to simulation modelling. The main principle in TDSM is that a test for a simulation model has to be specified before the simulation model is implemented. Hence, modellers are forced to think about how their model is going to be verified and validated, even before they begin to develop it. TDSM supports a view that V&V is not a step that is done after a model has been completely developed. Instead, TDSM explicitly embeds V&V in the iterations during a simulation modelling process. TDSM makes use of two unit test suites, verification suite and validation suite. Examples on how TDSM has been applied to verify and validate discrete-event simulation and agent-based simulation models will be given.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Very

08/09/2016 : 14:15 : Room-DS1.07

Code: OR58A1899

Reporting Guidelines for Simulation Models

Dr Christine Currie and **Dr Tom Monks** (*University of Southampton*)

Providing a good description of a simulation model is important to allow others carrying out follow up work to build upon what has gone before. In this talk we will discuss minimum reporting guidelines for simulation models that allow this transfer of knowledge to take place. While the focus will be on reporting of simulation models in academic literature, we anticipate the talk being of interest to non-academic users of simulation, where being able to build on previous work is arguably just as important. There has been previous work on setting reporting standards for optimization research and we will describe how this can be adapted to simulation, as well as the additional requirements for reporting simulation models.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Somewhat

08/09/2016 : 14:45 : Room-DS1.07

Code: OR58A1914

Siting a Geological Disposal Facility - A Comparison of Modelling Paradigms

Mr Matt Gilbert, Prof Simon French and **Prof Jim Smith** (*University of Warwick*)

Disposal of nuclear waste has become an increasing concern for the UK government over the past few decades. We present discrete event and system dynamics simulations modelling changes in public opinion for their previous failed geological disposal siting attempt in Cumbria between 2009 and 2013. We compare the two modelling paradigms with reference to our models for the Cumbrian siting process. In particular we provide suggestions for which modelling paradigm would be most useful exploring the effects of public deliberation structures under varying conditions. We also consider the benefits of using hybrid modelling for public deliberations.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Very

Sustainable Supply Chain



Organisers: Lampros Stergioulas and Masoud Fakhimi

06/09/2016 : 12:00 : Room-DS1.04

Code: OR58A1604

Time Series Price Dynamics of New and Remanufactured Products

Miss Supanan Phantratanamongkol, Dr Luc Muyldermans and Dr Gu Pang (*Newcastle University Business School*)

Extending the life-cycle of products has received increasing attention in the recent literature of closed-loop supply chains and reverse logistics. In this study, our aim is to empirically investigate price dynamics in terms of speed and timing of price erosion during a product life-cycle, and volatility and seasonality of time series. We collect prices for new and remanufactured smartphones and tables sold on eBay over a period of six months. We carry out the analysis by using SARIMA, ARIMA-GARCH, vector error correction models. Our results provide both original equipment manufacturers (OEMs) and remanufacturers a better understanding of attaining time series economic value from coexisted new and remanufactured products.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Very

06/09/2016 : 13:30 : Room-DS1.04

Code: OR58A1772

KEYNOTE: Exploring Opportunities for Circular Supply Chains Arising from Renewable Chemical Feedstocks

Dr Naoum Tsolakis, Dr Mukesh Kumar and Dr Jagjit Singh Srai (*University of Cambridge*)

The aim of this research is to provide an integrated framework for supporting the design of commercially viable supply chains (SCs) towards delivering value-added intermediates or end-products based on renewable chemical feedstocks. To that end, we first provide the inclusive hierarchical decision-making process that applies to all stakeholders involved in the design and management of circular SCs arising from renewable chemical feedstock platform technologies. We then propose a framework that captures SC configuration opportunities based on four essential pillars including: (i) renewable chemical feedstocks, (ii) production process technologies, (iii) markets, and (iv) value and viability. We conclude by identifying key elements that need to be considered for ensuring the viability of the defined circular supply networks.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Quite a lot

Is your talk accessible and relevant to Practitioners?: Relevant

06/09/2016 : 14:30 : Room-DS1.04

Code: OR58A1788

Lead Time Paradox in Closed Loop Supply Chains with Auto and Cross-correlated Demand and Return Processes

Prof Takamichi Hosoda (*Aoyama Gakuin University*) and **Prof Stephen Disney** (*Cardiff University*)

We investigate the dynamics of a closed loop supply chain with first order auto-regressive (AR(1)) demand and return processes. The remanufacturing process is subject to a random yield. It is shown that the "lead time paradox" emerges in many cases, and auto- and cross-correlation parameters can have significant impact on the paradox.

