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.

Each abstract listing shows the date, time and location of the talk, and has the abstract code which links it back to the *At A Glance Timetable* which appears earlier in this handbook.

This year, in an attempt to make it easier for delegates to 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.

We have used these answers to identify talks of particular relevance to practitioners. These talks are marked **(P)** in the *Full Timetable* and in the abstract listing.

We hope this innovation helps you to select the talks best suited to your needs.

Analytics

Organiser: Nigel Phillips

09/09/2014 : 11:30 : Room Windsor 0.05   Code: OR56A1443

The Use of Behavioural and Social Data in Predictive Analytics for Consumer and SME Credit
Mr Alan Hambrook *(Zoral Limited)*
The session will focus on the use of behavioural, social and unstructured data and their impact on predictive modelling. It will use consumer and SME finance examples to illustrate. Illustrations will cover a range of areas including, credit risk, real time underwriting, fraud detection/prevention. Techniques used and metrics resulting will be shown using a number of completed, case studies. The results show that the impact on core business metrics is significant, in a number of cases, surpassing conventional techniques. The talk will also cover related issues including: sourcing data, automating/monitoring data quality, identifying predictive vectors, maintaining predictive quality.

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

09/09/2014 : 13:30 : Room Windsor 0.05   Code: OR56A1363

Lessons from Clustering Tiny Data
Mr Nigel Phillips *(London South Bank University)*
The volumes of data available to organisations are already immense and growing exponentially. This big data resource represents a huge potential for knowledge discovery, but also presents many challenges which require new tools to discover meaningful patterns. Where relationships are already known supervised learning approaches such as neural networks, genetic algorithms and Bayesian reasoning can be used to efficiently search and process data, but the potential for greatest gains may lie in identifying weak signal - relationships that are outside our current models. Unsupervised learning offers potential for such novel disruptive discovery however there are a number of features of unstructured data that are likely to impede success. Two such impediments are noise – texts that are part of the corpus but effectively content free and the presence of input signals that dominate the more interesting weak signals. These challenges are explored using small (590) corpus of short (typically 200-300 word) text. This approach has proved illuminating and a number of key design issues are highlighted and some techniques for improving the detection of weak signals are evaluated.

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

09/09/2014 : 14:00 : Room Windsor 0.05　　　　　　　　　　　　　　　　Code: OR56A1422

From Business Intelligence to Predictive Analytics to Cognitive Analytics
Mr Matthew Robinson *(IBM)*

All industries have similar and pressing needs to increase visibility and control over progressively more detailed aspects of their operations. The increasing breadth and capability of technology, both hardware and software, and the integration between operational systems means that embedding analytics to drive better decisions is a must have - simple reports and dashboards don't offer the actionable insight needed. Combining monitoring (Business Intelligence) and actionable insight (Predictive Analytics) allows organisations to take control of the many touch points between consumers and systems, often in real-time. Cognitive computing systems overcome the challenge of creating, integrating and managing unstructured, analogue-text data through a massively parallel processing system. This, in turn, enables the system to evolve response guidelines and policies as new material is added to the data set. To rise to the challenge of a landscape of operational complexity organisations are moving their analytics from traditional statistics, through predictive models, into cognitive analytics. This talk addresses the key levers to successful use of analytics in organisations, including case studies, and considers the emerging area of cognitive computing systems applied to the field of analytics.

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

09/09/2014 : 14:30 : Room Windsor 0.05　　　　　　　　　　　　　　　　Code: OR56A1338

Risk Management Strategies for Finding Universal Portfolios
Dr Esther Mohr *(University of Mannheim)*

We consider an on-line version of the portfolio selection problem, and present two algorithms that achieve almost the same wealth as the best-constant rebalanced portfolio (BCRP) computed in hindsight. A portfolio is called universal if it achieves asymptotically the same wealth as BCRP under complete independence from statistical assumptions. Existing universal portfolio algorithms do not consider trading risk. The ability of successfully utilizing a portfolio selection algorithm in practice however requires the possibility to include risk management. Our two algorithms take into account the trading risk by the maximum possible return fluctuation. By means of competitive analysis we obtain upper bounds on the worst-case performance of our algorithms. These bounds equal the bound obtained by Cover's Universal Portfolio algorithm (UP) which is basically unimprovable. Numerical results using data from the NYSE during a 22-year period show that our algorithms are able to beat existing on-line portfolio selection algorithms, including UP, as well as BCRP in terms of risk-adjusted performance.

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

09/09/2014 : 15:30 : Room Windsor 0.05　　　　　　　　　　　　　　　　Code: OR56A1271

Modelling Operational Risk using Skew t-copulas via Bayesian Inference
Miss Betty Johanna Garzon Rozo and **Prof Jonathan Crook** *(University of Edinburgh)*

Operational risk losses are heavy tailed and are likely to be asymmetric and extremely dependent among business lines/event types. We propose a new methodology to assess, in a multivariate way, the asymmetry and extreme dependence between severities, and to calculate the capital for Operational Risk. This methodology simultaneously uses extreme value theory and the skew t-copula. The former to model the loss severities more precisely; the latter to effectively model asymmetry and extreme dependence in high dimensions. The paper analyses an update data set, SAS Global Operational Risk Data.

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

Analytics Applied to Busting Financial Crime in Real Time
Dr Ana Costa e Silva and **Mr Alvaro Prendes Ramos** *(TIBCO Spotfire)*
Existing financial crime solutions suffer from two problems: many false positives and long investigation times. At TIBCO, we propose predictive modelling to solve the first and Spotfire for the latter. Our models have a supervised and an unsupervised learning component. Spotfire/TERR help users configure these. Supervised learning requires a list of past 0s and 1s, i.e. past transactions of which we know some are fraudulent and some are not. With this, any discriminative model (e.g. random forest) can be trained to optimally detect past fraud patterns going forwards. However, a 0/1 list is not always available; and it will be affected by past undetections; and fraudsters are creative, once a technique does not work, they will think of another. This brings us to unsupervised learning: PCA (principal component analysis) captures the most significant patterns within the data into less variables, which we use for clustering. We then measure the distance of each transaction to the global mean or to the cluster centres to order transactions from oddest to least-odd. Once we publish these two models into the TERR server, Streambase can use them to compute the risk/oddness of each transaction in real-time. Rules for which actions to take when spotting one, e.g. email the police, can be set in Business Events. Dangerous transactions will be investigated by humans, whose decision can be made maximally efficient using a Spotfire template that collects all information about the transaction's history from disparate sources. Investigators can then complete a FormVine report, including their 0/1 vote, which gets stored in a centralised database. In time, these new 0/1s get fed back into the supervised learning algorithm, allowing the system to improve itself over time. The system is applicable to several sorts of financial crime, e.g. trade surveillance, online commerce, or AML.

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

Data Science: Best Practice & Governance in Analytics
Ms Sayara Beg *(Datanut)*
Data Science: Best Practice and Governance in Analytics – will describe how the Analytics, and the recent Big data revolution, has given rise to the new role of the 'Data Scientist'. It will explore core elements such as expertise, knowledge of tools and interpersonal skills that are expected from a Data Scientist today, and how those core elements have evolved over time. It will conclude with why the need for best practice, ethic and governance has now become immediately urgent and how this urgency can be addressed

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

Quality 'v' Quantity: An Analytics Perspective of Academic Assessment in Quantitative Methods
Dr Harry Venables *(University of York)*
University students often faced with word count limits for essay, report and dissertation writing can experience high levels of anxiety. When management or business students have to write reports on quantitative studies, stress levels are often further exacerbated due to writing about techniques and skills that they may already find difficult to grasp. These students often feel that they need an increase of the upper word limit. This paper is a case study based on observations that arose from an assessment for a second year management undergraduate analytics module. This paper aims to apply analytics techniques similar to those used by Squawka in their analyses of footballer performance. The objective for this paper is to identify if word count limits have any impact on the overall mark given for a report style assessment. The purpose for giving word limits to students is not to restrict their production of work, but to allow them to focus and concentrate on the important issues of an assessment. This paper touches on the age-old teaching anecdotal concept of

"Quality 'v' Quantity". The analysis conducted indicates that this is indeed measurable and valid. Furthermore, by allowing students to write outside the set word limits does not necessarily mean they will obtain a higher mark, even if they think that they will getter a better for expanding their work, they are more likely to gain an insignificant improvement if any. Consequently, students who were panicking just prior to submission and given a small word limit expansion probably gained nothing more than peace of mind to relax their anxieties.

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

11/09/2014 : 09:30 : Room Windsor 0.05   Code: OR56A1298
Journal of the Operational Research Society: Analysis and Geographical Mapping based on Web of Science data
Dr Nei Soma and **Dr Alexandre Alves**, *(ITA / Brazil)* and **Prof Horacio Yanasse** *(UNIFESP/Brazil)*
Journal of the Operational Research Society is the longest journal covering Operational Research areas. This paper analyses and maps the content of JORS to a period of 58 years considering data from the Web of Science. We map the geographical distribution and the relationships of the authors of articles that published in JORS considering the institution of their affiliation and the geographical distribution of authors that cited articles published in it. In addition, we present the articles' keywords and the authors' area in the form of word clouds. With these maps we can verify and analyse the coverage of JORS.

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

11/09/2014 : 11:30 : Room Windsor 0.05   Code: OR56A1267
Morphological Distance as an Enabler to Refine Morphological Analysis Solutions
Mr Bruce Garvey and **Prof Peter Childs** *(Imperial College London)* and **Dr Nasir Hussain** *(Strategy Foresight Partnership LLP)*
A common argument against the use of Morphological Analysis (MA), when addressing multi-dimensional problems, is that the total number of configurations generated, can be unmanageable. Software has helped mitigate this conundrum when used in conjunction with pair-wise analysis of parametric states. However, use of this software can still leave the modeller with large numbers of viable configurations to analyse. By resurrecting Robert Ayres' concept of Morphological Distance (MD), and using it as a follow-on process once the pair-wise analysis has been conducted, the remaining configurations are more meaningfully classified into three segments. Ayres (1969) categorises these segments as Occupied Territory, representing current state of the art, where minimal innovation is likely to occur. Secondly the Perimeter Zone, where viable configurations differ in a number of states from those in the Occupied Territory, and reflect some level of innovation from existing art. Finally Terra Incognita consisting of those configurations differing from existing art in 4 parameter states or more. Given the distance from solutions in the Occupied Territory, Terra Incognita solutions are likely to be truly creative. Ayres' original approach was to use MD as a first stage reduction process in the absence at the time of computerised pair-wise analysis. In this paper the authors will show by way of examples, how web-based software not only generates reduced configurations within the solution space but allows for the clustering of those configurations in the three segments as determined by the Morphological Distance. This refines the number of workable solutions and provides improved screening for product and technology designers involved in ideation.

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

Tensor Analysis of Interactions between Hyper-Heuristic Components
Mr Shahriar Asta and **Dr Ender Özcan** *(University of Nottingham)*

Hyper-heuristics are automated search methodologies that control and generate (meta)heuristics for solving computationally hard optimization problems. Achieving a high level of generality by supporting applicability to multiple problem domains and reusability are two key goals in a hyper-heuristic design. Hence, the use of data science techniques, particularly machine learning is crucial. In this study, we present a tensor based approach for designing a hyper-heuristic. The data collected during the hyper-heuristic search process is represented as a high dimensional tensor for further processing in a pre-learning stage. Our study shows that, using tensor analysis of such data results in an improved performance of the overall method being used. Moreover, we will demonstrate that the proposed approach generalizes well across different problem domains without requiring any change.

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

Behavioural Operational Research

Organiser: Sally Brailsford

09/09/2014 : 13:30 : Room Arts Bldg – Theatre 2   Code: OR56A1311
Including Patient and Provider Behaviour in Models of Healthcare Systems
Prof Sally Brailsford *(University of Southampton)*
One of the challenges of modelling healthcare systems is that the objects in the system are human beings and not inanimate widgets. Humans do not always behave rationally and this can lead to unanticipated outcomes. Moreover in healthcare settings these humans are often under great stress, not only the patients but also the health professionals who care for them. In this talk I shall discuss ways of incorporating human behaviour in OR models of healthcare systems, and will take both a backwards and a forwards look at approaches to tackle this challenging problem.

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

09/09/2014 : 14:00 : Room Arts Bldg – Theatre 2   Code: OR56A1325
Ensuring Usability of Decision Analytical Model: Practical Experience from MALT Study.
Ms Kinga Lowrie *(School of Health and Related Research)*
Decision analytic modeling is commonplace in healthcare decision making. The methods used have developed significantly over recent years with the emphasis being on enhancing validity and credibility of such tools. When decision makers are only interested in the outputs of models, then the need to look purely at validity is self-evident. However, when decision makers need to interact with the model as part of the decision making process, it can be argued that the usability of the model becomes integral to an assessment of its value. Ideally, the value of a decision tool should be evaluated in terms of the net (monetary) benefit of the changes that are implemented as a result of its use. This recognizes that a useable and credible tool will promote greater change and benefit. Whilst this could be investigated using a value of implementation framework, an alternative approach is to identify a proxy with which user value is assessed separately. As part of the Mainstreaming Assistive Living Technologies (MALT) study we developed a cost-effectiveness model with an integrated financial planning tool. The model will be used by Telehealth industry, NHS Commissioners and Managers to test different business scenarios for Telemonitoring in Heart Failure (HF). To our knowledge this is the first study that has used formal usability methodology in the process of model evaluation. The results of usability tests are presented and implication for researchers discussed. In the view of existing theories, End User Computing Satisfaction (EUCS) (Doll and Torkzadeh 1988) instrument have also been used to assess user satisfaction from the model. The results of the face validity testing of the EUCS instrument and applicability of the tool to Health Economics context will be also discussed.

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?: Relevant

09/09/2014 : 14:30 : Room Arts Bldg – Theatre 2   Code: OR56A1329

The challenges of Representing Human Behaviour in Simulation Models : Some Case Examples from Supply Chain, Evacuation Modelling and Rail Disruption

Dr Christopher Owen, **Dr Pavel Albores** and **Dr Andrew Greasley** *(Aston Business School)*

As more of the economy moves from traditional manufacturing to the service sector, the nature of work is becoming less tangible and thus, the representation of human behaviour in models is becoming more important. Representing human behaviour and decision making in models is challenging, both in terms of capturing the essence of the processes, and also the way that those behaviours and decisions are or can be represented in the models themselves. In order to advance understanding in this area, a useful first step is to evaluate and start to classify the various types of behaviour and decision making that are required to be modelled. This talk will attempt to set out and provide an initial classification of the different types of behaviour and decision making that a modeller might want to represent in a model. Then, it will be useful to start to assess the main methods of simulation in terms of their capability in representing these various aspects. The three main simulation methods, System Dynamics, Agent Based Modelling and Discrete Event Simulation all achieve this to varying degrees. There is some evidence that all three methods can, within limits, represent the key aspects of the system being modelled. The three simulation approaches are then assessed for their suitability in modelling these various aspects. Illustration of behavioural modelling will be provided from cases in supply chain management, evacuation modelling and rail disruption.

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

09/09/2014 : 15:30 : Room Arts Bldg – Theatre 2   Code: OR56A1394

Predicting Security Choices Considering a Set of Models and Behavioural Features

Dr Iryna Yevseyeva *(Newcastle University)*, **Dr Debora Jeske** *(Northumbria University)*, **Dr Charles Morisset** , **Mr James Turland** and **Prof Aad van Moorsel** *Newcastle University)*

Information security decisions typically are about trade-offs between security and productivity. These decisions are often complex, with several objectives to be considered simultaneously, and with the optimal decision very much depending on a specific situation and a person making decision. Ability to construct decision-making models based on previous choices and preferences of a particular decision maker may help in adapting security designs to a particular decision maker. In this work, we propose to construct a personal preferences-based decision-making model using results of choices decision maker made, and to apply the model to predict future choices of the decision maker. Assuming the decision-making process can be described with multiattribute utility theory, we propose to build a personal decision-making model by testing a set of different functions with a set of parameters that fit best the choices a decision maker made based on ordinal regression. We use the best fitting model to predict future decision maker's choices. We performed a model construction for a set of 34 subjects who participated in an experiment of ranking a set of Wi-Fi's based on a set of criteria for using in a public place. We assumed variability of not only importance of different criteria among decision makers, but also possibility of different direction of preferences and different form of criteria aggregation within a utility function. Knowing that different people have different preferences with respect to the same set of criteria (here expressed in a form of criteria weights defining relative importance), we also tested different forms of utility functions and direction of preferences to find a function that corresponds best to choices made. We illustrated that taking into account these variables improves prediction capabilities significantly and also looked at behavioural aspects to be taken into account within decision-making models.

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

09/09/2014 : 16:00 : Room Arts Bldg – Theatre 2   Code: OR56A1340

Building Capacity to Change Traditional Masculine Cultural Norms in a Sub-Saharan African Country

Mr Andrew Dobson

In this talk, the speaker will describe work done with an organisation founded by a group of local men in a sub-Saharan African country with the ambitious goal of changing the country's traditional masculine cultural norms. These are viewed as the fundamental cause of high levels of gender-based violence in the country (and others). The organisation had been funded to undertake a number of relatively small-scale projects, which appear to be successful on that scale, and had been successful in securing funding for further projects. However, it faced the combined challenges that: a) Achieving its overall goal of changing cultural norms requires a much greater level of activity; b) To have any chance of this, it needs to shift from being the local agent and implementer of small relatively complex projects, each contracted and funded separately by a variety of international donors with different goals, to managing much more as a whole, on behalf of the local people, a single prioritised programme; c) Because almost all of its funding comes for specific projects, it has difficulty finding time to take the initiative to try to bring this shift about. Work to support the organisation to try to overcome these challenges has taken a number of forms. The initial work involved: (i) Developing the organisation's capacity to carry out and present an analysis of its work as a whole; (ii) Development of an organisational-level monitoring and evaluation system. This has more recently extended into helping plan, and facilitating implementation of the early stages of, a 'road map' for ambitious organisational change from a project-based to a 'Programme Based Approach', which could also be viewed as a process of building a 'system' for achieving effective large-scale behavioural change. The talk will summarise the work done to date, and the further work planned.

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

11/09/2014 : 13:30 : Room Windsor 0.02   Code: OR56A1403

Understanding the Behaviour of Modellers and Model Users

Prof Bob O'Keefe *(Royal Holloway University of London)*

There is a long standing, but very thin, stream of research into understanding how modellers within operational research and allied areas behave when constructing and using models. Such research aims to better understand the modelling process, using empirical studies to construct a body of knowledge. This talk will briefly review such work, and present a framework for this area of endeavour. The framework suggests three areas where the behaviour of individual modellers and users can impact (beneficially or adversely) model construction and use: the model itself, the ways in which data is brought to bear on the modelling, and (perhaps most importantly) the underlying assumptions that the extant model represents. It also considers three approaches to the behaviour of individual modellers and users: decision making biases (the dominant theme in much behavioural economics), cognitive styles and individual differences (drawing upon well-established concepts in organisation behaviour, many of which are themselves borrowed from psychology), and observations about process (typically within model construction, and already well explored within operational research).

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

11/09/2014 : 14:00 : Room Windsor 0.02   Code: OR56A1410
Representing 'The Other': Approaches for Representing Actors of Interest in Experiments and Exercises
Mr Philip Jones and **Dr Hu Barucki** *(Dstl)*
To undertake Behavioural OR, Dstl has developed a number of approaches to represent individuals, groups and population segments in experiments and exercises. This paper gives an overview of a range of methods including: role play, a software tool for generating 'synthetic' people and groups and an approach based on stratified sampling to help select participants that are broadly representative of population demographics.

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

11/09/2014 : 14:30 : Room Windsor 0.02   Code: OR56A1270
The Expected Discount for a House Sale
Dr Andrew Brint *(Sheffield University)*
For many people buying or selling their primary residence is one of the largest financial transactions in their life. However the price the sale takes place at can be considerably different from the asking price. Hence there is the possibility of gaining or losing substantial sums in the transaction, but the transaction price has received very little attention in academic studies. Therefore an empirical analysis of the discount on the asking price is carried out with respect to what value the asking price represents, how long the house has been on the market and whether the house is part of a chain of dependent sales. As part of this analysis, a general model is developed. It is concluded that overpriced properties and properties that have been on the market longer lead to a slightly higher discount on the asking price,

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

Community O.R.: Collective Challenges and Open Systems

Organisers: Martha Vahl and Eliseo Vilalta-Perdomo

09/09/2014 : 11:00 : Room Windsor 0.03   Code: OR56A1392

Keynote Part 1: OR in Search for Community

Ms Martha Vahl and **Dr Eliseo Vilalta-Perdomo** *(University of Lincoln)*

This year's Keynote has a special format. The interest in Community OR has taken the form of a new Special Interest Group that is presently taking shape. To contribute to a better understanding of the variety of interest that is being incorporated, we have invited a number of people to present their ideas as short presentations or pitches. Below you will find an outline of what we have today. These may help to summarise the current thinking and (research) practices in Community OR. The presentations will be followed by a panel discussion. Social Innovation and Community OR Communities are the main addressees for sustainable change and improvement, at least in the European Union. There are some considerable difficulties here, as the cry for policies that are effective in delivering this change is getting stronger and communities are getting better in avoiding being addressed as stooges. At present OR explores contributions to the policy problem (see the new SIG for Social Policy). It is argued that policy should be supportive to community level activities and initiatives, rather than the reverse, if social innovation is to be promoted. Examples are presented. Organising Suppliers: Chain or commune? Economy-based supplier structures are organised under drivers that aim at the alignment of goals and the optimisation of resources available; however, this does not seem to apply to any size of business. Observations on microbusinesses suggest that they do not strive for economic drivers only. Lifestyle, family and other non-economic drivers are also part of their strategic decision making processes. Different snapshots about UK and Mexican microbusinesses are used to illustrate possibilities that supply chains and communities may provide. Community OR ideas are used as a framework for the comparison.

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

09/09/2014 : 11:30 : Room Windsor 0.03   Code: OR56A1428

Keynote Part 2: OR in Search of Community and Panel Discussion COR: OR in Search for Community

Prof Gerard de Zeeuw, **Dr Alejandro Ochoa-Arias** *(University de Los Andes)* and **Dr Huw Evans**

This year's Keynote has a special format because the of the Community OR SIG development. We have invited a number of people to present their ideas. Two problems in Community OR When dealing with communities, two frequent experiences stand out that tend to resist understanding or intentional change. The first concerns the fact that members may respond within but also to a question or frame. The second concerns the fact that individual preferences do not rationally give way to collective preferences. The two types of experiences are recognised in most forms of research and aggregated as 'biases' that are to be reduced. It is claimed that, in contrast, Community OR is incorporating both. Community OR's contribution to developing democratic engagement If COR includes empowering people in being involved in decision-making on issues that affect them and society it has the potential to contribute to the choice of approaches and processes for engaging people and thus develop dialogue and understanding about issues. Community OR: Searching for space for a new civil society The way in which community organizations are becoming engaged in designing policies and taking their own destiny on their own hands is becoming a common issue nowdays in South America. It is a

challenge to the way civil society was driven by a modern bias without being modern in their own cultural and social structure. Therefore, Community OR is not only becoming relevant to decision making in communities, but also it is challenged by the possibility of becoming a new social actor with new rationalities coming from issues such as aboriginal tribes, marginal sectors becoming central and engaged in building up a complex society.

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

09/09/2014 : 13:30 : Room Windsor 0.03   Code: OR56A1380

An Assessment of Postgraduate Operational Research Curricula in Higher Education: Training for Practice or Research?

Dr Jana Ries, **Dr Alessio Ishizaka**, **Prof Dylan Jones** and **Prof Ashraf Labib** *(University of Portsmouth)*

Developing an MSc in the area of multi-disciplinary area of Operational Research imposes a range of challenges which are first and foremost driven by the question 'What makes an excellent Operational Researcher?'. Throughout the UK and in Europe, a range of OR related postgraduate courses are on offer, including a dominating set of standard taught programmes, followed by international programmes in cooperation with European partner universities and industrial programmes. The presentation will give an insight into postgraduate OR education and its impact on employability by taking an industrial perspective on the need of OR education. Structural characteristics in curricula in postgraduate OR education will be outlined, identifying similarities and differences within course structures and content mainly in the UK with a selection of HE institutions in Spain, France, Germany and Italy. Best practices in the named countries will be outlined that allow gaining an understanding of potential strengths, weakness, opportunities and threats (SWOT) of OR education in HE with respect to setting a clear focus on employability for postgraduate students. Based on this SWOT analysis that incorporates views from practitioners, academics in HE in OR, the work will reflect on current approaches, best practices and potential benefits.

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

09/09/2014 : 14:00 : Room Windsor 0.03   Code: OR56A1391

Community OR & Social Innovation

Ms Martha Vahl

Social Innovation (SI) is increasingly popular as a magic wand to solve (Western) society's problems. If only people would create (or invent) their own change it would be beneficial for the individuals involved as well as for the public good. Unfortunately, SI is frequently linked to attempting to solve problems as if they are closed. The result is familiar to OR analysts and policy makers. They face the paradox: implementing what seems the best analytically is resisted the most emotionally. From a Community OR perspective one expects this paradox to be resolved: one either imposes what cannot be SI, or one supports SI but does not impose it. The latter alternative suggests the device of doing things together, i.e. focusing on the development of a collective the members of which collaborate in creating what is of the desired quality. Simply recording and analysing data is not enough. An example of a recent SI project funded by the EU will be presented. One of the results is that innovative collective action is helped by (the telling of) appropriate anecdotes.

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

Communities and Food Supply: Looking at Their Intersection
Dr Eliseo Vilalta-Perdomo and **Prof Martin Hingley** *(University of Lincoln)*

There is an extended opinion that Food Supply Chains (FSCs) create economic value; usually by aligning different actors along the chain. However, for food microproducers, economic value is not necessarily the main driver to engage with FSCs. This opens up the discussion towards how to build FSCs with potential members that do not always recognise practical advantages in working with others. We propose explore previous research done in the area of Community Operational Research (COR) by looking at micro-producers not as links constituting a chain, where the weakest is removed for the benefit of the rest. We explore if there are benefits from being members from a community (Food Supply Communities, FSComs), where they identify which individual actions contribute to the collective self-construction, and vice versa. To contextualise the discussion, we use the case of a typical UK regional, county-based food marketing group which provides umbrella marketing support for specialist SMEs

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

Data Envelopment Analysis

Organisers: Bing Xu, Jamal Ouenniche and Sadia Farooq

09/09/2014 : 13:30 : Room Windsor 0.02   Code: OR56A1370

Dealing with Insufficient Discrimination Problem in DEA through Production Trade-Offs Approach - The Case of Microfinance Institutions

Miss Sadia Farooq *(University of Warwick)*

In this study, we analyse a group of microfinance institutions (MFIs) through multi-stage DEA models. This multi stage methodology aims to capture the double bottom-lines of MFIs that result from their twofold objectives of helping the poor and achieving commercial sustainability. Using DEA for performance evaluation of MFIs remains an under-researched area. The limited number of studies that have used DEA in this field fail to provide a specific framework for MFIs, instead relying on frameworks developed for other types of financial institutions. Development of a DEA based framework for evaluating performance of microfinance institutions (MFIs) is thus a focal point for this study. Another important contribution of this study is an application of Production Trade-offs Approach, developed by Podinovski (2004), to deal with the problem of insufficient discrimination of efficiency scores. Under this approach simultaneous changes are made to different inputs and outputs in line with technological realities of the production technology. This approach results in improving discrimination of efficiency scores while ensuring that efficiency can be interpreted as a radially realistic improvement factor. We are able to propose a number of technologically feasible production trade-offs and demonstrate how it is possible to improve model discrimination without loss of traditional meaning of efficiency.

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

09/09/2014 : 14:00 : Room Windsor 0.02   Code: OR56A1263

Multiplicative DEA and the Natural Avoidance of Zero Weights

Dr Chris Tofallis *(University of Hertfordshire)*

Traditional DEA models use a weighted sum approach to aggregate variables. The weights are constrained to be non-negative. However, zero or negligibly small (epsilon) weights are very common for some of the units being assessed. This implies that the associated variables have been ignored in the assessment, despite the fact that those variables must have been deemed important to be included in the first place. Consequently a literature has developed for treating this long-standing problem by imposing additional constraints on weights. These are usually subjectively chosen. This goes against the DEA spirit of 'let the data speak for itself'. Although not widely known, multiplicative DEA has the great, but sadly overlooked, advantage that it does not suffer from this problem. The weights are naturally constrained to have a lower limit of unity. After taking logs the model reduces to a linear programming problem – the additive DEA model. Multiplicative DEA is sometimes applied in a way which leads to results which are not scale invariant. We show how this can be easily avoided.

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

09/09/2014 : 14:30 : Room Windsor 0.02   Code: OR56A1347

An Integrated Multi-Criteria Decision Analysis Methodology for Benchmarking Competing Energy Strategies implemented in the North Sea Region
Dr Bing Xu *(Heriot-Watt University)*, **Prof David Gray** and **Mr Amar Nayak** *Robert Gordon University)* and **Dr Jamal Ouenniche** *(University of Edinburgh)*

In this paper, we evaluate 21 competing energy strategies that have been implemented by the city councils, research institutions and universities within the North Sea Region. The key objective is to identify the good practice under multiple criteria. We propose an integrated multi-criteria decision analysis (MCDA) methodology as a benchmarking framework. Our implementation of this methodology involved a three-stage process. The first stage consisted of multiple rounds of setting up focus group discussions with experts, interviewing key players in each showcase, and sending questionnaires to different stakeholders to gather an exhaustive list of criteria and their definitions to be used in assessing business cases and to reduce such list to the key ones as well as gauging the participants views on the relative importance of these criteria and collecting measures of these criteria. The output of this stage is a list of nine criteria which are related to four dimensions; namely, financial, environmental, technical and social, along with the relevant data to estimate the weights that reflect the relative importance of these criteria. In the second stage, we rank order competing energy strategies under a combination of qualitative and quantitative conflicting criteria by using a MCDA methodology; namely, PROMETHEE II, under multiple scenarios that reflect different stakeholders' preferences. In the third and last stage, we analysed the multi-criteria rankings derived in the previous stage and contrasted them with mono-criterion rankings, which tend to reflect some players perspectives. The final output of this multi-stage process is a set of recommendations to policy makers.

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

09/09/2014 : 15:30 : Room Windsor 0.02   Code: OR56A1330

Keynote: Setting Handicaps to Industrial Sectors in DEA Illustrated by Ethiopian Industry
Prof Kaoru Tone *(National Graduate Inst. for Policy Studies)*

In the ordinary macro-economic input-output tables, the industrial sector consists of several dozen industries and each industry in a certain sector is an aggregate of many companies in the sector. We can apply traditional DEA models for evaluation of efficiency regarding all sectors by means of common input and output factors. However, there remain some insecure feelings in comparing all sectors as a scratch race. For example, some sectors are in fields with matured technologies, while others are in emerging fields. These situations lead us to compare sectors under a handicap race. In this paper, we propose a new DEA model based on the non-convex frontiers that all associated sectors may exhibit and handicaps are derived from. We apply this model to Ethiopian industry.

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

09/09/2014 : 16:00 : Room Windsor 0.02   Code: OR56A1445

Improving Data Envelopment Analysis with Production Trade-Offs Approach –A Case of Banking Sector Firms
Mrs Shamaila Ishaq *(University of Warwick)*

Data Envelopment Analysis (DEA) is an optimization technique used to assess the relative efficiency of homogenous organizational units, called decision making units (DMUs). Since its first application on banking sector by Sherman and Gold (1985) it has been used in a variety of ways by the researchers in various countries to evaluate the efficiency of different aspects of bank operations. However, these studies have mostly used multistage methods to study the impact of risk and different exogenous and endogenous factors on the efficiency of banks. Unlike these studies we have incorporated additional information such as risk, exogenous and endogenous factors and bank specific characteristics simultaneously into the DEA model at first stage.

Efficiency estimation with additional information is important because without such information standard DEA models often fail to discriminate sufficiently between the efficiency scores of DMUs particularly, in case of small data set. A traditional way to overcome this discrimination problem is the use of weight restrictions that are commonly based on the value judgements. This paper proposes a novel methodological application of production trade-offs in the banking context. In spite of being somewhat similar to weight restrictions, this novel methodology provides a different way of incorporating additional information based on technological judgements. This proposed development enriches the standard DEA model with the additional information that not only leads to the expansion of production possibility sets (PPS) but also provides improved discrimination as compared to standard DEA models. For the empirical application of production trade-offs, a number of trade-offs are identified in banking operations and incorporated in output oriented VRS DEA model. Comparison of efficiency scores obtained before and after application of trade-offs reveals that discrimination of the efficiency scores of banks improved with trade-offs.

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

Dynamic Programming

Organisers: Pavel Albores and Sophie Carr

09/09/2014 : 11:00 : Room Windsor 0.05   Code: OR56A1355

Discrete-Time Markov Decision Processes with Iterated Coherent Risk Measures
Mr Shanyun Chu *(University of Liverpool)*
This talk introduces a Markov decision process in Borel state and action spaces with the aggregated (or say iterated) coherent risk measure to be minimized. For this problem, we establish the Bellman optimality equation as well as the value and policy iteration algorithms, and show the existence of a deterministic stationary optimal policy in both finite-horizon and infinite-horizon case. The cost function, while being allowed to be unbounded from below (in the sense that its negative part needs be bounded by some nonnegative real-valued possibly unbounded weight function), can be arbitrarily unbounded from above and possibly infinitely valued. Moreover, conditional value-at-risk (CVaR) is taken as an example for illustrative purpose. We also show the comparative advantage to other risk aggregation approaches and possible implication for practitioners.

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

Emergency Response, Disaster Management and Humanitarian Logistics

Organiser: Pavel Albores

11/09/2014 : 14:00 : Room Windsor 1.03   Code: OR56A1268

Towards A Solution to Partners' Proliferation Problem in Disaster Response Networks
Dr Emel Aktas *(Cranfield University)*, **Mrs Sara Hasani** and **Dr Ramzi El-Haddadeh** *(Brunel University)*

When disaster strikes, the failure to initiate a timely response along with the allocation of necessary resources can cost human lives. One of the main challenges raised against the success of a disaster response is the proliferation of actors involved in the disaster operation. Background: Due to the rapid increase in frequency and severity of disasters occurring in recent decades, mobilization of all available resources and partners leads to proliferation of skilled and unskilled, reputable and non-reputable partners. Research problem: This phenomenon known as the 'partner proliferation problem' may lead to the oversupply or inappropriate supply of the aid, loss of human lives and damage to the reputation of the humanitarian community. Aim: This paper develops a decision support model for partner configuration to reduce the negative impact of partner proliferation. The objective is to select the partners who are capable of fulfilling the needs of disaster affected area. Method: By utilising the severity assessment technique previously developed by the authors in addition to the scheduling and task allocation techniques the needs for each humanitarian cluster (WASH, Shelter, Food and nutrition and Health) is assessed and matched with the appropriate partners. Findings: The decision making model drawn upon the existing records of 11,000 previous disasters and the review of the related literature, gives rise to the scenario-based model of the disaster impact severity. The results are then used to define specific task-based scenarios to re-structure the disaster response network. Contribution: This process leads to selecting the partners who are capable of providing the resources for that specific scenario from a pool of potential partners and provides guidance to decision makers whilst alleviating the partner proliferation problem.

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

11/09/2014 : 14:30 : Room Windsor 1.03   Code: OR56A1373

Tackling Flood Preparedness and Response: Combining GIS and Optimisation
Dr Pavel Albores, **Dr Christopher Brewster** and **Mr Oscar Rodriguez** *(Aston Business School)*

The elevated number of disasters globally combined with high marginalization and vulnerability levels in many countries are stressing the importance of efficient and effective disaster management. Moreover, the complex environment surrounding disaster situations along with the fundamental need to protect and provide for disaster victims are increasing pressure on both academics and practitioners to provide reliable tools for decision making. Therefore, the field of emergency logistics is acquiring a crucial role aiming to provide adequate care and support for people affected by catastrophic situations; dealing with a large number of stakeholders, scarcity of resources and high stakes. Given the challenges posed by disaster management for decision-making, Operational Research has proven to be a valuable support to address several of the logistical activities required to face catastrophic situations through the use of several techniques, but still with some shortcomings. Floods are amongst the most frequent and dangerous disasters globally, and the particular features of these disasters pose both challenges and opportunities for adequate decision-making. Considering the geographical nature of floods, the use of Geographical Information Systems (GIS) can provide interesting

insights to include in the decision-making process. Hence, this research will introduce a combination of GIS with multi-objective optimization to develop a system for disaster management, considering multi-agency collaboration for the location and operation of emergency facilities, along with the pre-positioning of relief commodities and decisions related to distribution after the disaster. This presentation will show some of the problems yielded by poor disaster management in the past and there will be an application of the system developed for a real case scenario to exhibit the advantages of the inclusion of the GIS and multi-agency collaboration, along with the use of multiple criteria for effective and efficient disaster management.

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

11/09/2014 : 15:00 : Room Windsor 1.03   Code: OR56A1429
Importance of Behavioural Operation Management in Emergency Logistics
Mrs Priyanka Roy, **Dr Pavel Albores** and **Dr Christopher Brewster** *(Aston University)*
Purpose: Emergency logistics is the process of planning, managing and controlling the efficient flows of relief, information, and services from the points of origin to the points of destination to meet the urgent needs of the affected people under emergency conditions (Sheu, 2007). In the last twenty years, 4.4 billion people have been affected by disasters (UNISDR, 2012). In the disaster management umbrella, emergency logistics is a very useful stream of research to accomplish that is because of its high relationship with operational research (Caunhye et al., 2012). The complexity of emergency logistics of recent disaster indicated the need of more research to improve the decision making process. In our research we introduce behavioural operations management/ operations research to improve the decision-making process of the logistical manager. This paper aims to facilitate undertaking research focused on the effects of human behaviour, judgement, decision making in the emergency logistics perspective. Methodology/Design: This paper presents a framework for identifying and addressing behavioural issues in emergency logistics perspective. In this paper we adopt Bendoly et al's. (2006) framework and apply it to the emergency logistics field. The framework will identify and classify behavioural assumptions employed in existing models and analyse how they can be represented using behavioural OR. Findings: Behavioural operation research is an emerging area in logistics and supply chain management. Therefore presenting the behavioural issues in the emergency logistics explores the interaction of human behaviour in the decision making process and also identify the future trends of research. Originality/ Value: This paper highlights an important research area and methodology. It further presents potential future research area in which interested researcher could address such topics.

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

Energy

Organisers: Prasanta Dey and Kostas Petridis

09/09/2014 : 14:00 : Room Windsor Auditorium   Code: OR56A1320

Evaluation of Risk and Opportunities Arising from Dynamic Electricity Pricing in Nordpool Power Market

Mr Rayko Toshev, **Prof Petri Helo**, and **Prof Jussi Kantola** , *(University of Vaasa)*

Nordpool spotmarket provides the world biggest marketplace for buying and selling power in the Nordic and Baltic regions. The advances in electricity trading markets are giving single consumers the power to participate at market as active generation node and sell surplus energy or demand limiting reaction, offering both day-ahead and intraday markets to its customers. The purpose of this article is to produce dynamic electricity price market risk analysis and use it to outline opportunities for technological development of companies in the energy sector. We evaluate electricity spot price market risk daily and constrict Value at Risk measure with Historical and Monte Carlo simulations for portfolio of electric capacity storage. The following questions are discussed: is the electricity market price risk level in Finland, Sweden, Norway and Estonia? Does Nordic electricity market increase or decrease volatility of electricity prices? Our inquiry showed decreasing volatility and stronger correlation among energy risk factors. Based on the backtesting results it can be derived that Value at Risk models that are commonly used in stock markets are suited for measuring market risk in energy trading. The process described in this work can be used as tool for companies in electricity market sector for combining risk as proactive approach in technology adaptation. Future modification of the model can be tested to validate if extending risk factors works the same way for other market sectors.

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

09/09/2014 : 14:30 : Room Windsor Auditorium   Code: OR56A1407

Proposing a Hybrid 0-1 Weighted Goal Programming/DEA Approach for the Optimal Design of Renewable Energy Production of Greece

Mrs Eleni Zografidou and **Dr Garyfallos Arabatzis** *(Democritus University of Thrace)*, **Dr Prasanta Dey** *(Aston University)* and **Mr Konstantinos Petridis** *(Democritus University of Thrace)*

Traditional plants of energy production have nowadays been replaced by renewable energy production plants and in general a switch to renewable energy forms has been noticed. Being free of high levels of GHG gas emissions, renewable energy is considered to be a clean energy form, which satisfies the requirements of Kyoto Protocol and European Environmental Directives. Besides the environmental aspect, investments in renewable energy production plants are financed in order to satisfy the energy needs and accomplish social and economic goals. In this work, a 0-1 Weighted Goal Programming (WGP) model is presented for the optimal design of the renewable energy production in Greece. Greece has 52 prefectures where each renewable energy plant can potentially be installed. Constraints are imposed to exclude specific renewable plants from some prefectures based on previous studies and resource availability or weather data. In general, the presented model takes into account economic, environmental and social criteria. The criteria are a-priori defined and concern the following: Energy production of each plant (Solar, Wind, Hydro, Geothermal and Biomass), Investment Ratio, Operation and Maintenance Costs, Tonnes of CO_2 avoided (tCO_2/y), and Jobs created. Due to different weights on the objective function, several scales of importance have been

considered. Based on this fact there are m*n! solutions from the WGP model, if weights are divided into n scales and m intervals. In the second stage of the analysis, Data Envelopment Analysis (DEA) approach is used in order to filter the best out of possible m*n! solutions that form the Pareto front. The inputs of the study are considered the slack variables that correspond to a goal's underachievement and as outputs the slack variables that correspond to a goal's overachievement. Technical Efficiency (TE) is used to normalize solutions' efficiency.

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

09/09/2014 : 15:30 : Room Windsor Auditorium   Code: OR56A1285
An Overview of Operational Research Methods for Offshore Wind Modelling
Dr Dylan Jones *(University of Portsmouth)*
This seminar presents an overview of how Operational Research (OR) methods can be used in order to assist decision making in the offshore wind sector. An overview of current used OR methods in the sector will be presented, drawing on the authors' experience gained on several European Union funded projects. Potential future uses of OR to reduce costs, facilitate stakeholder consensus, and gain logistic efficiencies will be discussed. An example use of multiple-objective method will be presented and the results discussed.

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

09/09/2014 : 16:00 : Room Windsor Auditorium   Code: OR56A1304
An Approach for Analysing the Impact of Different Pricing Mechanisms on Electricity Distribution Grid Utilisation
Dr Valentin Bertsch, **Prof Wolf Fichtner**, **Mr Marian Hayn** and **Mr Manuel Ruppert** *(Karlsruhe Institute of Technology (KIT))*
Electricity generation is currently being transformed with an emphasis on renewable energy sources (RES) and the implementation of smart grid technologies leading to a fundamental, structural rearrangement of the system. Centralised power generation is increasingly replaced by small-scale, distributed generation units which are characterised by their only partially predictable, fluctuating power output. The traditionally observed power flow from few power stations feeding in on transmission grid level towards consumers in lower voltage levels is no longer assured in regions with high penetration of RES. In view of the changing system, smart grid technologies can contribute to a cost-efficient and stable operation of distribution grids with a high share of RES. The technological advance in information and communication technology (ICT) can allow for extending monitoring and control to lower voltage levels and reducing the required investments in traditional grid reinforcement measures. In addition, ICT provides the infrastructural basis for implementing demand response measures, i.e. for realising load flexibility of end-consumers – either by direct control or by dynamic price incentives. For the latter, different pricing schemes are discussed, which contribute to maintaining voltage stability or avoiding capacity overloads in distribution grids. The approach presented in this paper consists of two components. The first component is a residential price elasticity model, which was developed using metering data from a field test including approx. 1000 households in Southern Germany with a tariff based on dynamic electricity prices. The resulting residential demand profiles provide the input for the second component, a probabilistic investigation of the low-voltage grid utilisation using power flow analysis, which solves the problem of nonlinear equations representing the steady grid state by applying the Newton-Raphson algorithm. Results are presented for a case study in a low voltage grid providing insight into the impact of different pricing mechanisms on the grid utilisation.