What is the nature of your talk?: Very theoretical

Does your talk require prior knowledge of the subject area?: Quite a lot

Is your talk accessible and relevant to Practitioners?: Somewhat

06/09/2016 : 15:30 : Room-DS1.04

Code: OR58A1803

TBL Modelling: Definition, Advantages and Challenges

Dr Masoud Fakhimi (*University of Surrey*), **Dr Navonil Mustafee** (*University of Exeter*) and **Prof Lampros K. Stergioulas** (*University of Surrey*)

Modelling & Simulation (M&S) studies have been widely used in industry to gain insights into existing or proposed systems of interest. Despite this, the application of M&S to evaluate the often competing metrics associated with Sustainable Operations Management (SOM) is likely to be a challenge. The aim of this review is to present an informed discussion on the suitability of specific modelling techniques in meeting the competing metrics for SOM. Triple bottom line (TBL), which is a widely used concept in sustainability and includes environmental, social and economic aspects, is used as a benchmark for assessing this. Findings from our research suggest that a multi-level hybrid M&S approach could be an appropriate method for SOM analysis. The assertion is that a combined simulation approach will provide a more realistic representation of the underlying behaviour of the TBL-based system (*vis-à-vis* modelling using a single simulation technique); however, this still has its challenges! In order to tackle the challenges associated with modelling for SOM, this research proposes TBL modelling concept. We define a TBL-based model as an abstraction of an underlying system of interest that is developed to analyse the system based not only on productivity criteria (e.g., resource utilization, service time) but also on environmental and social criteria. Finally this research argues that to apply TBL modelling approach, it is essential to go beyond the classical science as an origin of all traditional M&S techniques. This research disputes that TBL modelling based on classical science disciplines is not feasible, since, classical science does not have sufficient capacity to understand phenomena such as sustainable development.

What is the nature of your talk?: Theoretical. Does your talk require prior knowledge of the subject area?:

Some. Is your talk accessible and relevant to Practitioners?: Somewhat

The OR Society

Organiser: Louise Allison

06/09/2016 : 18:00 : Room-DS1.07

Code: OR58A2936

Membership Research Focus Group

Mrs Louise Allison (*The OR Society*)

The OR Society is undertaking some research with its members to better understand how the benefits that the OR Society offers can be improved. This session will provide the forum for an open exchange of views and for sharing ideas on how the Society can best serve members in the future. This will also enable the Society to learn more about what members really want from their relationship with the Society. This will be an opportunity for you to shape the future of the Society.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

Third Sector OR: Modelling for a better world



Organisers: Malcolm Fenby and David Collier

06/09/2016 : 13:30 : Room-DS2.08

Code: OR58A1700

Taking Action to Unlock Business Resources into Communities using SSM

Dr Miles Weaver and **Dr Kenny Crossan** (*Edinburgh Napier University*), **Mr Steven Paxton** (*Voluntary Action Fund (Scotland)*) and **Dr Hock Tan** (*Edinburgh Napier University*)

This session presents three system conceptual models that have been brought to action as a result of an SSM study with the Voluntary Action Fund (a long-standing Scottish grant-maker). VAF aim is to unlock and bring about more business resources into communities in Scotland. As part of the 'finding out stage' it became clear that VAF perceived the problem to be situated in a lack of connectivity and alignment between and within sectors to address the challenges being faced by communities, represented by CSOs. Resource mobilisation is a common issue across these organisations and has been identified by Midgeley and Ochoa-Arias (1999) as an area that community OR practitioners (CBOR) could support yet little research can be found. Although, in the business sustainability literature calls have been made for businesses to reconnect business goals with societal goals, going beyond CSR efforts (Porter and Kramer, 2011; Scagnelli and Cisi, 2014) and in creating joint value between business and CSOs (See Weaver et al., 2016). The 'VAF Connect' and Scotland's 'Responsible Business Forum' (SRBF) models are outlined, identified by nine "Rich Picture" workshops with VAF Trustees and Staff, and CSOs; a survey of funded organisations and expert interviews to confirm the validity of findings. An evaluation of the SRBF, implemented in February 2016, is offered in terms of addressing the problem situations and the identified success criteria. Further systemic changes are suggested to ensure its sustainability, scalability and effective governance. A number of challenges and lessons learnt are suggested in terms of applying systems-based approaches to CBOR problems, particularly the issue of 'resource mobilisation'. Also, to operationalise the concept of 'shared space' as an emerging paradigm for matching and aligning business and societal priorities, forging relationships and developing innovative business models for joint value creation.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Highly

06/09/2016 : 14:00 : Room-DS2.08

Code: OR58A1813

Insights from Evaluations of Investment Prioritisation Pilot Projects

Mr David Collier (*White Ox*)

International charities such as the Global Fund and the Bill & Melinda Gates Foundation require evaluation of all grant funded projects. The author will present insights based on his evaluation of several such (disidentified) projects piloting the use of epidemiological modelling and multi-criteria methods to support investment prioritisation decisions in Africa and elsewhere. The focus will on the conditions that make for successful applications of structured methods for involving stakeholders and evidence-based decision making in politicised contexts. Some implications of potential future scale-up or roll-out for the planning of pilot trials

will also be covered. Parallels and contrasts will be drawn between these projects and some comparable projects in the UK.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Highly

06/09/2016 : 14:30 : Room-DS2.08

Code: OR58A1771

International Student Numbers - Trends and Prospects

Mr Paul Randall

Over the last 5 years, the UK Higher Education (HE) sector has faced a period of change, notably in its financing arrangements and in the immigration regime for overseas students. A major charity, providing accommodation and support services for (mainly) overseas students was considering a substantial capital investment to increase its capacity. In 2013, a pro bono OR project analysed data, and other forms of information, from a range of sources. Its report on the risks to future overseas student numbers informed the Board decision on the proposed investment. It subsequently formed the trigger for further Government analysis of prospects for the HE sector. A follow up study in 2016 revealed a very different picture and new risks. That study has fed into the Board's thinking on the charity's strategic direction.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Relevant

06/09/2016 : 15:30 : Room-DS2.08

Code: OR58A1801

Making Data Flow Around, Lubricate, and Fuel, a Remote Rural Sub-Saharan African Hospital and Community Health Service Provider

Mr Andrew Dobson (*Independent*)

The speaker will describe how work as an OR analyst in remote rural Uganda with a locally-managed medium-sized not-for-profit health service provider has evolved into a core programme of work focussed on working with the 2 local IT staff to improve and enrich the flows of electronic data throughout the hospital and community teams, and moving the organisation along the road towards being a modern data-driven organisation, within a local context where there are significant extra challenges to this. These challenges range from those caused by the organisation's also being a small part in many other national and international agencies' agendas, which has led to different databases and accompanying IT having been imposed on the organisation at different times to serve largely those agencies' information needs, through the limitations of cracked software and hardware, to violent lightning strikes. The talk will describe how this work is proceeding, including: (1) The development of a prototype integrated reporting system which generates, from a single menu on any department's computer, reports and graphical analyses from all the different databases; (2) Working with different managers to stimulate and develop their interests in using information and developing analysis skills; (3) Developing, and beginning the journey along, a plan of work for overcoming the barriers to integrating the different IT systems and databases into a single virtual system; (4) Supporting work to change a culture of unfamiliarity and distrust or fear of computers amongst many of the ordinary staff. It will run through a few example areas in more detail, and then discuss the further conclusions so far, and the plans for the future, including the question of whether the work might be of wider interest to organisations with similar challenges across Uganda and beyond.