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

Forecasting

Organisers: Sven Crone and Devon Barrow

Code: OR56A1350
How Change of the Relative Importance of Product Attributes to Consumers can Influence Sales Forecasting Methods in Consumer Electronic Goods
Mr Semco Jahanbin, **Prof Paul Goodwin, Dr Sheik Meeran** and **Dr Joao Quariguasi Frota Neto**
(University of Bath)
Customer preferences are not stable, especially where a consumer needs to make a complex or unfamiliar decision. This is, to some extent connected with the theory of bounded rationality, which asserts that decision-makers have a limited capability to process information. As a result they use or recall only a certain subset of attributes during the decision-making process. If the subset changes over time, perhaps because some attributes become more or less salient, then clearly the relative importance of the attributes in the decision making process will change as well. Another reason for instability of customer preferences is the rapid technological development in consumer electronics products. As a result, some attributes have become more (sometimes less) important over relatively short periods of time. In this research the instability of consumer preferences for different attributes for a purposive sample of electronics products will be examined and compared from different angles with the aim of finding its influence on choice based conjoint analysis as a new product sales forecasting method. If evidence of changes in the relative importance of features is found through this comparison, it means that a static choice based model based on consumer responses made prior to the launch of a product may soon become out of date and hence any forecasts based on the models may have large errors. If not, it provides reassurance for those using static CBC models for forecasting sales of products with short life cycles.

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

09/09/2014 : 11:30 : Room Windsor 1.02   Code: OR56A1446
The effect of data format on judgmental forecasting
Prof Nigel Harvey *(University College London)*
People scrutinize time series data to make judgmental forecasts or to make judgmental adjustments to formal forecasts derived from those data. Does the format in which the data are presented affect their forecasting performance? First, I discuss work that indicates that data containing trends are processed better when they are presented graphically than when they are presented in tabular form. Next, I outline findings showing that people who see data presented as bar graphs make worse forecasts than people who see data as line graphs or unconnected points. Our analyses show that this is because their forecasts from bars are lower and contain more noise. Finally, I report some experiments designed to study whether this effect arises because people's forecasts are drawn downwards as their attention is attracted towards the solid representation of data provided by bar charts. In one of these, we examined graphs of negative data that were depicted beneath the horizontal axis: in the bar graph condition, bars came down from that axis instead of going up from it. If the effect arises because bars attract people's attention and because forecasts are displaced towards the centre of attention, the original effect should be reversed: forecasts should be displaced upwards rather than downwards. This is, indeed, what we found. Our findings have direct implications for the way data should be

presented for judgmental forecasters and indirect ones for the way they should be presented by forecasting support systems to allow judgmental adjustment of formal forecasts.

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

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11/09/2014 : 14:00 : Room Windsor 1.04   Code: OR56A1331

Forecasting the Required Spares for Unsupported Products
Dr Jonathan Malpass *(BT)*
In order to provide the best service to its customers, BT is continually upgrading its network. There are many hundreds of components in the network which are supplied by other companies who, in turn, are continually improving their products. If a company stops producing – and then supporting – a product, it is vital that BT has the capability to forecast accurately when they need to carry out an upgrading programme to replace old products with the latest versions. This presentation will describe the approach that is being adopted by BT's Supply Chain. The forecasting process involves forecasting the requirements for several years and running Monte Carlo simulations in order to estimate the likely point in time when the spare stock will be depleted. A 'frontier curve' is produced which indicates the required number of spares to support a product once the supply is terminated.

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

11/09/2014 : 14:30 : Room Windsor 1.04   Code: OR56A1334

Cross-validation Aggregation for Combining Autoregressive Forecasts
Dr Devon Barrow *(Coventry University)* and **Dr Sven Crone** *(Lancaster University)*
This research study evaluates cross-validation for combining forecasts, and is to our knowledge, the first application of Monte Carlo cross-validation to forecast combination. Monte Carlo cross-validation combines the benefits of both cross-validation and repeated random sampling in a single approach, splitting the original data into two mutually exclusive training and validation datasets based on a random assignment of observations to the validation set. This has the property that the training/validation proportion is independent of the number of folds, offering more flexibility in the size and number of training samples compared to k-fold cross-validation. Simultaneously the random sampling induces a variance similar to bootstrapping with some observations selected more than once or not at all. The study also provides: 1) a systematic evaluation based on time series length and equal number of samples, 2) an assessment of performance in terms of a bias and variance decomposition of the forecast errors and 3) the first comparison of cross-validation, and bagging for time series forecast combination. An empirical evaluation of the proposed combination framework demonstrates significant improvements in forecasting accuracy, especially for short time series, and long forecast horizons.

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

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11/09/2014 : 15:00 : Room Windsor 1.04   Code: OR56A1343

Sales Forecasting Models: an Application to the Automobile Sector
Mr Dilip Raghupath and **Dr Bahman Rostami-Tabar** *(Ecole Central Paris)*
Forecasting sales for sales & operation planning is a vital stage in a supply chain. A good sales forecast system enables a company to have an edge over competitors by saving on stock holding costs, material cost and confirm with just in time all while reducing wastage. In this study, we evaluate the performance of various methods for forecasting new car sales at PSA Peugeot-Citroën. The data used include monthly series of sales, all supplied to us by the company. The forecasting methods implemented in the case are univariate time series

approaches, and econometric models. The proposed models are compared to the current approach that uses the budget perimeters to forecast sales. We propose an intelligent forecast system that can be adapted to the needs and trends of a company.

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

Game Theory

Organiser: Aristotelis Boukouras

09/09/2014 : 12:00 : Room Windsor 1.02   Code: OR56A1376

Approximation of Epsilon-Aumann (Epsilon-Strong Nash) Equilibrium by Using Computational Intelligence Methods

Dr Noémi Gaskó, **Dr D. Dumitrescu, Dr Rodica Ioana Lung** and **Dr Mihai Suciu** *(Babes-Bolyai University)*

Aumann (strong Nash) equilibrium is an important refinement of the Nash equilibrium, which takes into consideration the benefits of cooperation among players. The epsilon-Aumann equilibrium is presented as an alternative solution that relaxes the conditions required in the case of the Aumann equilibrium, by allowing a small deviation (epsilon) in players' payoffs. An effective method to compute the epsilon-Aumann equilibrium, based on a generative relation and a nature inspired heuristic, is proposed. The advantages of this method are that it can easily adapt to different epsilon values (positive and negative), it permits the assignment of different epsilon values to each player and it is also capable to compute several epsilon-Aumann equilibria in a single run. Numerical examples are used to illustrate the efficiency of our approach.

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

10/09/2014 : 11:30 : Room Windsor 1.03   Code: OR56A1413

Keynote: How Game Theory and Operational Research Can Help Each Other

Prof Bo Chen *(University of Warwick)*

In this keynote talk, I will present a number of my recent research projects as examples to demonstrate how game theory and operational research interact. These projects range from scheduling to routing, from supply chain analysis to project management, from electricity market to traffic coordination, and from sporting decisions to jury voting.

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

11/09/2014 : 14:00 : Room Windsor 0.03   Code: OR56A1415

Planning against Terrorist Attacks: an Algorithm for Enhancing Defensive Resources Allocation

Dr Mischel Belderrain *(Technological Institute of Aeronautics)*, **Mr Marcelo Zawadzki** *(Brazilian Air Force Institute for Advanced Studies)* and **Dr Gilberto Montibeller** *(London School of Economics)*

Resources allocation for counterterrorism purposes remains a significant challenge to decision analysts, mainly due to terrorists' adaptive behaviour. One way to consider the interactivity between attack and defence in counterterrorism context is resorting to Game Theory. We argue that this problem may be well represented as a Stackelberg game. In this game, the defence, who is the lead player, looks for the defensive measures portfolio that may discourage the attacker from performing an attack. On the other side, the

follower player, that is the attacker, must decide whether or not to attack, and if attacking, he must decide what to attack. We start solving a complete information simple game that we call the base game. Then, we encompass on the base game uncertainties that, naturally, the defence has on the attacker preferences and beliefs. We use Monte Carlo simulations to obtain a predictive probability distribution of the attacker's behaviour and we solve a third game named the total game to define the best strategy (defensive measures portfolio) that the defence may adopt to discourage the attacker. To face the problem of scalability that is present in most of Stackelberg games, we present an algorithm that, by analysing several decision problems, reduces the scalability issue. The algorithm takes into account only a subset of defensive measures instead of considering all possible combinations of protective measures, thus avoiding the combinatorial explosion.

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

11/09/2014 : 14:30 : Room Windsor 0.03   Code: OR56A1295
A Game Theory Approach to PPPs
Dr Aristotelis Boukouras, Dr Jamal Ouenniche and **Mr Mohammad Rajabi** *(University of Edinburgh)*
The concept of public-private partnerships (PPPs) has attracted worldwide attention and acquired a new resonance in the context of developed and developing countries. Several types of analyses have been proposed to address PPP projects including Cardinal Game Theory. In this paper, we propose an alternative Game Theory-based analysis framework. In addition, we propose tools for operationalizing such framework including an algorithm for finding an optimal Generalized Nash Equilibrium. An illustrative example is provided.

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

11/09/2014 : 15:00 : Room Windsor 0.03   Code: OR56A1273
Cournot-Stackelberg Games in Competitive Delocation
Dr Diego Ruiz-Hernandez *(University College for Financial Studies)* and **Dr Javier Elizalde** *(University of Navarre)*
During economic contractions, the number of commercial facilities decreases. Firms need to shrink their network minimising the market share lost. We address the problem of closing facilities in a duopolistic market under myopic, Cournot and Stackelberg competition. We present a binary integer programming formulation, and provide algorithms for non-cooperative solutions. Existence of Nash equilibrium is empirically tested.

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

Health and Social Care

Organisers: Kirandeep Chahal, Navonil Mustafee, Lampros Stergioulas and Lisa Butland

09/09/2014 : 11:00 : Room Windsor 0.04   Code: OR56A1409

Keynote: Health Care Simulation for Policy Assessment: Widening Requirements Capture with Soft Methods

Prof John Powell and **Dr Nav Mustafee** *(University of Exeter)*

A simulation study consists of several well-defined stages, e.g., problem formulation, model implementation and experimentation. The application of multiple techniques in the model implementation stage is referred to as hybrid simulation, which we distinguish in this paper from a hybrid M&S study, the latter referring to studies that apply methods and techniques from disciplines like Operations Research, Systems Engineering and Computer Science to one or more stages of a simulation study. We focus on the first stage of a simulation study (and by extension a hybrid M&S study), viz., eliciting the system requirements, and conduct a review of literature in Soft Systems Methodology for healthcare operations management. We discuss the potential for the use of Qualitative System Dynamics as an additional soft OR method, complementing (rather than supplanting) existing approaches, which can further aid the understanding of the system in the problem formulation/conceptual modelling stage of a Hybrid M&S study.

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

09/09/2014 : 11:30 : Room Windsor 0.04   Code: OR56A1400

Application of Agent-Based Simulation for Sustainable Strategic Planning in Healthcare

Dr Anastasia Anagnostou , **Mr Masoud Fakhimi**, **Dr Simon J. E. Taylor** and **Dr Lampros Stergioulas** *(Brunel University London)*

Sustainable development disciplines are becoming an increasingly integral part of managerial discourse in different industries. Healthcare services have begun to undergo some changes in response to these challenges as sustainable development issues have become more prominent in all sectors of society. Healthcare stakeholders have realised that long-term success is profoundly dependent on balanced treatment of the Economic, Social and Environmental responsibilities through the lenses of the "Triple Bottom Line" (TBL) framework. Modern healthcare reforms are required to consider the TBL aspects in order to address the additional constraints of financial resources shrinkage, pressure to reduce the environmental impacts and demand for improving the quality of healthcare services. However, adopting such approach, particularly in healthcare, is not a trivial task. Additionally, hindrances remain in designing, implementing and improving such practices in healthcare on a regular basis. So, as sustainability is becoming more vital for healthcare, dealing with its challenges are also becoming more complex and costly. Modelling & simulation (M&S) is a valuable tool for studying complex systems. Since decision makers require further understating about the system for sustainability analysis, the scope of systems' modelling that hitherto focused predominantly on productivity-related performance measures has to gradually expand to incorporate sustainability-related criteria. In this research, we argue that Agent-Based Simulation (ABS) can facilitate sustainability modelling. ABS is being used to model complex adaptive systems that consist of interacting elements and is used mainly to model decentralised, complex systems that consist of many inter-dependencies. Therefore, ABS could help modellers to develop models for socio-environmental systems. However, the related literature indicates that

there is little practical support for applying ABS for sustainability purposes. This research investigates the application of ABS for analysing sustainable planning strategies for Emergency Medical Services (EMS).

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

09/09/2014 : 12:00 : Room Windsor 0.04   Code: OR56A1431

Listening to the Voices: Redesigning Mental Health Services around What The Patient Has To Tell Us

Dr Claire Ginn and **Dr David Halsall** *(NHS England)*

Alex steals fast cars and gets sent to prison. In prison he gets his medication and regular sleep. But once released the cycle begins again. We will describe how operational researchers have extended their analytical capability into a new area of co-production of patient feedback using in-depth interviews and video storytelling to influence policy making. The parity of esteem is a bold NHS objective requiring mental health to be treated equally with physical health. The moral argument behind this aim is compelling. However putting it into practice is extremely difficult and sets many challenges for OR practitioners. For example many of the techniques adopted to get patient feedback following care are very difficult to apply in a mental health setting. Operational researchers never shy away from problems which are complex and pressing. Analysts' in NHS England was been experimenting with a new method of capturing the needs of patients with complex mental health conditions as a way of addressing limitations in traditional patient feedback systems. An in-depth interview has been carried out with a patient who has schizophrenia and at the age of 27 has been to prison 14 times. A short video using an actor to play Alex (not his real name) has then been made by the analytical team to describe what it is like to be on the receiving end of NHS mental health care. This a powerful story showing what needs to be done if we are to achieve parity of esteem for patients like Alex.

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

09/09/2014 : 14:00 : Room Windsor 0.04   Code: OR56A1249

Improving Performance in Healthcare Organizations through Lean Thinking and Six Sigma: A Case Study

Prof Federico Barnabe' *(University of Siena)*, **Mrs Caterina Bianciardi**, **Mrs Letizia Bracci** and **Mr Jacopo Guercini** *(AOUS Siena)* and **Dr Pasquale Ruggiero** *(Brighton Business School)*

It is more than 30 years that, starting from the USA and the UK and later spreading worldwide, a reform process of public administrations was recognised as necessary in order to increase their capacity to provide more effective services at the same time spending less. After three decades the call for reforming the public sector is still urgent, and austerity, cutbacks and reductions in public spending are often mentioned as feasible policies. In this context, great emphasis has being subsequently given to the so called 3E (efficiency, effectiveness and economy). To this aim, among the feasible approaches to be used, Lean Thinking (LT) has recently attracted the attention of academics as well as practitioners and is increasingly implemented in public sector organizations and, in more detail, in the health care sector. Starting from these considerations, this work presents a case study where Lean Thinking tools and the Lean Six Sigma methodology were applied to increase efficiency and improve patients flow. The aims pursued by the study are twofold: a) demonstrate how it is possible to apply LT to pure services producers sectors; b) discuss how the integration of LT principles with Six Sigma methodology provides a coherent approach to performance improvements in healthcare institutions, not only in terms of technical efficiency but also for an overall improvement in value creation for all their customers. To do so, the paper presents and discusses the design and implementation of a LT project in the emergency department of an Italian healthcare organisation. Data and information were collected and analysed cooperating with the Team in charge of the Project and interviewing some professionals working in the ER.

Assessing the Validity of Operations Management (OM) and Strategic Management Principles in Healthcare Delivery Operations
Mr Ganye Kwah Driscole *(University of Southampton)*

The value of a great healthcare system to an economy is enormous and any country that succeeds in designing the best least-cost (cost efficient) healthcare system would lead in creating a competitive economy. A great healthcare system, defined as that which is accessible, affordable, timely, well managed with explicit and properly defined processes, safe and dependable, among others, means that the healthcare system is reliant upon by all players of the economy for a healthy population and economic competitiveness. Governments and operations management (OM) researchers of the developed economies have been working to strengthen their healthcare systems to reflect these characteristics and objectives but despite their efforts and heavy investments, healthcare deliveries in the developed economies continue to show signs significant strategic and operational inefficiencies similar of those observed in the manufacturing and other services organisation many years past. One area in the healthcare delivery system and process that exemplifies the current state of affairs in healthcare delivery, its problems and effects and reactions to research is the accident and emergency (A&E) department. A&E struggles with operational efficiencies which are either driven by its own internal operational strategies or by influences of the healthcare process external to A&E. This study starts by assessing the extent to which OM approaches drawn from manufacturing and service organisations have been successfully implemented and tools used in the healthcare sector. We question whether OM solutions provide any satisfactory model for improving complex integrative processes inherent in healthcare delivery. Specifically, we seek to assess the extent to which external systemic factors such as the distribution of GP surgeries and A&E departments can influence the flow of non-referred patients to A&E. Lowered rates of arrival of non-referred patients would means less waiting, congestion, improved care processes and throughput, and overall reduced delivery cost and improved efficiency.

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?: Somewhat

Elective Patient Treatment Governed by a Maximum Waiting Time Policy: Insights from Queue Models
Dr Dawid Kozlowski *(University of Southern Denmark)* and **Dr Dave Worthington** *(Lancaster University Management School)*

Many public healthcare systems struggle with excessive waiting lists for elective patient treatment. Different countries address this problem in different ways, and one interesting method entails a maximum waiting time guarantee. Introduced in Denmark in 2002, it entitles patients to treatment at a private hospital in Denmark or at a hospital abroad if the public healthcare system is unable to provide treatment within the stated maximum waiting time guarantee. Although clearly very attractive in some respects, many stakeholders have been very concerned about the negative consequences of the policy on the utilization of public hospital resources. With use of a queue modelling approach we show that maximum waiting time guarantee policies can reduce utilization of hospital resources, especially when imposed on small specialties. Patient booking, rescheduling and withdrawals are shown to be crucial to system performance. The aim of this paper is to support the enhancement of the quality of elective patient care, to be brought about by better understanding of the policy implications by hospital planners and strategic decision makers.

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

The Surprising Importance of the Apparently Trivial: OR and Common Sense in Health Care
Ms Penelope Mullen

Members of the general public – users, patients etc - can be faced with apparent illogicalities, errors and contractions when interacting with organisations. Instructions can seem vague, contradictory, irrelevant or even non-existent. Inappropriate 'standard' letters can cause confusion. Signposting is unclear or stops completely mid-route The 'computer' does not offer relevant input options and/or produces apparently unchallengeable illogical results Staff can find they have (or claim to have) no power to resolve problems. Even when staff acknowledge there is a problem, the response is often "that is how it works" or "that is what the computer says". Thus users face an apparent lack of common sense. Whilst such apparent illogicalities can be found in many types of organisations both public and private, they appear to be prevalent in health services. Does it matter? Aren't such issues unimportant? But frustrating experiences for patients could indicate inefficiencies in the system. Dealing with the consequences of 'illogicalities' can lead to further inefficiencies. Further, such illogicalities could undermine the benefits of potentially excellent OR applications in health care. So should such apparently trivial issues be the concern of OR? In addressing that question, this paper examines possible reasons for such 'illogicalities', including modern-day Taylorism, inadequately designed computer systems, defensiveness/hostility in the face of complaints and even in response to suggestions, and a general failure to view the world from the point of view of the user/patient. It explores potential impacts on the organisation and then advances some possible solutions including valuing spontaneous user/patient 'feedback', developing approaches to help view the world from the user's point of view and designing systems adapted accordingly..

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

Optimization of Courier Service in Hospitals
Dr Abdur Rais, **Prof Filipe Alvelos** and **Mr Joao Figueiredo** *University of Minho)* and **Ms Ana Nobre** *(Hospital of Braga)*

In recent years, healthcare has become an important part of a country's economy as the associated costs typically amount to a substantial portion of annual GDP. For continued increase in the longevity of general population and improved healthcare services, these costs are likely to continue to grow further. As such, it is important to control the costs of affordable healthcare especially when current financial environment urges further efficiency in all sectors of the economy. This talk considers a logistics issue in healthcare which is commonly faced by the hospitals and considered a cost concern. In particular, we address courier service at the Hospital of Braga in Portugal. We discuss the previous approach used at the hospital for providing this service and propose new optimization-based approaches. Compared to the previous approach, computational work shows that optimization can improve performance by around 50%. We have developed and installed an optimization software for daily planning of the courier service at the hospital. Among the key benefits from using this software, resource needed to maintain same service level as before decreased by 16.67% and urgent service needs can be attended to easily and quickly. Acknowledgement: This work has been supported by FCT within projects PEst-OE/EEI/UI0319/2014, PTDC/EGE-GES/110940/2009 and NORTE-07-0124-FEDER-000057; by ERDF through COMPETE Programme; by ON.2 O Novo Norte; and by NSRF through ERDF.

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

Information Systems

Organisers: Pavel Albores and Sophie Carr

11/09/2014 : 09:00 : Room Windsor 1.03   Code: OR56A1416

Temporal Data Structure and Performance Optimization

Mr Michal Kvet, Prof Karol Matiasko and **Mrs Monika Vajsova** *(Zilinska Univerzita v Ziline)*

Effective timed data processing belongs to one of the most important task of the development of current information and database systems. Object states storing methods valid in the past as well as states evidence, which will be valid in the future are essential elements to achieve suitable solution. However, standard temporal approach are based on paradigm storing only actually valid objects. If there is the requirement to process data using transactions, the problem is far more complicated. Extended column level temporal system is based on division objects and works with temporal column granularity. This system effectively stores data objects attributes based on the rate of the changes over times. Future valid data objects are managed using column level granularity using job functionality, too. The result is a new concept that brings the ability to define transaction data in the system which manages only the validity period - similar to bi-temporal system, but the root is uni-temporal system on column level. Size and performance represented by the approach time to get required data compared with the existing solution (uni-temporal and bi-temporal systems on object level) clearly show the quality of the proposed system. Moreover, significant factor is based on index structures, which optimizes approach methods and time. All changes are stored in temporal table, which stores all operations performed on the objects. It is based on usability, performance, effectivity and transaction management approach. It is mostly designed for communication systems, transport, medicine systems, and so on – simply in all systems, where the effectiveness of managed data is primary and necessary. It brings the data and allows creating future prognoses, optimizing processes and supports decision making.