What is the nature of your talk?: Very practical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Highly

06/09/2016 : 16:00 : Room-DS2.08

Code: OR58A1816

Knowing Your Audience: Cluster Analysis of Blood Cancer Charity Supporters

Mr Mark Montanana

Background: Bloodwise is a charity that provides support to those affected by blood cancer. Bloodwise contacted Pro Bono O.R. to request support from an analyst who could help them to 'know their audience better'. Bloodwise's database presented an opportunity to improve their knowledge about their supporters. They were keen to gain an insight about how many different group of supporters they have, what makes these supporters different from each other and the best way to engage with each group. Approach: A key stage of the project was to prepare the data into a format ready for analysis. This involved removing records with missing information in the dataset as well as transforming certain variables in the dataset into a binary format. Once the data preparation stage was completed, we reduced the dimensionality of the data by means of a 'Cluster of variables' analysis. This type of analysis has the added benefit of combining variables of a categorical and numerical nature into a format suitable for a segmentation model. Finally by means of hierarchical clustering algorithm we identified 8 different segments with a set of clearly defined characteristics. Solution: A set of strategies was proposed to engage with each segment. Bloodwise identified some quick wins around the promotion of sporting events. A decision tree model was built to derive a set of rules to classify new supporters into the 8 previously identified segments. The set of rules derived from the decision tree were coded into a VBA macro. One limitation of this project was the absence of an attitudinal component in the segmentation, this was highlighted to Bloodwise and as a result they are working on a survey that captures their supporters' different attitudes towards the charity.

What is the nature of your talk?: Practical

Does your talk require prior knowledge of the subject area?: A little

Is your talk accessible and relevant to Practitioners?: Somewhat

06/09/2016 : 16:30 : Room-DS2.08

Code: OR58A1781

An OR State of Mind - The Benefits of Process Management to the Diabetes UK Continuous Improvement Programme

Miss Nicola Drake and Mr Jon Richards (*Thales UK*)

In any working environment, especially as an organisation expands it is easy to 'stick with what works' and repeat successful processes. These processes are often duplicated with minor tweaks and become part of 'business as usual'. When the organisation is challenged to conduct improvements it can be very difficult to analyse these processes to identify what can be improved and where changes would provide benefits. Based on the fundamentals of Business Change and Process Management this Pro Bono O.R project demonstrates the benefits of an OR approach to identifying challenges and deriving improvements to business processes. This presentation discusses the analysis of business processes and the utilisation of all available information and people to derive observations and recommendations in direct support of the continuous improvement programme.

What is the nature of your talk?: Very practical

Does your talk require prior knowledge of the subject area?: None

Is your talk accessible and relevant to Practitioners?: Highly

Timetabling and Scheduling



Organiser: Rhydian Lewis

08/09/2016 : 13:15 : Room-DS1.04

Code: OR58A1688

Scenario-based Robust Optimisation of Scheduling Surgical Procedures

Dr Rhyd Lewis, Prof Paul Harper, Dr Ahmed Kheiri and Dr Jonathan Thompson (*Cardiff University*)

Operating theatre scheduling is known to be an NP-hard optimisation problem. In many hospitals increasing numbers of operations are being cancelled due to factors such as the unavailability of beds for post-operative recovery. This study investigates optimisation models for tackling problems associated with theatre scheduling with the aim of reducing the number of cancellations of surgical procedures. To these ends, a set partitioning formulation and a heuristic-based algorithm have been developed to solve the problem. Our results show that the utilisation of post-operative beds can be increased, and hence the number of cancellations can be decreased, which ultimately leads to greater patient throughput and reduced waiting times. A scenario-based model has also been employed to deal with the stochastic-nature associated with the bed requirements into the optimisation process. The results indicate that the proposed model could potentially lead to a more robust solution.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

08/09/2016 : 13:45 : Room-DS1.04

Code: OR58A1699

A Branch, Bound and Remember Algorithm for the Simple Disassembly Line Balancing Problem

Dr Jinlin Li and **Prof Xiaohong Chen** (*Central South University, China*), **Dr Caijun Yang** (*Xi'an Jiaotong University*) and **Prof Zhanguo Zhu** (*Nanjing Agricultural University, China*)

In this paper, the simple disassembly line balancing problem (DLBP), which is the very fundamental problem of the DLBP field and was formulated by Koc et.al (2009), is studied. The simple DLBP is similar to the well known type 1 simple assembly line balancing problem (SALBP-1), though it utilizes an AND/OR graph (AOG) instead of a task precedence diagram to represent the precedence relationship among the tasks. Although it is known that the complexity of DLBP is NP-hard in general, we prove that a DLBP without parallel tasks is polynomial solvable, and propose a branch, bound and remember (BB&R) algorithm to solve general DLB problems. Computational experiments on the basis of former data sets, as well as a new, more challenging one, show that our algorithm outperforms the most effective existing procedures for solving this problem.

What is the nature of your talk?: Theoretical

Does your talk require prior knowledge of the subject area?: Quite a lot

Is your talk accessible and relevant to Practitioners?: Somewhat

08/09/2016 : 14:15 : Room-DS1.04

Code: OR58A1710

A Lower Bound for the Restricted Job Completion Time Variance Problem

Dr Srirangacharyulu Brundavanam (*Indian Institute of Management Tiruchirappalli*)

This research addresses the completion time variance (CTV) minimisation on identical parallel machines. This performance measure is non-regular and its value may decrease when one of the job completion times increases. CTV is an appropriate measure where both earliness and tardiness are undesirable, and is consistent with just-in-time manufacturing systems and service stability concepts. Merten and Muller (1972) first introduced the CTV minimisation in single machine systems. Bagchi et al. (1987) first introduced the Mean Absolute Deviation (MSD) minimisation in single machine systems, and they drew equivalence between the CTV and MSD measures under certain conditions. Federgruen and Mosheiov (1996) addressed the problem of job scheduling on identical parallel machines with general non-linear cost structures. The problem considered in this paper is to schedule n jobs on two identical parallel machines so as to minimise the CTV, such that no machine is kept idle when jobs are available for processing. This situation arises when machine availability is very costly, and necessitates that the machine is not kept idle. This is referred to as the restricted version of the CTV minimisation problem, denoted by $(Pm|res|CTV)$. A lower bound on CTV for given partial schedule is developed by extending some of the properties in Federgruen and Mosheiov (1996). The lower bound for a partial schedule is computed as the sum of contributions of two sets of jobs – one, a set of jobs which are already scheduled, and the second, the set of jobs which are yet to be scheduled. The lower bound computation involves solving a single-constraint non-linear optimisation problem. Federgruen, A. and G. Mosheiov (1996) Heuristics for multimachine scheduling problems with earliness and tardiness costs. *Management Science*, 42, 1544–1555.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Quite a lot

Is your talk accessible and relevant to Practitioners?: Relevant

08/09/2016 : 14:45 : Room-DS1.04

Code: OR58A1830

Solution Methods for the Scheduling of Heterogeneous Parallel Machines applied to the Workover Rig Problem

Dr Rahimeh Neamatian Monemi, **Mr Kassem Danash** (*Université d'Artois*), **Dr Shahin Gelareh** (*Artoise University*) and **Dr Wissam Khalil** (*Lebanon University*)

We consider a parallel heterogeneous machine scheduling problem arising in the maintenance planning of heterogeneous wells. This problem particularly arises in the context of workover rig scheduling. The oil wells need regular maintenance to ensure an optimal level of production. After oil production is decreased at some wells, appropriate workover rigs with compatible service capacity are deployed to serve the wells at discrete locations. Every well needs a certain level of maintenance and rehabilitation services that can only be offered by compatible workover rigs. A new mixed integer linear programming model based on the arc-time-indexed formulation is proposed. Then, a heuristic selection type hyper-heuristic algorithm is proposed, which is guided by a learning mechanism resulting in a clever choice of moves in the space of heuristics that are applied to solve the problem. The output is then used to warm start a branch, price and cut algorithm. Our numerical experiments are conducted on instances of a case study of Petrobras, the Brazilian National Petroleum Corporation. The computational experiments prove the efficiency of our hyper-heuristic in searching the right part of the search space using the right alternation among different heuristics and confirm the high quality of solutions obtained by our hyper-heuristic.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