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

11/09/2014 : 09:30 : Room Windsor 1.03   Code: OR56A1418

Database Queries Transformation and Optimization

Mrs Monika Vajsová, **Mr Michal Kvet** and **Mr Karol Matiasko** *(Zilinska Univerzita v Ziline)*

Nowadays, it is necessary to store large amounts of data in information systems. The most important part of the current information technology is based on database systems. Already in 1970, the relation model approach has been created and still has a great success thanks to several factors. One of them is just SQL (Structured Query Language), which is declarative. Thus, user defines the required data, but not how to get them. It is therefore necessary to define and develop sophisticated internal methods for managing and processing such queries in order to minimize the response of the system and global costs. To accelerate performance time of the SQL queries, it is therefore necessary to know the principle of processes, access methods and techniques, as well as to create appropriate data structures and indexes. Database systems offer wide range of possibilities to influence the execution process of SQL statement based on statistics, setting parameters or by using hints. It consists of these steps: parser - performs syntax and semantic analysis, optimizer - finds effective way for processing. Because of the time requirement, most results are based on heuristics. Row source generator creates the executing plan in the form of tree, the nodes represent row sources. The last step is the SQL execution. The results of the SQL statement are got using the executing plan.

This paper deals with the rules and algorithms based on graph theory to transform one query to another with better performance level and compares the proposed solutions in real database systems.

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

Infrastructure

Organisers: Fuzhan Nasiri and Andy Chow

A Novel Approach to Life-Cycle Management of Infrastructure Networks: Combined Optimization of Cost and Value

Prof Christoph Heitz and **Dr Lilach Goren Huber** *(Zurich University of Applied Sciences)*

Optimal life cycle management (LCM) is one of the central issues in asset management of infrastructures. Decision making in LCM aims at simultaneously maximizing the benefit that the infrastructure creates, and minimizing the costs for generating this benefit, while both benefit and costs have to be considered with a long-term view. Classical methods for LCM Decision making are commonly based either on life cycle cost (LCC) minimization, focusing on the costs, or on risk assessment, in which case the focus is on the supply quality as the central measure for the generated benefit. In this paper we claim that considering only one of the two aspects at a time often leads to sub-optimal decisions. We introduce a new approach to LCM optimization which combines both of these aspects – life-cycle costs and life-cycle value generation - and is particularly relevant for infrastructure networks. The approach consists of a novel modelling of an asset that puts at the center the value that an asset provides for the owner, which may be non-monetary. An asset is essentially defined in terms of the relation between this value and the investment in the asset throughout its life cycle, depending on a chosen life cycle policy. Based on this model we construct a computational tool for a quantitative optimization of LCM decisions. An important part is the budget allocation amongst the various assets within the network. It allows to combine the minimization of LCC together with various aspects that may contribute to the value assessment of an asset, such as risk, reliability and quality of supply. The tool is currently being implemented in a decision support software for asset management of various infrastructure networks. The paper introduces the theoretical basis for our new approach as well as practical examples for its application.

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

Comparison of Centralised and Decentralised Paradigms for Urban Traffic Network Management

Mr Rui Sha *(University College London)*

This study investigates the difference between centralised and decentralised paradigms for managing urban traffic networks. Centralised paradigm derives control policies for the entire traffic network by assuming a single decision maker. Decentralised paradigm allows individual components in the network (e.g. junctions) to derive local control policies with certain communication mechanism between these local decision makers. While centralised control system may provide a better solution in terms of optimising overall system performance, it can take huge computational time and effort especially for large networks. Moreover, centralised system could be more vulnerable to unexpected disruptions to the network. The advantages of decentralised systems are its parsimony and robustness. The control systems are tested on a road network in Bloomsbury, Central London. The results show that the centralised control policy generally outperforms the decentralised ones, while this is not surprising. Nevertheless, it is shown that the discrepancy in performances

between the two indeed will get increasingly small when the volume of traffic in the network gets higher and close to the physical capacity of the network. This is because when the network gets congested, there is not as much freedom for managing traffic compared with the less congested cases. This is interesting as it suggests that the benefit of centralised management can be overestimated under some circumstances. Further discussion between the two control systems includes computational requirement, response to unexpected events, and real time applications. These will be discussed in the full presentation. This study contributes to the study of efficient and resilient urban traffic control system. It will also have an implication to other infrastructure systems, such as water and energy, as will be discussed in the paper as well.

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

11/09/2014 : 11:30 : Room Windsor 0.03   Code: OR56A1296
Keynote: Operational Research Methods for Policy Analysis in the Power Sector
Dr Afzal Siddiqui *(University College London)*
In the past decade, the electric power sector has faced targets for improved sustainability, e.g., in the form of more renewable generation. Such requirements are often confounded by the fact that the sector has been deregulated in most industrialised economies. Thus, power companies need to comply with increasingly stringent emissions regulations while dealing with aspects of imperfectly competitive markets. Likewise, policymakers need to take into consideration the game-theoretic interactions within industry. From this perspective, operational research methods employing complementarity modelling can provide a framework within which both power companies and policymakers can assess strategic and regulatory decisions, respectively.

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

Inventory Research

Organiser: Mohamed Zied Babai

11/09/2014 : 13:30 : Room Windsor 0.05   Code: OR56A1379

Keynote: On the Value of Sharing Demand Information in Supply Chains
Dr Mohammad Ali *(Coventry University)*
Many companies are embarking on strategies to share consumer sales data among supply chain members. In most cases, this requires huge investments in information systems and training. Benefits from sharing information have been discussed extensively in the supply chain literature. However, a steady stream of research papers on Downstream Demand Inference (DDI) suggest that the upstream member can mathematically infer the demand at the downstream member. They claim that there is no value in sharing demand information. Subsequent papers scrutinise the model assumptions in this stream of research and show the conditions where the consumer demand can and cannot be inferred mathematically by the upstream member. Hence, the review of this literature clarifies when information sharing is and is not valuable. In the DDI literature, the evaluation of the conditions under which information sharing is valuable can help companies make more informed decisions on such investments. Under other conditions, where information sharing is not feasible (because of such issues as trust and confidentiality), DDI can prove valuable.

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

11/09/2014 : 15:00 : Room Windsor 0.05   Code: OR56A1365

Using Multi-Armed Bandit Methodology to Balance Learning and Earning in the Estimation of Customer Choice Models in Revenue Management
Ms Yalin Bi, **Dr Christine Currie** and **Prof Joerg Fliege** *(University of Southampton)*
It has been proved that choice-based Revenue Management can result in significant increases in revenue. Estimating customer-choice models is difficult, especially in situations where it is not possible to observe customers who enter the system but do not purchase a product. As these are live sales systems, it is important that the system continues to earn revenues while the parameters are being estimated. We use a Multi-Armed Bandit experiment to find the optimal trade-off between learning and earning in choice-based Revenue Management. We use the Multinomial Logit model to describe customer preferences, and a variation of the Expectation-Maximization (EM) algorithm is used to jointly estimate the parameters of this model and the customer arrival rate. This constitutes the learning phase. Approximate dynamic programming is used to find the set of optimal prices at each time step as part of the earning phase. The talk will describe the complete methodology that we have implemented and provide some numerical 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?: Somewhat

Making an Impact

Organisers: Ruth Kaufman, Ramune Gedgaudaite and Aidan Cross

10/09/2014 : 08:15 - 08:30 : Room Windsor 0.02 and 0.03
MAI - Introduction and Welcome - Coffee and Croissants!
Ruth Kaufman *(Independent Consultant)*
The 'Making an Impact' stream is specifically designed for practitioners - people whose day-job is to help solve their organisation's problems, whether as in-house or external consultant. Each event within it is intended to help participants build on existing experience, develop practice, make links and enable cross-fertilisation through sharing knowledge and expertise.

10/09/2014 : 08:30 - 09:30 : Room Windsor 0.02 and 0.03
Speed Networking
Ramune Gedgaudaite *(Ebiquity)* **and Aidan Cross** *(DWP)*
A fast-paced opportunity to meet others through rapid face-to-face conversations. Be prepared to engage with other like-minded professionals, regardless of experience, background or specialisation.
Bring notepad and pen, and your business cards if you have them (blank cards will be provided). Warning: latecomers may have to wait for a gap in the proceedings before they can join in.

10/09/2014 : 11:00 – 12:30 : Room Windsor 0.03
The Academic-Practitioner Bazaar … A Poster Session with a Difference
Ramune Gedgaudaite *(Ebiquity)*
A case study of academic-professional practitioner collaboration shared by Kees van Haperen, and discussion on what makes a collaboration successful, effective and impactful, will be followed by ten or so 60-second presentations from academics and practitioners, aimed at persuading you the audience to visit their poster/flipchart describing a relevant problem that could be solved by closer academic-business relationship. Expected attendees include avant-garde representatives from organisations such as FICO, Manchester Metropolitan University, Atkins, London School of Economics, Ebiquity Plc., University of Warwick, OMG Plc., Henley Business School and others.

Making an Impact – Workshops

The list below is not necessarily in the order of presentation. Full details and descriptions will be available from the conference reception.

10/09/2014 : 15:00 - 16:15 : Rooms Windsor 0.02 – 0.05 and 1.02 – 1.05

MAI56: Workshops: running in two sessions on the afternoon of 10 Sept 2014
Aidan Cross *(DWP)*

Chair	Title	Content
Sophie Carr *(Bays Consulting)* Ian Seath *(Improvement Skills Consulting Ltd)* and David Wrigley *(ORvis Consulting Ltd)* Code: OR56A1452	The clash of theory and reality – when project management becomes people management	In this interactive workshop we'll examine three typical project scenarios where people, not data or methodologies, are at the heart of the problem, using real world case studies to identify how problems can be identified early and be avoided or addressed if they do occur.
Sayara Beg *(Datanut)* Code: OR56A1453	Introduction to Data Science	The Data Science workshop will give attendees a taste of what a data scientist would need to think about when approaching a challenge. In the workshop we take a small problem and break it down step by step, in a fun way, following data science governance and standards. You will leave the workshop with an understanding of data science concepts.
Ian Seed *(Congentus)* Code: OR56A1449	Generating Options to Use in Soft O.R.	A lot of the time when evaluating choices significant effort is placed on the analytics side. Scoring, collecting data, producing mathematical models and carrying out sensitivity analysis are all aspects we're extremely familiar with. However, what if the choices being evaluated aren't the right ones or incomplete? Even the most sophisticated analytics will not be able to rescue that. Typically, only rudimentary brainstorming is used to generate the options which is known to be a poor technique, at best. We will be exploring a few structured methods for generating options that are a significant improvement on traditional brainstorming in an interactive session.
Richard Vidgen *(Hull University Business School)* Code: OR56A1450	Machine learning with R: an introduction	The measure of success of any project is whether you met the customer's needs, which isn't necessarily giving them what they asked for! Software development teams all over the world have adopted Agile. They believe it's the approach that gets them closest to this goal because it puts the customer at the centre of the development process. But even in the software world there are cynics who say Agile is just being chaotic and lazy. What do you think? Are there lessons to be learned from Agile for delivering successful O.R. projects? Join us in this workshop to learn about Agile, hear some tales from the trenches at SIMUL8 Corporation from applying Agile in software development and O.R. projects and debate the merits of Agile as a framework for delivery in O.R. Will Agile make your next project a success or just add more chaos?

Chair	Title	Content
Michael Mortenson *(Loughborough University)* Code:OR56A1451	Model Students: An Operational Researcher's Guide to Upskilling for Analytics	With numerous reports forecasting significant skills shortages, and Harvard Business Review declaring "data scientist" as the sexiest job of the 21st Century, does big data mean a big opportunity or a big threat for operational researchers? As analytics grows in reach and prominence, how can O.R. maximise this opportunity and establish a position at the heart of analytics? Incorporating the results of two years of research into the area, this talk will discuss both the "hard" and "soft" skills most in demand with employers, from programming languages to predictive modelling, and some of the low- and no-cost tools that can be used to "upskill". The workshop will also provide the opportunity to share your experiences of advanced analytics in practice, and debate the future of O.R. in the era of big data.
Giles Hindle *(University of Hull)* Code: OR56A1454	Field Notes from Consultancy Using Soft O.R. and Problem Structuring Methods	Soft O.R. and Problem Structuring Methods constitute a set of approaches to tackling complex problems and strategic thinking. They have been successfully used in a wide range of contexts and usefully expand the area of application for analytical consultants and the O.R. discipline. Drawing on the author's own Action Research programme spanning 20 years, a set of field notes for successful practice is presented. The author will explore typical problems, intervention modes and project designs and give practical advice on the application of techniques such as situation mapping, picturing, conceptual modelling and systems thinking. Reference is also made to a spectrum of consulting approaches from facilitative/ participative to analytical/ expert.
John Morton *(CPM Consulting)* and Richard Vidgen *(Hull University Business School)* Code: OR56A1456	Creating value from Big Data and business analytics: the organisational challenge	Advances in ICT have led to an exponential growth in the volume, variety, granularity and rate of generation of the data (velocity) that organizations can access. Big Data and business analytics are becoming an increasing worry for the company board and senior executives. Have they "missed the boat", is there any value in the data anyway, and if there is, is it relevant to their organization? A summary of the results of recent research into how organisations create value from [big] data will be presented. Attendees of the workshop will then be asked to engage in structured break-out groups to identify the challenges that organisations face in creating value from their data. The findings of each group will be summarized in plenary. If appropriate, the workshop will be followed up with a Delphi study to consolidate the issues and to identify priorities for action.

Chair	Title	Content
Benjamin Schumann *(DecisionLab)* Code:OR56A1455	Get me out of this grid! Agent-based modelling in geospatial environments	Most people like beautiful maps. They provide a huge amount of information visually without overloading our limited information processing capabilities. Moreover, many O.R. practitioners also like agent-based modelling: it is a useful alternative for solving many O.R. problems by defining individual behaviour. The problem is that these two worlds rarely meet. They should! Often, O.R. problems require agents to act in a geospatial environment: Where do you place water reservoirs? What airport destinations are best suited for an airline? How do people use road networks? Geospatial analysis can provide new insights into problems as maps contain a lot of information without overwhelming users. To date, bringing together Agents and geospatial analysis was mostly handled in two ways: • Neglect the geospatial bit altogether, or • Draw geospatial "map" manually. Why is that? Quite simply, both agent-based modelling and geospatial analysis tools are rather sophisticated. Mastering both is a challenge. Linking both worlds is even harder. We at decisionLab do our best using the AnyLogic software. So far, AnyLogic has been a great tool for agents but was weak with maps. This is about to change... In this workshop, you will get to see the future of agents and geospatial modelling: you will send taxi drivers through the maze of central London. You will create a network of pharmacies in one click and get delivery trucks to serve them. You will see agents actually following Google Maps routes (or OpenStreetMap, if you prefer)! And you will learn about other cool capabilities of agents in spatial environments that were fiendishly difficult to do until ... now!
Andy Harrison *(FICO)* Code: OR56A1457	Optimising the real world, robustly	We all know that the world is messy, complicated, complex, uncertain and non-linear. But many areas of Operational Research have been very successful by assuming that the world is not messy but simple, certain and linear. Linear programming, in particular, has delivered significant, tangible benefits to industrial problems by assuming the world is certain and linear. Bigger and every more powerful computers, grids and clouds together with breakthroughs in solver technology have meant we can solve bigger and bigger linear programmes to allow us to tackle industrial problems that just a decade ago were impractical to even consider. This will become even more so, as Big Data delivers tera-, peta- and perhaps even zeta-bytes of data to formulate ever larger linear programmes. However, with ever more data comes more errors. In addition predictions made from this data are often uncertain. With this in mind, earlier this year, the FICOTM Xpress Optimization Suite introduced support for robust constraints. This means it is now possible to model uncertainty and obtain robust optimal solutions efficiently.

Chair	Title	Content
		In this workshop we will use the FICOTM Xpress Optimization Suite to explore the implementation of robust constraints and their impact on the solution. This will include the implementation of a robust optimisation model for production planning under uncertainty. So come to the workshop ready to do some hands on modelling. If you want to bring your laptops, I can supply a copy of Xpress to use on a USB key (or if you're keen you can get your own copy from http://www.fico.com/xpress). But whether you have a laptop available or not you will have an opportunity to can roll up your sleeves and build some robust optimisation models. If you enjoy the workshop and you want to explore optimisation and using the FICOTM Xpress Optimization Suite more, there is a three day training course organised through the OR Society, which will run 18th – 20th November in Birmingham. For more details see http://www.theorsociety.com/Pages/Training/Courses/2014/324.aspx
TBC	Designing a Career in O.R.	Abstract text to be confirmed
TBC	Moving from Operational Research to Operations Management	Abstract text to be confirmed
TBC	Going about a Pro Bono project	Abstract text to be confirmed

Metaheuristics

Organisers: Ender Ozcan and Andrew Parkes

10/09/2014 : 11:00 : Room Windsor 0.04   Code: OR56A1395

A Modern Meta-heuristic Approach Winning the MISTA 2013 Scheduling Challenge
Dr Daniel Karapetyan, **Mr Shahriar Asta, Mr Ahmed Kheiri**. **Dr Ender Özcan** and **Dr Andrew Parkes** *(University of Nottingham)*

The multi-mode resource-constrained multi-project scheduling problem is a challenging real-world problem which was the subject of a recent challenge organised as a part of the 6th Multidisciplinary International Scheduling Conference (MISTA 2013). In this talk, we present the winning algorithm of the MISTA 2013 Challenge. Our approach combines a Monte-Carlo tree search technique, a new class of very large scale neighbourhoods, meta/hyper-heuristics and a highly optimised schedule generator while exploiting the power of multiple cores for an effective and efficient search. The performance of the proposed approach is significantly better than the other competing approaches, producing the best solution for 17 out of the 20 test instances and performing the best in around 90% of the trials across all instances. This talk covers the main components of our approach as well as provides insights into its success.

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

10/09/2014 : 11:30 : Room Windsor 0.04   Code: OR56A1375

An Approximate Method Based on Column Generation and a Black-Box MIP Solver
Prof Filipe Alvelos *(Universidade do Minho)*

Many integer programming/combinatorial optimization problems can be addressed by decomposition approaches based on column generation. Column generation solves the linear relaxation of a model with an exponential number of variables by alternating between a problem with a subset of the variables (the so called restricted master problem) and subproblems where variables that may potentially improve the current solution of the restricted master problem are identified by using their linear programming reduced costs. The subproblems can be tackled by any appropriate optimization algorithm (e.g. problem specific or branch-and-cut). To obtain integer solutions, column generation is usually combined with branch-and-bound (branch-and-price) – column generation solves the linear relaxation model of each node of the tree. In this work, we describe a different method where column generation is mostly used for identifying "good" subproblem solutions which are then combined by a black-box MIP solver into an integer solution to the overall problem. An iteration of this approach is composed of two major steps (i) define the set of constraints to include in the relaxed model solved column generation and (ii) define the set of subproblem solutions to be included in the model for the black-box MIP solver. Information about the overall solutions and subproblem solutions is used to define the set of constraints in (i) and the set of subproblem solutions in (ii), namely: the incumbent solution, column generation memory, optimal solutions, and reduced costs, and memory on overall solutions provided by the MIP solver. We describe and present comparative computational results of this method for multicommodity flows, two dimensional bin packing and parallel machine scheduling with setups problems. This work has been supported by FCT – Fundação para a Ciência e a Tecnologia (Portuguese Foundation for Science and Technology) within project scope: PEst-OE/EEI/UI0319/2014.

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

10/09/2014 : 12:00 : Room Windsor 0.04   Code: OR56A1297
A GRASP for the Social Team Formation Problem
Dr Victor Cavalcante, **Dr Ana Paula Appel, Mr Thiago Caetano**, **Dr Vagner Santana** and **Mr Steven Tsukamoto** *(IBM Research)*
Performing collaborative tasks in an effective way requires, typically, developing abilities to work together and communicate with each other. Thus, social relationships play a very important role when teaming up people. Together with other standard requirements, like minimum skills or time of experience needed, they are essential elements in the process of decision making. The optimization problem resulting from this context has been named in the literature as the social team formation problem. This current research work investigates the adequacy of Greedy Randomized Adaptive Search Procedures to deal with this problem. In a nutshell, variants of the GRASP heuristic proposed were developed and the results obtained are compared with the best results reported in the literature. Our experiments with the GRASP depicted show that our approach produces meaningful and high quality outcomes, outperforming other heuristic results and finding optimal values for several instances available in literature. Our GRASP implementation not only demonstrated to very effective for smaller size problems, but also arose as a promising alternative approach to deal with real world team formation problems. Furthermore, our results reinforced the possibility of effectively enhancing decision problems by introducing social network information when aiming at capturing and dealing with social aspects in the context of optimization applications.

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

O.R. & Public Policy

Organiser: Robert Solly

Keynote: Contributions from OR Practice to a Useful Theory of Public Policy
Dr John Friend
The intricate webs of accountability involved in important public policy choices present the OR community with both structural challenges and also opportunities to claim leading roles in the design and facilitation of interactive policy processes. The 50-year legacy of the Institute for Operational Research, launched by the UK OR Society in partnership with the Tavistock Institute of Human Relations, offers not only a wide array of examples of innovative contributions to the practice of developing public policies in Europe and other continents, but also advances in theory that have attracted attention from other professional and academic communities. A recent OR Society charitable investment project on The Future Policy Influence of OR, which culminated in a joint event on Shaping Choices in Public Policy with the UK government's Policy Profession, has highlighted the opportunities for present and future generations to build on the innovations of OR's pioneers.

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

Policy Analytics: An agenda for Research and Practice
Prof Valerie Belton *(University of Strathclyde)*, **Dr Giulia Lucertini** *(Lamsad)*, **Dr Gilberto Montibeller** *(London School of Economics)* and **Prof Alexis Tsoukias** *(Lamsad)*
The growing impact of the ''analytics'' perspective in recent years, which integrates advanced data-mining and learning methods, is often associated with increasing access to large databases and with decision support systems. Since its origin, the field of analytics has been strongly business-oriented, with a typical focus on data-driven decision processes. In public decisions, however, issues such as individual and social values, culture and public engagement are more important and, to a large extent, characterise the policy cycle of design, testing, implementation, evaluation and review of public policies. Therefore public policy making seems to be a much more socially complex process than has hitherto been considered by most analytics methods and applications. In this paper, we thus suggest a framework for the use of analytics in supporting the policy cycle—and conceptualise it as ''Policy Analytics''.

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?: Highly

How to Measure Stakeholder Capacities to be Engaged in to Policy Process: Interest Groups Representation Maturity Index
Prof Birute Mikulskiene and **Prof Birute Pitrenaite-Zileniene** *(Mykolas Romeris University)*
The purpose of the paper is to draw the main elements of representation maturity index that is important for better interest representation within public administration and create the self-evaluate tool useful for both parties, for public administration while interest groups are invited in to policy making processes and for interest groups increase their representation capacity. Data to create representation maturity index were collected using focus group interview between public administrators and their stakeholders within health policy. Focus group discussion was guided in accordance with participatory and deliberative policy paradigm with support of stakeholder theory. The decision making group instruments and practice within ministry were discussed seeking to find out the main role of stakeholders, their composition, the way of recognition of their competence. In additional three semi structural interview with individuals from most prominent interest groups (patients organization, pharmaceutical association and doctors association) from health policy sector were conducted with the purpose to focusing to the practice of interest group every day activity. Interviews have revealed confronting nature of interest groups attitudes towards competencies that interviewees recognize as necessary. Out of qualitative analysis of empirical data, the components of representation maturity index was drawn. The representation maturity index is proposed to be based on 5 elements: 1. internal management practice, 2. decision making practice, 3. ratio between internal and external activities, 3. education and training activities, 4. quality assurance system. The maturity index could be graded from Level I (least mature) to Level III (most mature). Every element is supported by 3 criteria status for grading (technically exist, developed, operationalized).

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

Mapping Potential Conflict 'Pathways' to Support Contingency Planning
Mr Samuel Scott and **Mr Robert Solly** *(Dstl)*
MOD analysts and scientists have used a simple roadmapping approach to help planners and policy makers to understand the range of potential routes that an ongoing conflict might follow. This approach has improved our understanding of conflicts, helping keep an open mind on how they might develop, and improving understanding of the implications that each potential route might have for us.

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

Reassuringly Complicated - Systems Thinking as a Catalyst for Policy Definition
Mr Ian Mitchell *(BIS)*
Operational Research assists Policy development through structuring problem areas. Systems Thinking using Causal Loop diagrams has proven effective in identifying frameworks for complicated areas by creating maps based on stakeholder views.The maps offer ways to summarise problem areas in terms acceptable to policy leads and their stakeholders. The paper describes recent successes using this technique to foster growth. It emphasises the importance of treating the process as socio-technical rather than an analytical exercise.

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

11/09/2014 : 09:30 : Room Windsor 1.05   Code: OR56A1448
Causal Loop Diagramming of Public Policy Issues: The Munro Review Experience
Prof David Lane *(Henley Business School)*, **Ms Elke Husemann** and **Prof Eileen Munro** *(LSE)*
This talk reflects on the Department for Education's employment of systems thinking as a central element of 'The Munro Review of Child Protection'. We focus here on the use of causal loop diagramming. We present the legislative and organisational framing of 'child protection' and discuss the inherent risk balance of 'child rescue' and 'family preservation'. We describe the environment from which the Munro Review emerged. We give two examples of the public policy questions examined. The first is a visualisation of the 'compliance culture' that had grown up in the sector. We describe how this was created, what it revealed about the sector and what the response was to the diagnosis that it offered. For a second example we describe the use of system dynamics and group model building to develop a large, complex CLD of current operations. This dealt with the intended and unintended consequences of previous policies and helped us to identify the drivers of the sector. We show how this OR work gave structure to the many concerns that the Review had to deal with. We also show how it led to a set of recommendations that aimed to be systemically coherent, thereby avoiding problems that were seen to have arisen as a result of previous policies. These recommendations received Government support and continue to be implemented.

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

11/09/2014 : 11:30 : Room Windsor 1.05   Code: OR56A1425
Reshaping Children's Health Services
Prof Jonathan Rosenhead, **Dr Maggie Barker** and **Mr Mike Cushman** *(London School of Economics)*
The continuing reduction in the number of children entering hospitals for treatment as inpatients meant that Camden and Islington had too many inpatient paediatric units. This study, commissioned by the then Camden and Islington Health Authority, was to formulate a paediatric care strategy to cover primary, community and secondary care. A series of 3 one-day Strategic Choice Approach workshops were held, with participants representing major local hospitals (including Great Ormond Street, Royal Free and University College Hospitals) as well as patients and GPs. The talk will describe the analytically-supported discussions, the consensual decisions, and the outcomes.

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

11/09/2014 : 12:00 : Room Windsor 1.05   Code: OR56A1326
Development of an Improved Framework for the Assessment of Bio-Security Threats
Dr Ashley Carreras and **Dr Gilberto Montibeller** *(Decision Consulting Ltd.)*
The main objective of the project was to suggest an improved framework for the assessment of bio-security threats for Defra and develop a prototype multi-criteria model. We worked with a team of experts from Defra, AHVLA, Fera, Cefas, and academic experts, in refining the system currently used for such assessments. These experts were involved in defining the improved model's parameters and to testing the prototype. The prototype allows the assessment of each type of impact (social, environmental and economic), as well as the elicitation of the probability of these threats happening, with the use of expert judgment. Impacts are aggregated in terms of both dis-utility and equivalent monetary values. The model is based on strong axiomatic principles of decision analysis, adequate for the assessment of threats and widely used in similar contexts.

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

11/09/2014 : 13:30 : Room Windsor 1.05   Code: OR56A1341

An Evidence Based Approach to Judicial Recruitment

Dr Tom Irving *(Ministry of Justice)*Public sector budget cuts mean that there is pressure on all government departments' budgets. Traditionally, recruitment of judges took place on an ad hoc basis, resulting in shortages or oversupply. The Ministry of Justice has developed a simulation model to match the future supply of judges to the forecasted demand in workload. This has helped us deploy judges more efficiently, saving valuable taxpayers' money.

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

11/09/2014 : 14:00 : Room Windsor 1.05   Code: OR56A1385

Introducing Outcome Measures using an Operational Research Approach

Ms Jean McLeod *(Christ Church Group)*

This presentation outlines the policy driving the implementation of UKROC (United Kingdom Rehabilitation Outcomes Collaborative) outcome measures at an acute Neurological Rehabilitation Unit (RU), between 1/2/13 and 1/2/14 and the iterative Operational Research process employed. It also highlights the importance of an OR Outcome Measures Champion to facilitate buy-in from the operational team and to ensure that the data was firstly collected and then, that it was consistent and valid. The cost of delivering health care has always been difficult to define at the patient level and quite often regional variation has meant that not all clients received the same level of service. Healthcare Resource Group (HRG) had been used to set tariffs, as they reflected the intensity of case-mix, however costing Acquired Brain Injury proved elusive. (DH, 2000). This is because the marked heterogeneity of Acquired Brain Injury (ABI) requires a variety of measures to assess an individual's level of disability. The continuous debate regarding the sensitivity of some measures in assessing the nuanced and subtle changes over time, (Alderman, Wood & Wiliams, 2011) led the Department for health to commission research through the National Institute of Health Research (NIHR). A team from Northwick Park Rehabilitation unit and Kings College London were tasked with developing a national database of rehabilitation outcomes, drawing together the best parts of internationally recognised rehabilitation outcome measures and creating a uniformed set of tools for the assessment of client needs (Turner-Stokes et al., 2012). This would enable funders to benchmark providers against each other but more importantly enable funders to gain a coherent understanding of the costs associated with this domain of care. Rolling out UKROC at RU was an iterative process and the poster shows the pathway identified to guide this project.

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

11/09/2014 : 14:30 : Room Windsor 1.05   Code: OR56A1430

OR and Public Policy Making: Case Study of Mental Health Waiting Times

Dr Louise Plewes *(NHS England)*

Patients waiting for an operation for a physical health problem have the right to be treated within 18 weeks of referral, but patients with mental health issues have no such guarantee. NHS England analysts are investigating how introducing a comparable access or waiting time standard for mental health might contribute to improving the experience and outcome for patients with mental health conditions. However, diagnosis and treatment of mental health conditions are not like physical health. The patient pathways are complex, individuals can bounce around the system for many years, and recovery or discharge is rare. Traditional data sets and evidence bases are not good at tracking patients – they tend to echo the services provided around the system, rather than conditions and treatment pathways. In some areas there are no data at all. This can result in poorer experiences for patients, and sub-optimal health outcomes. This talk will explain our approach in taking the first steps to overcome some of these issues. We will discuss how we dealt with the complexity of the problem and the lack of supporting evidence; and how we identified and costed a

range of options for a mental health access and waiting time standard, and modelled some of the potential impacts of implementation. Our approach shows how OR has contributed to policy making in a high profile area, where there are multiple stakeholders and complex relationships between the agencies involved.

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

11/09/2014 : 15:00 : Room Windsor 1.05   Code: OR56A1438

Defence Science and Technology Laboratory, Support to Operations: Guiding the Nation Through Uncertain Times

Mr David West, **Mrs Felicity Brantingham** and **Mr Rupert White** *(Defence Science and Technology Laboratory)*

For the last 17 years Dstl has provided almost continuous Operational Analysis and Scientific Advice and support to UK commanders on operations and several hundred analysts and scientists have deployed on operations of up to 6 months each. UK commanders have benefited from effective decision support and the rapid implementation of technical solutions to operational challenges, most notably in the fight against Improvised Explosive Devices and the redeployment of UK forces from Afghanistan. Support to Operations Group maintains analysts and scientists at readiness to deploy to meet operational requirements. These individuals must have the experience, skills & operational credibility to be able to appropriately support a headquarters. To ensure sufficient dedicated staff to meet all eventualities Dstl is dependent on training and recruiting augmentees from across the organisation. The augmentees will be stood up in two elements: the High Readiness (HR) element: immediately ready for deployment on operations and the Lower Readiness (LR) element: able to deploy in slower time after receiving an uplift in training. Staffed by volunteers, the training and exercise programme is approximately 6 weeks per year which individuals conduct alongside their day-jobs. Those at readiness must pass a standardised selection process to ensure that they are suitable to deploy, and an individual training programme is agreed to develop our capabilities in certain areas. Understanding the nature of likely future operations helps to shape the readiness training programme, to ensure we have the right skills and experience, at readiness, to support operations. A readiness strategy has been endorsed, detailing the Dstl approach to maintaining high and low readiness pools, and this strategy is in the process of being implemented. It is expected that Full Operating Capability will be achieved by March 2015

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

O.R. Consultancy and Case Studies

Organiser: John Medhurst

09/09/2014 : 11:00 : Room Windsor 1.05   Code: OR56A1384
Keynote: The Evolution of OR in the Defence Industry in the UK – a Personal Perspective
Mr Noel Corrigan *(CORDA)*
This paper presents a personal perspective on the evolution of Operational Analysis (OA, the application of OR to military problems) in the UK defence industry over the last thirty years, and where it may go in the next thirty. This period has seen a shift from product assessments to service solutions, from conducting independent analysis of how new equipment could improve military effectiveness in a cold war environment, through to the current drive to deliver cost efficiencies via availability contracts and capability management. The changes in application area have been accompanied by changes in the approaches used, embracing developments in systems thinking and interdisciplinarity. Drawing on experiences and case studies from CORDA's history as an independent consultancy, and now part of the UK's largest global defence company, I will reflect on how both the customer and the work has changed significantly since the 1980s to respond to the changing environment.

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

09/09/2014 : 12:00 : Room Windsor 1.05   Code: OR56A1426
Assessing the Benefits of Improved Seasonal Weather Forecasts on the UK Food Chain
Dr David Wrigley *(Jigsaw Consultants)*
This paper presents the experiences of a team of independent consultants in quantifying the benefits that would accrue from the introduction of new seasonal weather forecasting services. The Client needed to develop a Business Case for a new High Performance Computer which would enable more accurate seasonal weather forecasts. The Business Case had to demonstrate how improved weather forecasts can deliver socio-economic benefits to the UK. We were tasked with assessing the potential benefits to the UK Food Chain. The study developed a conservative and robust estimate of the socio-economic benefits resulting from improved seasonal forecasts, especially in the area of reducing food waste and better matching food production to retail demand. The Client was able to use these figures as part of a compelling business case. Key aspects of the study included: • Desk research into the theoretical and empirically evidenced benefits of improved forecasts to the sector • Interviews with representative businesses within the sector • Development of benefits maps and use cases • Development of a quantitative benefits model using a Monte Carlo simulation approach • Sensitivity analyses Challenges included: • Working within an unusual multi-disciplinary field • Making contact with businesses within the sector • Selecting a sub-set of possible benefits • Netting off positive and negative benefits • Communicating probabilistic data and results

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

09/09/2014 : 13:30 : Room Windsor 1.05   Code: OR56A1406

Strategic – Operational Business Alignment: Pertemps People Development Group; A Case Study of Academic – Professional Collaboration
Mr Kees Van Haperen *(VH2 Ltd)*
Context The project sought to achieve alignment between strategic and operational activities and identify and scope business performance improvement initiatives. The project approach involved a collaboration between a small team of consultants from Koios Group Ltd, led by its former MD and presenter, and academics from Warwick Business School, led by Prof. Alberto Franco (now Loughborough University). Its design was based on a multi-methodology approach comprising Soft Systems Methodology and Oval Mapping, combined with a number of techniques and principles from management methods including 6-Sigma, Performance Management, Enterprise Architecting and Project Management. The aim was to both conduct the intervention supporting the management team in realising their strategic objectives, as well as assisting them in developing their own organic capability and enable them to undertake future engagement as part of a continuous improvement culture. Brief Description this presentation reports on the design and implementation of a strategic intervention for Pertemps People Development Group (PPDG), a medium-sized organisation operating in the business of helping unemployed individuals back into long-term, sustainable employment or to access training opportunities. The intervention adopted a problem structuring approach, and used computer-supported group causal mapping and soft systems modelling to identify how PPDG could continue growing the business without its enabling or supporting functions growing at the same pace, hence increasing the gross profit margin. It was felt that by improving the integration across functions and the alignment of operations with the organisation's strategic objectives the desired improvements would be achieved. The intervention was successful in identifying key areas for improvement that had strong commitment by senior management to address them. I will briefly discuss the methodology adopted for this engagement, the outcomes resulting from the engagement and I will reflect on the case study as a Professional – Academic collaboration.

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

09/09/2014 : 14:00 : Room Windsor 1.05   Code: OR56A1389

Bridging the Gap – Systems Models Linking Consumer Behavioural Insights to Coherent Strategic Planning
Dr David Exelby *(Decision Analysis Services Ltd)* and **Mr Vittorio Raimondi** *(Foresight Associates LLP)*
Many consumer-based enterprises are sitting on large data repositories of consumer intelligence – both transactional and market research-derived. We have found firms typically underuse this data for robust strategic planning – focusing on more tactical opportunities and performance management. Systems modelling approaches can help in the design of strategic planning frameworks that in turn can drive focused data mining of these data sources. The insights and processes that arise from such an approach yield valuable benefits for the firm. These include a common language for planning, coherent data for modelling and planning tools that enable brand teams to create actionable plans. We will describe the application for global brand owning companies which have adopted this systems-based strategic planning across all their markets and share our experiences in introducing the approach and supporting its development.

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

Code: OR56A1382

Using System Dynamics to Model the Links between Transport and the Wider Economy
Mr John Swanson *(Steer Davies Gleave)*
This paper describes a system dynamics model that has been built to simulate how complex urban areas evolve over time, particularly the links between transport, population, employment and land-use. The motivation for developing the model was the question asked repeatedly by national governments and local authorities: can transport investment help to regenerate our economy? And if so, what kind of investment? It seems obvious that there must be a relationship between transport and economic activity, but many examples exist where transport is in good supply yet a local economy is failing. Transport is necessary but not sufficient, seems to be the conclusion, but this does not help authorities charged with making investment decisions to help increase employment and generate growth. For that, a model is needed. The Urban Dynamic Model (UDM) is a large scale system dynamics model that incorporates transport networks and 'land-use' which is short-hand for the processes that shape the houses or commercial properties that are built, where, and who uses them. The spatial distributions of households and the workforce they bring, employers and the jobs they seek to fill, and the transport networks connecting them all together give rise to complicated patterns of movement that shift over time as they evolve. They comprise a complex system replete with feedbacks – such as the classic loop between congestion, investment, growth and increased congestion – that system dynamics is ideally suited to handle. The UDM combines techniques drawn from transport modelling with ideas from Forrester's original urban model. It has been applied for over ten years now, and the talk will illustrate its use in Leeds City region where it was used to design and test a substantial transport investment programme worth £1bn over ten years.

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

Code: OR56A1414

A Mangle Perspective of a Theoretically Plural Action Research Case Study
Mrs Dawn Gilbert and **Dr Mike Yearworth** *(University of Bristol)*
This case study describes an exploratory application of a developing theory to an industrial context. In this case, as in many OR interventions, the beliefs, opinions, and preferred paradigm of stakeholders affected by OR practice were diverse. Extant Problem Structuring Methods provide approaches we can employ when working with a gathering of these stakeholders. The case study examined in this paper involved three diverse groups of stakeholders who did not gather together, rather were engaged with in a series of 1:1 sessions. We chose to characterise our stakeholder groups along philosophical grounds as follows; i) the positivist-driven group, ii) the constructivist-driven group, and iii) the critical realist group. The basis of our characterisation was observation of their language, the nature of the goals, and preferred methods used by each group. The need to work with individual, yet diverse stakeholder perspectives and beliefs drove the need for theoretical pluralism within the action research activity itself, while the ongoing engagement with each individual stakeholder focussed only on one paradigm. The exploration delivered satisfactory outcomes to each stakeholder. A summary of how each stakeholder perspective drove the use of a particular combination of data and methods to add to knowledge could be summarised using the style of a scientific paper, however, for the interested OR practitioner, much detail and many nuances of the elaborate interweaving of methodologies and methods employed would be lost. We describe the theoretically plural research that was carried out using Pickering's concept of the mangle of practice, as an approach to present the case study in a more informative way, as recently espoused by Ormerod. We also reflect on the mangle of practice approach to writing in particular with reference to its ability to illustrate the use of theoretical pluralism.

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

09/09/2014 : 16:00 : Room Windsor 1.05   Code: OR56A1369
A Dangerous Fever: Modelling Insurgencies using the Mathematics of Epidemics
Mr John Medhurst *(Larrainzar Consulting Solutions Ltd)*
This paper discuss the potential for modelling the spread of insurgencies using the same mathematical approaches that have previously been used for representing the spread of epidemic and endemic disease. The proposal will be supported by data drawn from historical examples of insurgencies and will show how lessons from the world of disease modelling can also be applied to practical effect as part of a Counter Insurgency (COIN) strategy. The relevance of models of both epidemic and endemic disease will be discussed, as well as the ways in which demographics can influence the recurrence pattern of insurgent conflicts and the lessons this gives to those attempting to restore stability to dangerous parts of the world.

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

09/09/2014 : 16:30 : Room Windsor 1.05   Code: OR56A1316
Designing Collaborative Enterprise Networks: Developing the Collaboration Canvas
Mr Andrew Hale *(Frazer-Nash Consultancy / University of Bristol)*, **Mr Mike Hoskin** *(Frazer-Nash Consultancy)* and **Prof Leroy White** *(University of Bristol)*
Cross-sector collaborations are growing as an accepted vehicle to develop technology. However, whilst their popularity increases, no accepted best practice informing their design, development and assessment exists. This paper addresses that problem. By building on the theoretical framework for designing Collaborative Enterprise Networks (CEN) proposed by Hale and White (2014), this research develops a commercial tool to be used within a consultancy context to apply the principles of the framework. Through a review of extant literature around network theory, clustering and communities of practice, the paper expands on the original research conducted by Hale and White, informing further development of the framework. Subsequently, the eight principles of the CEN framework are used to support the assessment of a collaboration set up in the defence sector, for the purpose of developing specific equipment and technology. The assessment is conducted through semi-structured interviews with key stakeholders from each of the organisations involved, providing a balanced understanding of current practice. The interviews are structured using the eight principles of the CEN framework, ensuring a common platform for comparison of each participant's perspective. Through applying the framework in a practical context, key strengths, weaknesses and lessons are observed and the practical limitations of applying a theoretical framework discussed. Finally, through analysing the output from the collaboration assessment, a tool to support the design, development and assessment of CEN's is presented, in the form of the "Collaboration Canvas". An updated version of the CEN framework first outlined by Hale and White is also presented, taking into account lessons learned from further theoretical exploration and practical application of the framework.

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

10/09/2014 : 11:00 : Room Windsor 1.05   Code: OR56A1275
Looking to OR futures: Stories from the OR Society Charitable Projects initiative
Prof Jo Smedley *(University of South Wales)*
In 2012-2013, the OR Society funded 7 projects to stimulate future thinking in OR, encourage collaboration between academic and practitioners and pump prime a ready source of topical developments to promote OR interest and engagement. This session provides a snapshot of the project outcomes to date viewed through the lens of reflective stories focusing on impact and benefits for various OR audiences.

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?: Relevant

10/09/2014 : 11:30 : Room Windsor 1.05   Code: OR56A1283

The Use of Case Studies in Teaching Operational Research within UK Universities
Dr Christine Currie *(University Of Southampton)*, **Dr Kathryn Hoad** And **Dr Frances O'Brien**
(Warwick Business School) and **Dr Marion Penn** *(University of Southampton)*
This paper reports on a project into the current use of case studies in the teaching of Operational Research
(OR) within UK Higher Education. The research consisted of two stages: a survey of OR lecturers in UK Higher
Education institutions; and a collection of more in-depth cases studies illustrating particular examples of the
use of case studies. The research found that case studies are used to support teaching across a range of
student groups and within a variety of modules and courses. There was also evidence of differences in the
ways that case studies are incorporated into OR teaching. The research identified that case studies are used
to develop a range of students' skills, one of the key skills being the ability to transfer academic knowledge
to real-life contexts. Some barriers to the use of case studies were identified in the project, including the
development of new cases; the authors make suggestions to overcome such barriers. The authors would like
to acknowledge support for the work from the Higher Education Academy.