Transport and Mobility



Organisers: Javier Faulin, Gunes Erdogan and Tim Pigden

08/09/2016 : 09:30 : Room-DS2.13

Code: OR58A1704

Reducing Leading Times in Last Mile Distribution: the Horizontal Cooperation Role

Dr Javier Faulin and **Mr Adrian Serrano** (*Public University of Navarre*)

Globalization, market and macroeconomic uncertainties are pushing logistic service providers to seek for new ways to achieve a greater efficiency. That is especially critical for small and medium enterprises (SME) that usually do not have enough size to take advantage of economies of scale. For that reason, horizontal cooperation, as the alliance between two or more companies that operate at the same level of the supply chain, is being setting as a major strategy for small logistic service providers. It is well-known that economic profits, as well as environmental impacts have been widely studied in Operations Research and Business literature, but, in contrast, little attention has been paid in evaluation on service quality effects of horizontal cooperation. However, considering delivery problems in the last mile distribution scope, the study of the service quality is seen as a key competitiveness factor. Thus, we are analyzing in this work service quality using an agent-based simulation model in which Horizontal Cooperation is permitted in a last mile distribution environment. Among others, major issues such as trust and level of cooperation are taken into account allowing for a dynamic form of coalition. It means that the alliances may evolve including new participants that may keep different degrees of cooperation with the coalition. Computational results show promising managerial insights as an outcome of Horizontal Cooperation supporting firms to reduce lead times considerably to increase service quality and competitiveness.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Very

08/09/2016 : 11:30 : Room-DS2.13

Code: OR58A1707

A Conic-Programming-Based Approach for Trajectory Optimisation of Unmanned Gliders

Mr Walton Pereira Coutinho (*University of Southampton*), **Dr Maria Battarra** (*University of Bath*) and **Prof Joerg Fliege** (*University of Southampton*)

In recent years, employing Unmanned Aerial Vehicles (UAV) to collect data and make measurements has gained momentum. Often, the use of UAVs allows for a reduction in costs and improvements of other performance criteria. Those characteristics make UAVs suitable for disaster assessment, response and management. While the utilisation of powered UAVs has been broadly investigated in the literature, the employment of unpowered UAVs such as gliders has not being well explored. In fact, specialised control systems based on optimisation must be developed in order to guide such vehicles during their operations. In this paper we consider the problem of guiding a glider, along predetermined waypoints, in a wind field. We propose a Conic Programming Glider Trajectory Optimisation Problem, motivated by disaster assessment applications, and a solution framework. Some preliminary computational results are presented at the end of this work.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: A little
Is your talk accessible and relevant to Practitioners?: Relevant

08/09/2016 : 12:00 : Room-DS2.13

Code: OR58A1606

A Relaxation-Based Algorithm for the P-Centre Problem

Miss Becky Callaghan , Dr Gabor Nagy and Prof Said Salhi

This paper aims to solve large continuous p-centre problems exactly by investigating the reverse relaxation algorithm proposed by Chen & Chen. The algorithm is reexamined and developed by adding four mathematically supported enhancements to improve efficiency and the overall computational time.

What is the nature of your talk?: Theoretical

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Somewhat

08/09/2016 : 13:15 : Room-DS2.13

Code: OR58A1712

KEYNOTE: Green Logistics: Developments in Vehicle Routing Models

Prof Richard Eglese (*Lancaster University*)

The issue of environmental sustainability is introduced and targets for greenhouse gas emissions in the future are described. Focussing on vehicle routing models relating to road freight transport, different types of models for estimating fuel consumption and emissions are presented. Examples are provided of vehicle routing models that make different modelling assumptions and approximations, particularly whether time-independent or time-dependent vehicle speeds are used. A section discusses models for alternatively powered vehicles, including electric vehicles. Some future research directions are indicated.