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

10/09/2014 : 12:00 : Room Windsor 1.05   Code: OR56A1291

**Using Morphological Analysis as a Problem Structuring Method to Identify Organisational
Diversity Practice Improvements**
Dr Nasir Hussain *(Strategy Foresight LLP)*, **Mr Bruce Garvey** *(Imperial College)*, **Mr Jeremy Glover**
(6S Infinity Ltd) and **Mr Amit Popat** *(Camden and Islington NHS Foundation Trust)*
Embedding diversity practices in organisations is not simple - high levels of complexity, uncertainty, differing
perspectives and conflicting priorities of the various stakeholders need to be addressed. Given these 'wicked
components', soft OR methods are well suited in problem-structuring such intangibles that are difficult to
assess and interrelate both qualitatively and quantitatively. We have used Morphological Analysis (MA) as a
problem structuring method in two disparate organisations for this work (an Anglo-American legal firm and
an NHS trust). MA was developed by Fritz Zwicky in the 1960s for exploring all possible solutions to a multi-
dimensional, non-quantified complex problem (where causal modelling and simulation do not function well).
With dedicated software and facilitation of a subject matter specialist team, internally consistent options
identify critical pathways in a maze of possibilities. For both projects, 6 dimensions were developed:
leadership commitment, workforce engagement, stakeholders, 'why do it', showcasing diversity and
outcomes. 334 configurations out of a possible problem space of 6400 were isolated (a 95% reduction) by
performing a pair-wise analysis of the all the options in the problem space matrix (aka Cross Consistency
Assessment process). Upon clustering, the main results were that i) there were no significant effects on the
intended outcomes by the involvement of the employees (i.e. are recipients of the benefits but not major
actors for change, ii) certain actions raised public image (e.g. diversity initiatives sponsored by the senior
management team, iii) formal education helped to reduce legal issues but did not increase organisational
resilience, iv) internal communication of success helped to increase organisational resilience. The project with
the NHS trust is on-going. By using this highly practical method, time-constrained organisations can rapidly
audit their diversity status and appropriately reallocate resources where greater benefits in the long-term may
be realised.

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

O.R. in Sport

Organiser: Philip Scarf

09/09/2014 : 13:30 : Room Windsor Auditorium   Code: OR56A1417
A Comparison of Olympic and Paralympic Performances
Prof David Percy *(University of Salford)*
At London 2012, South African Oscar Pistorius created history as the first amputee sprinter to compete in the Olympic Games. Other athletes achieved amazing feats long before the Paralympic Games were introduced, including gymnast George Eyser who won six medals at the 1904 Olympic Games in spite of a wooden prosthesis for his left leg, and several others who have competed in both Olympic and Paralympic Games. An exciting challenge of considerable interest is how, and to what extent, we might compare the performances of Olympic and Paralympic athletes in order to offer enhanced integration of the two competitions. To address this issue, we apply the interactive shrinkage method for class handicapping proposed by Percy (2013) to competition results from the London 2012 Summer Games and Sochi 2014 Winter Games. Our analysis generates some promising results and offers some surprising revelations. It also suggests that this method can be used to enable fair comparisons of performances by athletes from other diverse subgroups of the population. We hope that these ideas will be used to provide extra incentive and reward systems for motivating unified sporting participation in general settings.

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

Problem Structuring

Organiser: Amanda Gregory and Alberto Paucar-caceres

09/09/2014 : 14:00 : Room Windsor 1.02   Code: OR56A1327

Keynote: Zooming in on Problem Structuring Interventions: An Affordance Perspective
Prof Luis Alberto Franco *(Loughborough University)*
Empirical studies examining the complex dynamics between the social and material aspects of OR interventions are beginning to appear in the literature. Despite these advancements, we know very little about these dynamics at the micro-level of analysis. This is partly because of a lack of theories that can inform an empirically grounded understanding of the interplay between the social and the material as they become interwoven in micro-level practices. To address this gap, I adopt an affordance perspective to examine how the materiality of an OR technology can shape, but not fully determine, social actors' behaviours during interaction with that technology. I illustrate the potential usefulness of the affordance perspective for the case of problem structuring interventions that use Group Explorer as a group causal mapping technology. I then show, via an empirical case vignette, how perceptions of affordances called forth by the technology affect social actors' behaviours within a strategy workshop. I conclude with a discussion of the implications of adopting an affordance perspective for the conduct of OR intervention research and practice.

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

09/09/2014 : 15:30 : Room Windsor 1.02   Code: OR56A1354

Using Critical Systems Thinking to Facilitate Change in the Cyprus Police Force
Mr Harry Kogetsidis *(University of Nicosia)*
The rate with which change occurs has increased dramatically over the years and organisations are increasingly faced with dynamic and very complex operating environments. Like private companies, government departments are also subject to external pressures and significant change. The Cyprus Police Force is a typical government organisation with a very hierarchical structure. Like the rest of the public sector, Cyprus Police face a very turbulent environment, characterised by reduced spending, more work for its members and often much criticism from the public. Furthermore, the island's recent financial instability, together with demographic changes and new forms of crime have created additional pressures. Its new leadership has to respond to this challenging environment and to meet government targets and the public expectations. This paper will discuss how a new research initiative based on action research and informed by critical systems thinking can help in structuring the problem situation and facilitating the management of change in the Cyprus Police Force. The paper will report on some early findings and discuss a number of issues related to this research. Particular emphasis will be paid on the importance of understanding the divergent interests of different stakeholders and involving the various parties in the change process. The paper will then justify why critical systems thinking with its three commitments can make a significant contribution within an organisational context characterised by a bureaucratic environment and an unequal distribution of power.

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

A Systemic Framework to Strengthen Checkland's SSM with Maturana's Biology of Cognition Concepts

Prof Alberto Paucar-Caceres *(Manchester Metropolitan University)*

In management practice, SSM is arguably one of the most used problem structuring methods. However, some critics have argued that it has serious shortcomings particularly in the initial phases when the situation is structured (Rich Picture) and when deciding which areas of a problematic situation are to be chosen as relevant. For an SSM "purist", issues of power and dominance are left to his/her own devises and the tools offered, e.g.: the three Analyses: S1; S2 and S3, are only sketched guidelines/models and in some cases not useful or difficult to operationalise. Furthermore, after an SSM intervention, for debating changes, SSM offers the concept of "accommodation" a key (if not subtle feature of SSM) but again, the researcher is left with a vague idea about as to how to use it, leaving a gap in the methodology. In practice, researchers and practitioners experience that accommodation of interests is a process can be highly emotional and SSM does not offer any guidance as to how to manage this. This paper attempts to fill this gap and try to enrich SSM applications, through demonstrating that Maturana's Biology of Cognition (BoC) notions could and should be understood as a complementary toolset to Checkland's soft systems methodology. Maturana's BoC attributes connotative role to language and gives importance to emotions, which together with language braid in forming the consensual domain of conversations of living organisms. These are concepts that not incompatible with an interpretivist stand and they can enrich an SSM intervention. We envisage to advance a framework in which some of the interpretative approaches can benefited by using second order cybernetics principles in particular, we expect that some of the SSM phases of "finding out" and "modelling" can be improved by introducing BoC concepts.

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

Multimethodology Using Soft Systems Methodology (SSM) and Situational Strategic Planning (SSP)

Prof Mischel Carmen Neyra Belderrain and **Ms Paloma Ribeiro dos Santos** *(ITA - Instituto Tecnológico de Aeronáutica)*

Situational Strategic Planning (SSP), used in government planning of cities, has four steps called explanatory, normative, strategic and tactical-operational moments. Since SSP has similar characteristics with complex problems, both can be structured with PSM (Problem Structuring Methods). This paper presents a proposal to use Soft Systems Methodology (SSM) at different moments of Situational Strategic Planning. The explanatory moment can be aided by: a) construction of rich picture to identify the relevant systems and possible impacts of interventions and; b) analysis of CATWOE (clients, actors, Transformation, Weltanschauung, Owner, Environmental constraints). The Strategic moment can be aided by: a) comparison of current and idealized models, and; b) development of actions to achieve the elaborated strategies. The authors contend this multimethodology can be successfully applied in public policies proposals.

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

10/09/2014 : 11:00 : Room Windsor 1.02   Code: OR56A1351
Mixing Methods – Lessons from the Field
Prof Susan Howick *(University of Strathclyde)*, **Prof Fran Ackermann** and **Dr Thomas Houghton**
(Curtin University), **Prof John Quigley** and **Prof Lesley Walls** *(University of Strathclyde)*
Whilst there has been a lot written about mixing OR methods, there has been limited attention paid to generic lessons that could be gained from mixing methods in practice. Many real problems demand the use of a mixed method approach and thus recognising and sharing generic lessons could prove beneficial to both practitioners and researchers. This paper seeks to present an in-depth evaluation of a mixed method case study to gain further understanding and lessons for the mixed method OR/MS community. In doing so it aims to 1) develop a set of learning points and 2) subsequently categorise the learning points. The first aim, identifying learning points, is to provide help to both practitioners as well as researchers as further insights can be determined and opportunities capitalised upon. The second aim, focusing on categorisation, seeks to separate those learning points that are relatively generic i.e. relating to operational research modelling interventions, those which are unique to mixing methods and those that reflect the exacerbating effect of mixing methods on interventions. In this manner a better understanding of the practice of mixing methods can be achieved.

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

10/09/2014 : 11:30 : Room Windsor 1.02   Code: OR56A1294
A Systems Thinking Approach to the Exploration of Challenges being Faced by Practitioners in Online Distance Education
Mrs Sulafah Basahel and **Dr Jose-Rodrigo Cordoba-Pachon** *(Royal Holloway, University of London)*
Online Distance Education (ODE) is a special form of education, in which the instructor and student are physically separated and communicated through web-based communication tools. ODE is constantly expanding and Higher Education Institutions (HEI) around the world are attempting to utilize Information and Communication Technologies (ICTs) to enhance the learning process and strategies of knowledge delivery. Practitioners in ODE face complex situation of ill-defined and interrelated challenges that affect their activities and hinder the improvement of ODE. Accordingly, any strategy to deal with these challenges will impact the learning outcomes that are being planned and delivered through ODE. To intervene and improve a social system such as online distance education is important to pay more attention to people who involve and work in ODE. Covering the different perceptions of stakeholders together in ODE will ensure a comprehensive approach to enhance the online distance education initiatives. In previous study Moore and Kearsley (2003) proposed a hard system view of traditional thinking of the management and understanding how different functions in sub-dimensions of online distance education should be processed. Their system thinking view of ODE is limited and lack of concentration on relationships between parts and engagement of multiple perceptions of stakeholders in ODE. Also, it highlights some of predefined problems occurred in ODE to achieve the single goal of efficiency of online distance education. This study proposes a soft system view as a conceptual lens to explore the ill-defined and interrelated challenges in online distance education. Soft System Methodology (SSM) will be employed in a higher education institution in Saudi Arabia and will be used to help stakeholders in ODE to gain more knowledge about the complex situation in ODE. That will enable them to engage with vision and plan development for any intervention activities in future to enhance education practices.

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

10/09/2014 : 12:00 : Room Windsor 1.02   Code: OR56A1432

Soft Systems Methodology Applied to Educational Area in the Context of Brazilian School of Engineering Expansion

Prof Mischel Carmen Neyra Belderrain, Mr Leonardo Alencar de Oliveira, **Mr Cristiano Link** and **Mrs Hadassa Pereira de Carvalho** *(ITA)*

Technological Institute of Aeronautics (ITA), one of the best Schools of Engineering in Brazil, will undergo several changes in order to enhance its recognition on the international scene. This paper describes an application of Soft Systems Methodology (SSM), reconfigured by Ion Georgiou, in the context of ITA expansion, focusing on the education area. Partial results show some weak points on the current educational model. Culturally feasible and systemically desirable actions are proposed. Introducing innovative ideas and new educational policies, traditional institutional values will be emphasized. Seeking new partnerships with other universities, foreign cooperation, entrepreneurship and engaging students in extracurricular activities will all be highly encouraged.

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

11/09/2014 : 09:00 : Room Windsor 1.02   Code: OR56A1323

Action Research using Soft Systems Methodology: Exploring Executive Coaching as an Intervention Mode

Dr Giles Hindle *(University of Hull)*

Soft Systems Methodology (SSM) is an approach to tackling messy, ill-structured problems. Drawing on both the author's own Action Research programme and a review of the existing literature, a taxonomy of intervention modes for SSM is presented. The author then explores the use of executive coaching as an intervention mode. Reference is also made to a spectrum of consulting approaches from participative to expert.

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

11/09/2014 : 09:30 : Room Windsor 1.02   Code: OR56A1387

Enhancing Decision-Making Processes to Address Counter-Terrorism Challenges

Mr Fred Cameron, **Dr Jeff Appleget** and **Ms Tahmina Karimova** *(US Naval Postgraduate School)*

Recently the Ministry of Defence of Tajikistan has been seeking support to improve its decision making capabilities. In particular, Western nations have been collaborating with the Tajikistan government the areas such as peace-keeping and counter-terrorism. This presentation is about an engagement recently provided by the US Naval Postgraduate School covering Operations Research techniques familiar in the West that can be applied to counter-terrorism. During a week of collaboration in Dushanbe, various techniques were shared with Tajik personnel, including such areas as decision making, problem solving, and manual and computer-based simulation. In many respects, the Tajik military's approach until recently was derived from that of the Soviet Red Army -- with a fairly rigid approach to decision-making procedures. But lately it has incorporated delegation of greater flexibility lower in the echelon. Decision making as applied in many Western military organizations is more compatible with such flexibility. This presentation will address areas where the collaboration was fruitful, and some areas were much more remains to be done.

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?: Relevant

Using Acyclic Causal Maps to Define Requirements
Mr Peter Harvey and **Mr Dan Page** *(Chemring Technology Solutions)*
Within the defence arena, projects generally specify user and system requirements using a range of techniques from military judgement panels and operational reports through to detailed operational and performance modelling. Requirements are used for a number of purposes, communicating to industry what is needed, evaluation of proposals and as the basis for accepting the delivered outputs into service. This paper will identify weaknesses in current requirements practice and discuss the strengths and weaknesses of a structuring method that can rapidly identify an integrated and coherent set of qualitative user or quantitative system requirements, through analysis of the influence and importance of the nodes within an acyclic causal map linking level high level programme goals to lower level measures of performance.

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

Applying the Viable System Model to Inform Defence Transformation
Mr David Lowe, **Dr Louise Martingale** and **Mr David McNeish** *(Dstl)* and **Dr Mike Yearworth**
(University of Bristol)
The United Kingdom Ministry of Defence (MOD) has undergone a radical transformation in response to the Levene Review published in 2010. The Defence Transformation programme has – amongst other changes - delivered a revised operating model for MOD with streamlining of Head Office in Whitehall, greater autonomy for Front Line Commands and the introduction of private-sector expertise across the organisation. The Defence Science and Technology Laboratory (Dstl) has developed an assessment framework to identify key strengths, weaknesses and uncertainties associated with this new operating model. This framework is based upon a nested application of Stafford Beer's Viable Systems Model in order to set system-focused assessments in the context of the wider Defence Enterprise. This presentation will (i) review the implementation of this problem structuring method, (ii) reflect upon the impact of the findings to identify methodological lessons, and (iii) discuss the applicability of this method to other situations.

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

The Use of Problem Structuring Methods by Interdisciplinary Research Teams
Dr Jonathan Atkins and **Dr Amanda Gregory** *(University of Hull)*
This paper is about the formation of interdisciplinary research teams, the role that models, as boundary objects, can play in this process and the classification of modelling approaches as Problem Structuring Methods (PSMs). The main focus of the paper is a case-study account of the first stages in the establishment of an interdisciplinary team (drawing together researchers in marine biology, economics and management systems) seeking to establish a basis for collaborative working. All participants anticipated that there might be an expected gain from their collaboration and cooperation in future research projects but felt that they first needed to establish a basis of common understanding. The case focuses on a participatory modelling workshop that the team engaged in which involved using a model, panarchy, as a PSM to explore the behaviour of linked natural, social and designed systems. To give a focus to the workshop, the participants examined a local site that they already had knowledge of, Flamborough Head, a UK marine site which holds an EU designation as a Special Area of Conservation. The panarchy model was chosen because it was known to but little understood by all and their exploration and use of it revealed different meanings according to participant's different academic and professional backgrounds. It will be argued that panarchy, if used in the way it was in the case workshop, may be considered to be a PSM.

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

11/09/2014 : 14:00 : Room Windsor 1.02   Code: OR56A1313

Reflecting on the Process of Client Engagement: Using the Mangle to Assess a PSM Intervention

Mr Patrick Tully *(Frazer-Nash Consultancy)* and **Dr Mike Yearworth** *(University of Bristol)*

A practitioner attempting to apply Problem Structuring Methods (PSMs) is frequently operating at the whim of clients in terms of the successful implementation of the intervention. In order to explore this claim we set out the basis for the use of a novel systemic PSM to support an organisational change programme and present a case study of the implementation of this intervention. PSMs have been developed to support decision makers intervene in complex problem situations that are not amenable to more rational and optimal solutions. A process-based PSM has been developed, utilising hierarchical process modelling, which allows decision makers to work together to move towards a strategic goal. This method builds upon group model building techniques and extant PSMs to enable a facilitated group of diverse stakeholders to construct a socio-technical systems model and use this model to explore the problem situation and thus take purposeful action. Our paper applies this method to a large organisation seeking to demonstrably ensure the safety of operations of the interface of two systems. Within the literature, case studies of such interventions are typically published in the style of a scientific paper whereby the intervention itself is presented along with a discussion of the outcome. However, given the consultancy environment within which our intervention was implemented and the recent exhortation from Ormerod to present more informative case studies about the process of OR we have interpreted and presented our work using Pickering's concept of the mangle of practice. It is intended that this method of case writing will help produce a more realistic description of what actually happened in the client engagement and enable the authors to make better sense of what occurred for the benefit of the wider OR community.

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

11/09/2014 : 14:30 : Room Windsor 1.02   Code: OR56A1439

Mitigating Risk Within a Supply Chain Through Careful Problem Structuring

Prof Anthony Hines *(Manchester Metropolitan University)*

Extant literature suggests that innovation is necessary to mitigate risk in supply chains. However, particular types of risk are not always clearly identified. This fuzziness makes structuring problems observed in empirical studies difficult for further analysis. Supply chain professionals experience different types of risk. These professionals also often possess the necessary skills to solve their own problem through sharing information. This paper discusses research conducted with sourcing professionals in the apparel sector. The research used cognitive mapping software to structure thought processes of participants identifying specific risks with a view to mitigating risk through developing innovative strategies. The study focused attention on the key decision makers drawing out their tacit knowledge to apply solutions to the problems identified. The findings indicate the importance of sharing information in co-creating solutions to supply chain risk. The work demonstrates the necessity of careful problem structuring to identify strategies to intervene and mitigate risk. Much of the supply chain literature assumes technical solutions. This research demonstrates the importance of learning through shared understandings of the problems faced.

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

Professionalism or Pluralism? Rethinking (once again!) the Future of Soft Operational Research

Dr Jose-Rodrigo Cordoba-Pachon *(Royal Holloway, University of London)*

This paper aims to contribute to ongoing discussions about pluralism in Soft Operational Research (Soft or), Problem Structuring Methods and Applied Systems Thinking. Pluralism is currently conceived of as a way forward for people to tackle perceived complexity in messy situations. The meaning of pluralism is being debated and proposals to link it to social theories (i.e. critical realism, pragmatism) have been put forward. Debates between advocates of these proposals might have not been fully developed. This partly suggests that there is still not a clearer direction, set of directions or insights in relation to the future of pluralism in soft OR let alone the future of OR. Using ideas on the sociology of professions and social science disciplines, the paper offers an interpretation of pluralism in Soft OR as a sign of another stage of development of OR as a profession. This interpretation can shed light into some possibilities for the future of Soft OR as well as what OR academics and practitioners working in this and similar fields can do (and cannot do) about it.

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

Project Management

Organisers: **Gary Bell, Rosane Pagano and Jonathan Warwick**

09/09/2014 : 11:00 : Room Windsor 1.04   Code: OR56A1411
Keynote: Value Management: From Wishful Thinking to Causal Certainty
Mr Roger Davies *(London Value Managers)*
This paper explores how Operational Research (OR) is used in Value Management to find, quantify, optimise and realise value in the context of strategic change programmes. The inherent difficulty experienced in quantifying the value of change is introduced and a universal definition of value, designed to eliminate ambiguity, defined. The scale and financial implications of the failure of programmes to deliver real value are placed into context. Seven repeating failure patterns are proposed then key Value Management principles defined in terms of solutions to these patterns and structured as phases in the IMPACT framework, which is founded on true causality. The application of OR is introduced in the context of shifts in mental and physical models demanded for this causal approach and demonstrated for each phase using a case study. Finally, current research in modelling Learning Journeys with the purpose of creating sustainable value is outlined.

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

09/09/2014 : 12:00 : Room Windsor 1.04   Code: OR56A1408
Practical Project Management
Dr Katherine Byrne *(Ministry of Justice)*
"No battle plan ever survives contact with the enemy" Project Management disciplines sometimes seem to suggest that there are strictly defined approaches to managing projects. However, Operational Research practitioners tend to deal with unstructured, messy problems – bringing order to this chaos is what OR is all about. So how can we use project management tools to our advantage and prevent a "box ticking" approach to managing OR projects? This light hearted and interactive look at managing OR projects in the real world will challenge you to think about why project management matters and how you can apply it in genuinely useful ways.

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

09/09/2014 : 13:30 : Room Windsor 1.04   Code: OR56A1427
A System Dynamics Approach to Reducing Schedule Risk on Process Plant Construction: The Development of a Model.
Mr Norman Howard
A model has been developed to understand and ideally prevent overruns and reduce costs on the mechanical part of the design and construction of plants processing chemicals, petroleum or other materials. The model takes account of the consequences of schedule changes and defects, their adverse synergy and the impact of schedule pressure, and also of the application of front-end engineering. Front-end engineering, if used, adds

time and resources to fully define a project's scope and processes, and reduce the risks of changes and defects in the design and construction phases. Although the mechanical part of a contract is a relatively low proportion of total costs, net savings (including revenue from reduced delays) could theoretically be a significant proportion of budgeted costs. A system dynamics approach has been applied, using well researched ideas such as the rework cycle, taking account of feedback loops, bottle necks and non-linear impacts that occur in construction projects. The simulation model runs on Vensim software, linked to data entry in Excel. The model is currently limited by uncertainty in some of its parameter values. The model is sensitive to data describing some non-linear relationships, such as between schedule pressure and productivity, hours and productivity and morale loss and productivity. The degree to which values of these parameters may vary across contractors and project types is unknown. Data has been taken from a few relevant available sources but the model needs to be fully validated and calibrated to provide commercial value.

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

09/09/2014 : 14:00 : Room Windsor 1.04   Code: OR56A1300
Exploring The Use of a Multi-Method Approach to Business Case Development
Dr Gary Bell, **Mrs Swati Umale** and **Prof John Warwick** *(London South Bank University)*
This paper outlines the development of a multi-method approach to constructing an effective and efficient business case for proposed changes within an organisation. This emerging approach is based on the scholarly work of Marty Schmidt. Identified strengths and limitations of Schmidt's work informs the offered multi-method approach. Each method (i.e. Holon Rich Pictures, Project and Product Descriptions, Qualitative System Dynamics, Dynamic Financial Models (Excel spreadsheets)) are outlined and justified. The methods are applied in practice through a business case which examines a proposed website for the Centre of Business Project Management. We explore the 'added-value' of the website through comparing 'business-as-usual' and 'proposed-business-change'. Additionally, further analysis is undertaken through exploring various 'what-if' scenarios that reveal different benefits (soft and hard) and costs which informs the business decision. We reflect upon the offered multi-method approach (within the context of effectiveness and efficiency) through generating key lessons learnt which guides future theory and business case practice.

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

09/09/2014 : 14:30 : Room Windsor 1.04   Code: OR56A1352
The Entanglement of Technological and Organizational Change: An Actor-Network Investigation
Mr Jonathan Tanner *(London South Bank University)*
Change in organizations is often accompanied or driven by projects. This study investigates three project cases within a Higher Education Institution that is subject to large scale restructuring at the same time as developing an organization wide information system that is expected to make a significant contribution to the management of information and data. The first case will investigate the project team developing the information system with the aim of understanding how the team comes into being (the act of translation), how the team manages to define the scope and requirements of the project, how the behaviours of the team are defined and agreed and how and why others agree to be brought under their influence. The second case relates to the project team that has been put together for the purpose of managing the organizational restructuring and culture change process. One of the aims of this team is to bring together disparate organizational groups and cultures and to enable the diffusion of the newly developed information system. The third case is concerned with the actual information system . The system will be the output of the software project team & once released into the wider organization will start to impact on the work of staff and students - and will operate as much as an actant as the human project teams. The two project teams and the

organization will depend on the information system and the system will be dependent on the project teams. This entanglement of the three actants will either result in the stabilization of the organization as expected or result in the dissolution of the project in unexpected directions. Using Actor-Network Theory the study considers both human and non-human actors/actants as equals in terms of agency during a time of significant organizational change.

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

09/09/2014 : 15:30 : Room Windsor 1.04   Code: OR56A1345
Sustainability in Projects: A Value Management Perspective
Dr Rosane Pagano and **Dr Garry Blair** *(Manchester Metropolitan University Business School)*
The aim of this study is to carry out a comprehensive exploration of how sustainability principles can be made more practically applicable to the daily work of the project manager by adopting a value management perspective. Sustainability in business, and therefore in project management, is a growing area of concern to organisations. However, sustainability concepts can still be quite broad, complex and abstract, enough to challenge project management professionals on how to practically map those on project management processes. A number of previous studies have attempted to develop additions to the project management standards and methodologies in order to incorporate sustainability. Some suggest that environmental aspects should be seen as aspects of quality; others offer checklists of sustainability aspects mapped onto the five broad process groups. The value management approach however brings together, in a systematic and practical way, a wide range of powerful techniques focussed on mapping, tracking and valuating complex drivers such as sustainability principles. This paper is a work in progress. It argues that the value management approach can be a robust framework for assessing and justifying the investment on 'sustainable decisions', and for assisting in the delivery of sustainability values through process.

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

09/09/2014 : 16:00 : Room Windsor 1.04   Code: OR56A1405
Exploring the Use of Cognitive Mapping for Management of Risk
Dr Golda Komanapalli and **Dr Gary Bell** *(London South Bank University)*
The presentation explores the use of Cognitive Mapping to inform risk appreciation of two proposed project scenarios. We will discuss orthodox risk approaches and highlight some of their strengths and limitations. An overview and justification for the use of Cognitive Mapping is provided. This qualitative approach is applied in practise to a proposed need for change within an organisation. The identified risks of two proposed project scenarios are outlined in the presentation. We reflect upon the application of Cognitive Mapping to risk, and highlight some lessons learnt which informs future work of our emerging approach to the management of risk.

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

Queue Modelling

Organiser: Navid Izady

09/09/2014 : 11:00 : Room Windsor Auditorium   Code: OR56A1286

Setting Kanban Cards for Non-Stationary and Stochastic Flow Lines Via Sampling

Mr Justus Arne Schwarz and **Prof Raik Stolletz** *(University of Mannheim)*

Traditional Kanban systems are designed to work in a static operating environment. Recent works suggest to change the number of Kanban cards based on the current inventory level to account for stochasticity in the system. We provide a systematic overview of the existing approaches. Based on that, a new mechanism for the Kanban card setting under stochastic and moreover non-stationary operating environments is introduced. This operating environment occurs for example during production ramp-ups. In contrast to existing approaches, the proposed approach uses information about the future development of the system to proactively change the number of Kanban cards. We discuss objectives and preliminary results of the new card setting approach and outline similarities to the buffer allocation problem.

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

09/09/2014 : 11:30 : Room Windsor Auditorium   Code: OR56A1293

Stochastic Scheduling of Customers under Abandonment

Dr Peter Jacko *(Lancaster University)*

Many real-world situations involve queueing systems in which customers may abandon if service does not start sufficiently fast. The notorious examples are scheduling of customers in contact centres and scheduling of patients for a treatment. We study a comprehensive model for multi-class queue scheduling accounting for customer abandonment, with the objective of minimizing the total discounted or time-average sum of linear waiting costs and abandonment penalties of customers in the system. We assume the service times and abandoning times are exponentially distributed. We formulate the scheduling problem in the MDP framework, in particular as a restless bandit problem. We study the optimal policy, but due to its intractability we also develop simple "index rule" heuristics by different methods, which turn out to have an elegant and novel closed form characterization, generalizing the $c\mu$-rule. We illustrate an excellent performance of these index rules in computational experiments and simulations, and partial analytical results of maximal stability and asymptotic optimality. This is an overview of joint work with Urtzi Ayesta, Vladimir Novak and Kevin Glazebrook.

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

09/09/2014 : 12:00 : Room Windsor Auditorium   Code: OR56A1357

Stochastic Decomposition Property for M/G/1 Retrial Queues with Impatient Batches
Dr Nawel Arrar and **Prof Natalia Djellab**
We are interested by the retrial queuing systems, precisely the model of type M/G/1 retrial queues with batches arrival and impatient customers, which operates under so-called classical retrial policy. The results obtained are cumbersome and complex. So, we establish the stochastic decomposition property (SDP) to simplify the solving complex models. Our study includes also asymptotic behavior of the system under high retrial intensities.

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

10/09/2014 : 11:00 : Room Windsor 1.04   Code: OR56A1361

A State-Dependent Bulk Service Model for Capacity Planning in Health Care Clinics
Dr Navid Izady *(University of Southampton)*
A discrete-time state-dependent bulk service model is developed for modeling the appointment queues in primary and specialty care clinics. The model takes patient no-shows and appointment cancellations into account, and works with any stationary arrival distribution. Both the arrival pattern and clinic capacity are allowed to be state-dependent, varying depending on the number of patients in the queue.The application of the model in balancing the capacity between advance booking and walk-in patients is then presented using a framework suggested in the literature for capacity planning with electronic referral and appointment booking systems like Choose and Book system implemented in the UK NHS.

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

10/09/2014 : 11:30 : Room Windsor 1.04   Code: OR56A1393

Using Single-Node Queues to Understand the Behavior of Tandem Queues – The Case of a Maximum Waiting Time System.
Dr David Worthington *(Lancaster University)* and **Dr Dawid Kozlowski** *(University of Southern Denmark)*
Between 2002 and 2013 the Danish health care system offers a maximum waiting time guarantee (MWTG) for patients needing elective patient care based on their total waiting time for treatment. As a patient's total waiting time is made up of waiting time for an outpatient appointment and then for inpatient treatment, the system of interest is essentially a tandem queueing system. Well known results for open and closed Jackson networks tell us that under some circumstances each queue in a tandem network can be modelled independently. Unfortunately the necessary assumptions do not hold for the MWTG problem. However in this presentation we recognise that when queues are short in the MWTG problem, the MWTG will not be operational and the system will operate as if it is a simple open queueing network. On the other hand if the system is overloaded it will spend periods of time when a patient leaving the system will almost immediately be replaced by a newly referred patient, and will thus behave much like a closed queueing network. Hence there is reason to believe that at least under some circumstances the nodes in the MWTG problem will behave as if they are single node queues. The purpose of this paper is therefore to investigate this hypothesis and the extent to which well-known results for single-node queues can be used to understand and predict the behaviour of queues managed operating under a MWTG policy.

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

Spare Parts Provisioning Strategies for a Repairable Critical Component

Prof Baris Balcioglu *(Sabanci University)*, **Dr Dragan Banjevic** and **Dr Pedram Sahba** *(University of Toronto)*

We consider alternative strategies to reduce the spare part provisioning costs of a system of multiple fleets where each fleet comprises finitely many machines. We assume that each machine is subject to failure due to a critical component such as the engine. Failed components are immediately sent to a repair shop and if there is, a spare component is installed on the failed machine to reduce the length of down periods. Problem parameters are the possibly different down time costs and rates of the exponential component times to failure for each fleet and spare part holding costs. Depending on the structure of the inventories and how a repaired component is allocated, we study three strategies. In the first two, which we call the hybrid policies, we permit a shared inventory serving all fleets and/or reserved inventories for each fleet. Alternative dispatching rules for the repaired component differentiate the two: The destination for a repaired component can be chosen either on a first-come-first-served basis (hence, the hybrid FCFS policy) or by following a static priority rule among different fleets (hence, the hybrid priority policy). Our analysis gives the steady-state system size distribution of the two alternative models at the repair shop. The third policy is the application of the multilevel rationing (MR) policy from the production/inventory literature. Here, prioritized fleets use a centralized inventory which is divided by rationing levels. Only when the inventory level is above the threshold for a fleet, its demand is supplied from stock. Otherwise, even if there may be stock on hand, the failed machine waits for a repaired component. We solve the problem by constructing a recursive queueing model. We conduct numerical examples demonstrating the relative performance of the three policies and how they compare to the optimal policy.

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

Routing Applications and Transport

Organisers: Jamal Ouenniche and Daniel Karapetyan

09/09/2014 : 11:30 : Room Windsor 0.02   Code: OR56A1310

A Sustainable Capacitated Vehicle Routing Problem with Loading Constraints with an Illustrative Case Study

Dr Xiang Song *(University of Portsmouth)*

This research focuses on the loading-routing problem, which tries to deliver customer goods like food, fruit, vegetables, dairy products and chemical detergents to customers based at schools, universities, and hotels etc. The deliveries are packed in either pallets, roll-cages or wheeled dollies and are loaded into a vehicle before being delivered to customers. The sequence of the products ordered by customers in the vehicle routes should be designed to avoid unnecessary unloading and repacking operations. In addition, four conflicting objectives need to be considered: Minimise the total travel distance, minimise the number of vehicles used, minimize the congested routes used and minimize the pollution. Thus a multi-objective mathematical model for this Sustainable Capacitated Vehicle Routing Problem with Loading Constraints is set up. The extended goal programming technique is applied in order to find a range of available distinct solutions.

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

09/09/2014 : 12:00 : Room Windsor 0.02   Code: OR56A1309

Dual Local Search for the TSP: New Dual Neighbourhood Structures

Miss Mona Hamid and **Dr Jamal Ouenniche** *(University of Edinburgh)*

Routing problems have been at the origin of the design of many optimal and heuristic solution frameworks such as branch-and-bound algorithms, branch-and-cut algorithms, local search methods and metaheuristics. In this research, we propose new dual neighbourhood structures for the traveling salesman problem (TSP) and test their performance on the TSPLIB instances within a dual local search framework. Computational results suggest that the proposed dual search framework is a promising design.

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

11/09/2014 : 09:00 : Room Windsor 1.04   Code: OR56A1337

Disruption Management in Vehicle Routing: Problems and Models

Prof Richard Eglese and **Mr Sofoclis Zambirinis** *(Lancaster University)*

When distributing goods from a depot to a set of customers, a route and schedule for each delivery vehicle is normally planned that will take into account the customer requirements and constraints such as the capacities of the vehicles and time windows for deliveries. However, after that plan has started to be executed, there may be different types of disruption that mean that the original plan is no longer feasible. Disruption management refers to the process of revising the original plan to reflect the new situation which minimizes the negative impact of the disruption. In vehicle routing problems, disruptions may occur due to several different types of situations such as vehicle breakdowns, traffic congestion due to accidents, delays in

receiving supplies at the depot and other unexpected events. In each case, the best response to the disruption will depend on further details of the distribution problem that is being considered and the relevant objectives for managing the disruption that may include additional costs to customers or the distributor due to deviating from the original plan. The paper will consider examples of disruption management in vehicle routing, showing how the characteristics of the problem can affect the structure of the resulting optimization model.

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

11/09/2014 : 09:30 : Room Windsor 1.04   Code: OR56A1324

A Sim-heuristic algorithm for Robust Vehicle Routing Problems with Stochastic Demand
Mr Abdulwahab Almutairi and **Prof Dylan Jones** *(University of Portsmouth)*, **Prof Angel Juan** *(Open University of Catalonia)*, **Dr Simon Martin** *(University of Stirling)* and **Dr Djamila Ouelhadj** *(University of Portsmouth)*

In this paper we consider the Vehicle Routing Problem with Stochastic Demand (VRPSD) in which customers' demands are stochastic, random variables following a probability distribution. We propose to model and solve the VRPSD by developing robust mathematical models and a Sim-heuristic solution method to minimise the transportation cost while satisfying all demands in a given bounded uncertainty set. The Sim-heuristic combines Monte-Carlo simulation with Randomized Clarke and Wright algorithm in order to efficiently solve the VRPSD combinatorial optimization problems. Computational experiments will be conducted to evaluate the performance of the robust models and the solution quality generated using Sim-heuristic.

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

11/09/2014 : 11:30 : Room Windsor 1.04   Code: OR56A1358

Improving Public Transport Accessibility via the Optimisation and Synchronisation of Schedules for Key Transport Modes.
Dr Michelle Dunbar *(University of Wollongong)*

As the population within modern metropolitan cities continues to grow, greater population dispersion means that daily commuters are increasingly faced with longer commute times and journeys consisting of multiple legs; often involving more than one mode of transport. In a bid to discourage the use of the private motor-car and facilitate the uptake of public transport, there is a developing trend towards the construction of centrally-located Transport Hubs, allowing passengers to connect with multiple modes of transport. To assist passengers in connecting with their outbound mode more efficiently, it is desirable to synchronise connecting modal services within the Transport Hub. In this presentation we consider the problem of designing shuttle-bus routes for passengers connecting with one of four different modes of transport at a Transportation Hub. We seek to minimise the average waiting time for passengers, the number and cost of missed connections at the Hub and the total travel time. Furthermore, we incorporate time-of-day effects and passenger heterogeneity with respect to "value-of-time". In addition to commuters, the framework developed is amenable and directly extensible to the perishable good delivery problem for which items possess heterogeneity in delivery priority. Our model is posed as an extension of the vehicle routing problem with time windows, and solved using column generation. We provide a brief outline of our optimisation formulation and preliminary results for a number of datasets.

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

A Computational Study of Labelling Algorithms for Multi-Objective Shortest Path Problems With or Without Resource Constraints

Miss Yi Qu, **Prof Tolga Bektas** and **Prof Julia Bennell** *(University of Southampton)*

The multi-objective shortest path problems (MSPP) and the constrained multi-objective shortest path problem (CMSPP) are extensions of the classical SPP, both of which find a wide range of practical applications. This paper describes and presents a numerical comparison of a number of labelling algorithms for the MSPP and the CMSPP. The algorithms include label correcting and setting. Extensive computational comparison results are presented on three types of networks, namely full, acyclic and random, which show the superiority of label correcting algorithms for both the MSPP and the CMSPP

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

Scheduling

Organiser: Djamila Ouelhadj

11/09/2014 : 09:00 : Room Windsor 0.04   Code: OR56A1288

Cross-Trained Workforce Allocation for Service Industries
Dr Christopher Kirkbride and **Miss Emma Ross** *(Lancaster University)*
In some (large-scale) service industries, the fine detail of individual shift scheduling may take place in the final week or a matter of days before the final plan is implemented. For such decision-making to be successful, tactical planning decisions need to be made sufficiently in advance to ensure that the resource capacity required is available to meet forecasts of planned and unplanned demand over a short to mid-term horizon. We consider aggregate resource capacity planning models within this tactical planning horizon that seek to make the best use of a large cross-trained workforce through its allocation to forecasts of demand over this horizon. At an operational level the model output provides a snap-shot of the distribution of the resourcing requirements over this horizon that can assist planners in realising the achievability of this demand in practice. At a planning level the model output will highlight where issues of unmet demand or unutilised capacity within this horizon is a potential concern. For the former issue mitigating strategies may be employed and accounted for, at a cost, such as planned overtime, outsourcing, etc. For the latter issue, we show how planned demand may be re-allocated to earlier in the horizon to make use of excess capacity.

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

11/09/2014 : 09:30 : Room Windsor 0.04   Code: OR56A1289

A Two-Stage Stochastic Program for Optimal Cross-Training of an Existing Workforce faced with Uncertain Demand
Miss Emma Ross and **Dr Christopher Kirkbride** *(Lancaster University)*
Cross-training is a popular staffing policy for coping with demand uncertainty and shortage in supply. When implementing such a policy we must make decisions regarding how many workers to train, in which skills and to what level. We might also ask if there are particular training configurations which lead to a higher level of flexibility than others. Existing cross-training literature is primarily focussed on measuring the benefits of different training configurations and finding optimal staffing levels for a pre-defined configuration. Few attempts have been made to model the more day-to-day decision of `how should our existing workforce be enhanced through training, given what we know (and don't know) about the demand we face?'. In this talk we will attempt to better understand the interaction between a cross-trained workforce and uncertainties in demand by modelling this training and allocation problem as a two-stage stochastic program.

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

Linear Programming Applied to Production Planning of Manufacturing Processes
Mr Juan Esteban Diaz Leiva and **Prof Dong-Ling Xu** *(The University of Manchester)*

In a study recently completed, a linear programming (LP) model was developed and employed as supporting instrument for production planning of manufacturing processes. Two production plans based on the same information were generated; one by the company's production planning committee (PPC) and the other through the application of the LP model. Both solutions were compared and analysed. The production plan generated through the methodology proposed outperformed the one obtained by the PPC in a number of aspects. Firstly, the combined use of common sense and the LP model enabled the generation of a feasible and more profitable production plan than the solution provided by the PPC, which satisfied the integer constraints in the problem but was infeasible in the sense that some resource constraints were violated. After obtaining an optimum but inapplicable non-integer solution by solving the LP problem, simple modifications of lower and upper bounds for decision variables enabled the generation of a feasible integer production plan. Secondly, about 10 minutes were required to obtain a production plan through the methodology presented, in contrast to 32 man-hours needed by the PPC. Thirdly, optimum allocation of work centers was also provided by the LP model; such allocation was not even examined by the PPC. Furthermore, the LP model presented a straightforward way to generate a consolidated list of materials needed to undertake the entire production plan. The LP model also enabled the manufacturer to consider production of final products and sub-products simultaneously; this was something that the PPC was only able to do after a preliminary production plan was already established. Individual list of materials had to be generated for every product and then consolidated before the PPC could analyse the manufacture of sub-products. Finally, useful information about opportunity costs and limiting production factors were obtained through sensitivity analysis.

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

Single Machine Scheduling with Time-Dependent Linear Deterioration and Rate-Modifying Maintenance
Dr Kabir Rustogi and **Prof Vitaly Strusevich** *(University of Greenwich)*

We study single machine scheduling problems with linear time-dependent deterioration effects and maintenance activities. Maintenance periods (MPs) are included into the schedule, so that the machine, that gets worse during the processing, can be restored to a better state. We deal with a job-independent version of the deterioration effects, that is, all jobs share a common deterioration rate. However, we introduce a novel extension to such models and allow the deterioration rates to change after every MP. In other words, each MP is allowed to be distinct, so that they can affect the machines differently. The duration of the MPs depends linearly on its start-time. We study several versions of this generalised problem and design a range of polynomial-time solution algorithms that enable the decision-maker to determine possible sequences of jobs and MPs in the schedule, so that the makespan objective can be minimised. We show that all problems reduce to a linear assignment problem with a product matrix and can be solved by methods very similar to those used for solving problems with positional effects.

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

11/09/2014 : 13:30 : Room Windsor 0.04   Code: OR56A1336

A Mixed Integer Programming Approach for Allocation of Surgery Blocks to Operating Rooms

Dr Bülent Çekiç *(Hacettepe University)*

This study aims to find an optimal solution to the balanced distribution of surgical services to operating rooms. For that matter, a mixed integer programming model is developed. The objective function of the model aims to minimize setup costs and provides a weekly balanced distribution of operating rooms to surgical services. Operating-room-allocation is expected to create bottlenecks in cases of emergencies. To exhibit the effects of emergencies and the changes in operating room assignments, some scenarios have been developed and the model is solved for all these cases. The results have revealed that the current allocation of the operating rooms to the surgeries face some time and set up costs to overcome the emergencies. When some of the surgical services are let to use at least one of the operating rooms freely, it is observed that the costs are reduced. The usage of all operating rooms without any constraining allocations by the surgical services, makes the total setup cost zero. However, in this case, there occurs operating-room-renewing costs which are not explicitly included into the model. The actual data about the allocation of the operating rooms are obtained from a public hospital. The results shows that the alternative scenarios exhibit more balanced operation distributions and a flexible operating room usage with less time and setup costs.