What is the nature of your talk?: A mix

Does your talk require prior knowledge of the subject area?: Some

Is your talk accessible and relevant to Practitioners?: Relevant

08/09/2016 : 13:45 : Room-DS2.13

Code: OR58A1706

Enlarging Competitiveness through Horizontal Cooperation: Threats, Opportunities and Trends

Dr Elena Pérez-Bernabeu (*Universitat Politècnica de València*), **Dr Javier Faulin** (*Public University of Navarra*), **Dr Angel A. Juan** (*Open University of Catalonia*) and **Mr Adrián Serrano** (*Public University of Navarra*)

Due to the fact that road transportation is the leading way of moving goods in most regions in the world, enhancing this shipment structure can produce a high impact in the overall hauling system. The definition of horizontal cooperation would state that this is an agreement between companies at the same managerial level that are willing to save costs offering simultaneously a good service along with other kind of benefits. Many difficulties arise around a perfect horizontal cooperation between partners that may be competitors, because they are not willing to share all the managerial information among them. Thus, horizontal cooperation has lately evolved till the point that it is being considered a common practice in the transportation sector, and it is even being regulated by the regulations of the European Union directives (Regulation (EC) No 1072/2009 of the European Parliament and of the Council of 21 October 2009 on common rules for access to the international road haulage market. Therefore, business collaboration schemes are settled for many reasons, such as: i) searching efficiency in the distribution arena ii) cost minimization iii) considering of green aspects in the transportation activities, including the reduction of the carbon footprint iv) minimization of traffic congestion problems in road transportation, among other problems. Reaching milestones in horizontal cooperation can be a tough task, but there are some tools available in the literature that can be very helpful. In this presentation, we are going to introduce a general overview of horizontal cooperation focusing our study in the description of vehicle routing problems which are mainly used to cooperate horizontally, such as the routing problems with backhauling constraints. Moreover, a classification of the literature will be shown, focusing on green transportation, from the theoretical approaches to the practical ones.

What is the nature of your talk?: A mix
Does your talk require prior knowledge of the subject area?: A little
Is your talk accessible and relevant to Practitioners?: Very

08/09/2016 : 14:15 : Room-DS2.13

Code: OR58A1847

A Biased Randomised Clarke and Wrights Savings Heuristic for the Pollution Routing Problem with Time windows

Mrs Hassana Abdullahi and **Prof Dylan Jones** (*University of Portsmouth*), **Dr Angel Juan** (*Open University of Catalonia*) and **Dr Djamila Ouelhadj** (*University of Portsmouth*)

The Pollution Routing Problem with Time Windows (PRPTW) deals with the problem of minimising CO2 emission while routing a fleet of vehicles to serve a set of customers with known demand and set time windows. We define a mixed integer linear programming (MIP) model and the Biased Randomised Clarke and Wrights Savings Heuristic (BRCWSH) to solve the problem. This model takes into account operational costs such as driver cost and environmental costs simultaneously. The proposed model also uses a speed optimizer to determine the speed of each vehicle on each arc. Using benchmark instances, computational experiments will be conducted to evaluate the performance of the proposed formulation and solution quality generated using (BRCWSH).

What is the nature of your talk?: A mix
Does your talk require prior knowledge of the subject area?: A little
Is your talk accessible and relevant to Practitioners?: Relevant

08/09/2016 : 14:45 : Room-DS2.13

Code: OR58A1682

Vehicle Routing in the Lubricants Industry: A Case Study

Mr Tim Pigden (*Optrak Distribution Software Ltd*)

The lubricants industry provides a number of unusual challenges for vehicle routing. For bulk lubricants (pumped off the vehicle) a major concern to distributors is the risk of cross-contamination of products due to use of common hose and pumps which imposes a sequencing constraint on routes. Vehicle types include both traditional compartmented vehicles and "hybrid" vehicles which carry out bulk deliveries through the use of IBCs (intermediate bulk containers) and packed deliveries of drums, pails and packaged goods - space being allocated to bulk or packed goods according to need. There is a cleaning minimisation problem as compartments are cleaned where necessary prior to reloading. Finally there is an element of "prize collecting" as planners combine "must-go" urgent orders with "can-go" orders in the immediate neighbourhood. The talk will present a case study based on the implementation of the Optrak Vehicle Routing software for a major lubricants distributor in the North-Eastern United States.

What is the nature of your talk?: A mix
Does your talk require prior knowledge of the subject area?: A little
Is your talk accessible and relevant to Practitioners?: Very