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

11/09/2014 : 14:00 : Room Windsor 0.04   Code: OR56A1367

Keynote: Hyper-heuristics and Scheduling

Dr Ender Ozcan *(University of Nottingham)*

Many different types of scheduling problems commonly and frequently appear in society, industry, academia and government. More efficient and effective schedules have the potential to generate significant social, environmental and financial impact. The design and development of search methodologies deriving the intelligent decision support systems for scheduling is a challenging task. Hyper-heuristics embody a class of search techniques that automate the heuristic design process and raise the level of generality at which search methods operate. They provide high level strategies embedding reusable software components that are useful across different problem domains rather than for a single one. This talk covers hyper-heuristics and provides insights into how they can address some selected challenging scheduling problems.

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

Simulation

Organiser: Thomas Monks

10/09/2014 : 11:00 : Room Windsor 0.02   Code: OR56A1442

Keynote: Cloud Computing for Modelling & Simulation

Dr Simon J E Taylor and **Dr Anastasia Anagnostou** *(Brunel University London)*

Cloud computing offers scalable, elastic, on-demand access to a range of computational resources. Arguably, the time taken to obtain results from a simulation can limit the range and accuracy of experiments. Low cost cloud computing resources can potentially speedup simulation experimentation and produce more results more accurately. However, developing cloud computing solutions for industry is difficult without appropriate expertise. Working towards a general approach to cloud computing for simulation, this paper discusses how the CloudSME Simulation Platform is providing a novel approach to cloud computing for modelling & simulation. An example of the agent-based modelling & simulation system REPAST is used to show how the platform can make it easy for end users to use the facilities of multiple clouds.

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

10/09/2014 : 11:45 : Room Windsor 0.02   Code: OR56A1458

PANEL SESSION: Is Simulation in Health Different?

Dr Thomas Monks *(University of Southampton)*

Those of use that work in simulation modelling will be familiar with the viewpoint that simulation in healthcare is different from simulation in other fields of application. The simulation special interest group invites you to a panel session debating this issue. Is simulation in health actually different? If so how is it different and do we have any evidence to support that view?   Our panel is comprised of three leading researchers in simulation: Dr Simon Taylor, Professor Sally Brailsford and Professor Stewart Robinson. Practitioners with experience in healthcare and other domains are particularly encourage to attend and join the debate.

Panellists:
- Stewart Robinson, University of Loughborough and President of The OR Society
- Sally Brailsford, University of Southampton
- Simon Taylor, Brunel University

11/09/2014 : 09:00 : Room Windsor 0.02   Code: OR56A1308

Automated Police Response Officer Selection for Incident Response

Miss Johanna Leigh , **Mrs Sarah Dunnett** and **Mrs Lisa Jackson** *(Loughborough University)*

It's essential the Police force improves the efficiency of its resources to ensure adequate service in the face of major funding cuts. Automation to the response officer selection process can improve efficiency by assisting in the selection of the most appropriate response officer to attend an incident. Currently dispatchers are tasked with selecting the appropriate response officers to send to incidents, by using their experience and judgement as to which would be the most suited, or officers themselves opt to attend specific calls. This typically does not result in the most suitable officer being selected to attend an incident for maximised

efficiency. Providing a software tool to assist in the decision making process will decrease uncertainty in the decision and hence allow the most appropriate officer to be selected to attend an incident. The officer selection tool developed in this work considers the response officer's response time, their availability and their driving standard when selecting an officer. The response time is estimated by finding the quickest route from each officer to the incident, taking into account traffic conditions and which type of roads they will have to travel on. Simulation is used to test the effects of using the officer selection tool over selecting random officers. The results show that using the tool developed response officer time is saved, increasing their availability and reducing response times and fuel costs.

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

11/09/2014 : 11:30 : Room Windsor 0.02   Code: OR56A1251

Coordinating and Carrying Out Distributed Investment Decisions: How Much Collaboration Pays?
Dr Stephan Leitner , **Dr Alexander Brauneis** and **Dr Alexandra Rausch** *(Alpen-Adria Universität Klagenfurt)*
We implement a mechanism for coordinating distributed investment decisions within organizations . We test (i) the mechanism's robustness to incapabilities in forecasting measures associated with investment opportunities and (ii) the impact of the coroprate structure (in terms of the number of departments and collaboration among departments) on the coordination mechanism's fault (in)tolerance. The implemented mechanism is inspired by the idea of the competitive hurdle rate (CHR) (Baldenius et al. In Baldenius et al. in Account Rev 82(4):837–867, 2007) which is well established for allocating (scarce) resources. The CHR mechanism is derived from an agency model, which assumes agents as being heterogeneous, fully competent, and fully rational, and investment opportunities as being perfectly homogeneous. We employ the so called agentization approach (Guerrero and Axtell in Emergent results of artificial economics, Lect Notes Econ Math, vol 652, Springer Berlin, pp139-150, 2011) and transfer the logic behind the CHR mechanism into a simulation model. We add collaboration among departments and heterogeneity (with respect to departments and investment opportunities). In addition, we derive an optimal rule for allocating initial capital expenditures among departments, and model departments as being incompetent to perfectly forecast measures associated with investment projects. We present results on the impact of the level of collaboration among departments and different levels of departmental competence in forecasting on our coordination mechanism's efficiency, and give decision support on how to organize the corporate structure for the domain of investments. In particular, we find that in the case of low forecasting abilities, a low number of departments and a relatively low number of investment opportunities increases the coordination mechanism's efficiency. However, if individual forecasting abilities are high, our recommendation tends towards a low number of investment projects under cosideration, but a high number of departments operating these investment projects.

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

11/09/2014 : 12:00 : Room Windsor 0.02   Code: OR56A1433

Exploring the Interplays between Balanced Scorecard and System Dynamics: Insights from a Case Study
Prof Federico Barnabe' *(University of Siena)*, **Prof Cristiano Busco** *(National University of Ireland)* and **Prof Enrico Supino** *(University of Bologna)*
Purpose The purpose of this paper is to explore the potentials of a "dynamic" Balanced Scorecard (BSC) developed and implemented in accordance with System Dynamics (SD) modeling principles and tools. In particular, building on a review of the relevant literature and the discussion of the insights emerging from a case study, this article explores the way in which SD can address some of the areas of concern (i.e. causality, time, complexity and learning) related to the popular BSC model as developed by Kaplan and Norton, and

help to provide a holistic managerial tool to be used to support strategy formulation and implementation. Design/methodology/approach This article presents a case study in which a two-step approach to the BSC implementation was followed. Initially, the company object of this study developed and implemented a "traditional" BSC, while in the second stage the same BSC was refined and transformed into a simulation SD model to be also used for policy making and scenario analysis. Overall, the paper relies on empirical data to explore the opportunities offered by simulations and computer-aided approaches involved in the process of implementation of the BSC. Practical implications The empirical data discussed in this article provides evidence of the potentialities of a SD-based BSC. In doing so, the article shows how the areas of concern highlighted by the literature enable to question the ways in which the BSC model is built, implemented and used in practice, rather than simply the logic of the model itself. Research limitations/implications. The case material used in this study has undergone a process of data simplification in order to present and discuss a simulation model in an academic paper limiting the degrees of complexity that the original data would have presented.

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

Strategy Analytics

Organisers: Frances O'Brien and Martin Kunc

09/09/2014 : 15:30 : Room Windsor 0.03   Code: OR56A1274

OR Practitioners and Professional Identity
Dr Frances O'Brien and **Ms Amrit Matharu** *(Warwick University)*
This talk will explore the concept of professional identity in relation to OR practitioners. The talk will consider questions such as how do OR practitioners describe the nature of what they do? The talk will particularly consider the role that the use of tools (frameworks, methods and modelling) plays in how practitioners construct their understanding of professional identity.

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

09/09/2014 : 16:00 : Room Windsor 0.03   Code: OR56A1302

Harnessing Complexity to Defend the Boundary-Less Organisation against Cyber Attacks
Mr Graeme Pauley *(PA Consulting Group)*
CXOs require a credible response to cyber information risk. Drawing on theory from cybernetics, physics and military strategy we believe there is a response that takes strength from harnessing complexity. For an organisation to be in control it must ensure that the range of response available matches the variety of situations it has to deal with. Hard-wired responses can be effective in predictable situations; however, modern, blended enterprises are messy; relying on other organisations to deliver their mission. These boundary-less organisations magnify complexity and accelerate the pace of cyber events. In the 1970s, cyberneticians developed the concept of a viable organisation. Following a biological metaphor, such organisations were structured to respond to market signals autonomously at every level. It was believed these organisations would be able to withstand changes in their environment, such as new and evolving threat actors. In the early 90s, fashionable chaos theory suggested that agile, market-facing organisations could spontaneously re-organise into new forms in response to market intelligence. Such organisations would – in theory – be able to out-compete rivals through constantly reinventing themselves in new and unpredictable ways in response to market signals. At the same time, military strategists were developing new insights about outwitting opponents in aerial combat. They realised that the ability to observe, orientate, decide and act faster that an opponent (the OODA loop) achieves an unpredictable and apparently chaotic response, which creates doubt and confusion in adversaries. This paper shows how we may draw upon these theories to mount an effective cyber defence; for example by: 1. Placing individuals at the heart of decision making (not standards); 2. Focusing investment on superior world-views for understanding threat information (not technology); and 3. Ensuring access to information driven by these world views.

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

Long Term Dynamics and Enduring Feedback Structure
Dr John Morecroft *(London Business School)*

A fundamental idea in system dynamics is that interdependencies in business and society pre-determine the performance over time of firms and industries. This idea is often summarised in the phrase 'feedback structure gives rise to dynamic behaviour'. But what if the time horizon of a modelling study spans decades or more? Is it possible to find enduring feedback structures that retain their identity (and power to shape events) over such long periods? To probe this question I select a well-known system dynamics model of the upstream oil industry. I review the structure of the model and its simulated dynamics against the backdrop of major technological and political changes manifested within the time horizon the model originally sought to explore.

Sustainable Supply Chain

Organisers: Fereshteh Mafakheri and Lampros Stergioulas

10/09/2014 : 12:00 : Room Windsor Auditorium   Code: OR56A1255

Examining Green Supply Chain Management and Organisational Performance in Thailand

Prof Dotun Adebanjo *(University of Greenwich)*, **Dr Tritos Laosirihongthong** *(Thammasat University)* and **Prof Keah Choon Tan** *(University of Nevada)*

This study examines the deployment of pro-active and re-active practices in the implementation of Green Supply Chain Management (GSCM) and analyzes their impact on environmental, economic, and intangible performance by considering business strategy as an intermediary organizational focus. Different studies have examined the relationships between green practices and organisational performance however, none has considered the influence of the strategic focus of the organisation. Fifteen GSCM performance items were grouped into three broad groups—environmental, economic, and intangible performance while GSCM practices were grouped into five constructs - Green Purchasing, Product-Related Eco-Design; Packaging-Related Eco-Design; Reverse Logistics; Legislation & Regulation. The constructs were then structured into a model that comprised of 21 hypotheses. Data were collected from 190 ISO 14001 certified manufacturing companies in Thailand and used to test the research hypotheses. Factor analysis was used to examine the construct validity while multivariate linear regression was used to test criteria validity. The study found that legislation and regulation is regarded as a priority and is a key driver of environmental, economic and intangible performance while reverse logistics has relatively low adoption levels and was not significantly linked with any of the dimensions of performance. The study has also found that manufacturers that pursue a low cost strategy are less likely to adopt the green practices that will lead to a positive association with the three dimensions of performance examined in this study. Conversely, organizations that adopt a quality and time-based strategy are more likely to invest in green supply chain practices that will lead to a significant positive association with the three dimensions of performance. The study also showed that Thai manufacturers appear to have failed to understand the potential link between some green supply chain practices and some dimensions of performance.

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

11/09/2014 : 09:00 : Room Windsor Auditorium   Code: OR56A1368

Sustainable Agrifood Supply Chain Management: the Case of the Greek Organic Food Sector

Dr Foivos Anastasiadis *(International Hellenic University)*, **Prof Eleftherios Iakovou**, **Mr Naoum Tsolakis** and **Prof Dimitrios Vlachos** *(Aristotle University of Thessaloniki)*

The agrifood industry is one of most vital sectors in the EU, as it represents one of the key drivers for the national economies of several of its member countries. The supply chain activities of the sector span a wide range of stakeholders from "farm to fork", including but not limited to: primary production; manufacturing; packaging; logistics; warehousing; retailing. Additionally, growing environmental and social concerns with respect to the impact of the agrifood industry have resulted into increased regulatory interventions from the European Commission. Furthermore, academicians and practitioners alike have widely acknowledged the need for adopting comprehensive sustainable strategies in every business activity of the agrifood supply

chains. In this paper we investigate a specific sub-sector of the agrifood industry, namely the organic food sector. We specifically explore the level of sustainability of the supply chains engaged exclusively with organic food. We discuss operations research tools employed in green supply chain management for the agrifood and organic food industries, while we further provide an outline of the relevant hierarchical decision-making processes. We present a holistic assessment of such chains, including every process from "farm to fork", took place for the Greek organic food sector. Initially, every process was mapped and then compared to the existing best sustainable practices for the sector. We employed a case study approach utilizing semi-structured questionnaires and interviews with C-level executives and upper management from top Greek companies of the sector. Key findings suggest a satisfactory level of adopting sustainable strategies, yet they reveal a potential for further adaptation of such strategies as well as tweaking the existing ones for enhanced sustainable performance and profitability. Finally, the study concludes with suggestions for future research.

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

11/09/2014 : 09:30 : Room Windsor Auditorium   Code: OR56A1401
Investigating the Application of Hybrid Simulation Approach for Sustainable Supply Chain Analysis
Mr Masoud Fakhimi and **Dr Lampros Stergioulas** *(Brunel University London)*
Increased supply chain complexities and constantly growing environmental and social challenges have increased decision makers' concerns towards necessity of improved and updated management of supply chain within the organisations. Sustainable supply chain management is an enriched management of supply chain based on balanced integration of organisation's Economic, Social and Environmental responsibilities (Triple Bottom Line framework) with respect to organisations' strategic priorities. As attention to the sustainable development disciplines is rapidly becoming vital for industries, tackling its challenges is also becoming more complex and pricey for organisations. Computer simulation could be valuable tool in providing understanding and insight for coping with such complex phenomenon. TBL-based systems can be very complex and uncertain as they combine various subsystems consisting of many elements and stakeholders with very different interests across the supply chain. Therefore, measuring sustainability is not easily achievable. In addition, TBL-based systems entail operations with difference levels of details and abstractions (from Tactical to Strategic level), which introduces extra degree of complexity for developing model for whole supply chain. So, it may be the case that combination of modelling techniques can assist modellers to be able to fully cater for systems with such characteristics and needs. To tackle these challenges, this research investigates the application of hybrid modelling for sustainability analyse of supply chain. To achieve this aim, in this paper, the authors explore the literature to conduct a comparative analyse on the characteristics of sustainability against capabilities of simulation and modelling techniques. In addition, the authors will argue for a shift in existing traditional modelling paradigms and application of the post-normal modelling approach to investigate, understand and tackle the challenges associated with developing model for studying the systems against sustainable development targets.

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

11/09/2014 : 11:30 : Room Windsor Auditorium   Code: OR56A1364
The Role of Small Farms in Sustainable Food Security: A System Dynamics Approach
Prof Dimitrios Vlachos, Prof Eleftherios Iakovou, Dr Christos Keramydas and **Mr Naoum Tsolakis** *(Aristotle University of Thessaloniki)*
According to The Royal Society, prevailing farming practices that are currently employed to enhance agricultural production towards meeting the global food needs proved to be unsustainable in practice; thus, a transformation is needed to scale up sustainable agricultural intensification. Moreover, the United Nations Environment Programme indicates the transformation of smallholder farming, by reinforcing the role of

smallholders in food production and natural resource stewardship, as the way forward within a sustainable development context. In parallel, the EU funds research to explore the role of small farms (SFs) in global food security. Therefore, the need to streamline policy-making regarding small-scale farming within a local agrifood supply chains (AFSCs) framework is pivotal. In this manuscript, a System Dynamics approach is employed so as to study the social, economic, and environmental role of SFs and the associated local AFSCs in ensuring food security within a sustainability context. Specifically, based on the generic concept of SF products' market diffusion, an extended version of the Bass diffusion model is employed in order to explore the dynamics of the consumers' behaviour and predict the subsequent small-scale farming development trends. Indicative key performance indicators in monitoring the proposed system's performance include total number of employees in SFs and the expected total profit of SFs. Moreover, a set of external interventions/policies are evaluated in terms of their impact on the development prospects of small-scale agriculture. The preliminary results indicate that through appropriate governance and effective policy interventions the potentials of enhancing small-scale farming and smallholdings capacity are promising towards ensuring food security. This work is a first-effort towards the development of a quantitative decision-making support tool that could be employed by policy-makers, including governments, international organizations, and food industry enterprises, towards the effective design of strategic interventions in a sustainable manner.

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

11/09/2014 : 12:00 : Room Windsor Auditorium   Code: OR56A1322
Trade-off between Fuel Emissions and Service Level in Maritime Transportation with Uncertain Port Times
Dr Emel Aktas *(Cranfield University)* and **Dr Afshin Mansouri** *(Brunel University London)*
Maritime shipping is responsible for about 3.3% of the greenhouse (GHG) emissions. Container ships are among the largest emitters of CO_2 followed by bulk shipping, crude oil tankers, and general cargo ships. Slow steaming is widely adopted by ship liners to reduce fuel consumption and GHG emissions. There are trade-offs between saving in fuel emission and reaching the desired service level. We address speeding decision in liner shipping for a vessel calling at n ports along a route to minimise fuel emission and to maximise service level where port times are uncertain. The aforementioned objectives are conflicting; higher service levels might require sailing at faster speeds to make up for the delays in ports, resulting in greater fuel consumption. This scenario leads to a complex stochastic multi-objective optimisation problem. We develop a multi-objective simulation optimization evolution strategy to find Pareto optimal frontier. By defining the lower bound for fuel consumption and the upper bound for service level, we develop a reference for benchmarking the quality of the Pareto frontier. We examine applicability of our approach using real data of two ship liners in the Pacific Ocean and the Mediterranean. Considering uncertainty of port times and tightness of arrival times as the two key factors that affect service level and fuel consumption at three levels, we generate data sets accounting for a wide range of combinations of these two factors for the experiments. We find that the level of uncertainty in port times is a key factor affecting service levels and speeding decisions become less effective under high port uncertainties. This problem is more critical for shorter routes where the contribution of port time to the overall journey time is significant. We discuss sensitivity of the two objectives to problem characteristics and provide managerial implications for ship liners and port operators.

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

11/09/2014 : 13:30 : Room Windsor Auditorium　　　　　　　　　Code: OR56A1360

Keynote: A Methodological Framework for Green Logistics Networks under Periodic Review
Replenishment Policies

Prof Eleftherios Iakovou *(Aristotle University of Thessaloniki)*, **Prof Rommert Dekker** *(Erasmus University Rotterdam)*, **Dr Ioannis Mallidis** and **Prof Dimitrios Vlachos** *(Aristotle University of Thessaloniki)*

In this manuscript we propose a methodological framework for evaluating the cost and CO_2 emissions trade-offs of implementing periodic review inventory planning policies at each node of a frequently encountered in practise multi-echelon logistics network design instance. The proposed methodology determines optimal order delivery frequencies and stock levels at each node and its application is further illustrated through a real-wold case study of a white goods retailer's logistics network. Various managerial insights are obtained, while it is further documented that a CO_2 optimal solution results in lower transportation frequencies and thus in lower transportation CO_2 emissions and costs, but also, in higher holding and backorder costs.

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

11/09/2014 : 14:30 : Room Windsor Auditorium　　　　　　　　　Code: OR56A1328

A Multi-Objective Optimisation of a Manufacturing Supply Chain under Fuzzy Scenario-Based Demand

Dr Jiabin Luo and **Prof Dobrila Petrovic** *(Coventry University)*

The real-world manufacturing supply chain investigated in this study consists of suppliers, a manufacturer and customers. Two types of suppliers are considered: standard and emergency. Standard suppliers can provide materials at a lower cost but in a longer lead time, while emergency suppliers offer materials in a shorter lead time at a higher cost. Customers can forecast demand several times before placing a fixed order. There is no obligation for customers during the forecast period. However, they cannot change demand after the fixed order is placed. Materials are purchased from standard suppliers in advance according to forecasted demand. However, the fixed order may differ from forecasted demand, in terms of both quantity and time of placing the fixed order. In order to satisfy all customer demand, any shortages of materials must be purchased from emergency suppliers when the fixed order is placed. We have developed a multi-objective optimisation model to determine how much to order from suppliers in such a way as to maximise effectiveness, robustness and resilience of the supply chain. The uncertain information of customer demand is modelled by fuzzy scenarios. Each scenario is defined by a change in quantity and time of placing a fixed order, and a probability of its occurrence. All these parameters are expressed using linguistic terms and modelled using fuzzy sets. Supply chain effectiveness is described by the expected total costs of all the scenarios; robustness is represented by the expected variance of costs; and the resilience is characterised by the expected customer fill rate, which shows the ability of the supply chain to cope with disruptions. Sensitivity analysis is performed through a series of numerical experiments with respect to the quantity and time of demand change. The effects on the performance of the supply chain are analysed.

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

Integrating Environmental Sustainability and Lean Management with Innovation ; Impact on Manufacturing Firms in Improving Environmental Efficiencies
Mr MD Samsad Reza *(University of Greenwich)*

Environmental sustainability is no more a fashion or an optional ornament for the organizations to practice as there is an increasing pressure from the stakeholders (consumers, government, NGOs) to become environmentally sustainable. Yet, most organizations are reluctant to adopt environmental practices unless there is financial benefit in the short term simply because of the change in the system or investment it requires. Lean management/manufacturing is well known for targeting and eliminating wastes from the process which also provides financial benefit by cutting costs. Therefore, integrating lean with green management practices can deliver financial benefits with improved environmental performances. On the other hand, innovation is regarded as a tool for increasing the competitiveness but lean management was criticised for its rigidness and lack of flexibility which is often the prerequisite of innovation. Consequently, it would be interesting to investigate the integration of lean and green management with innovation and their impact on environmental performances. UK food sector is a highly regulated and monitored sector to ensure food security and safety and it is also a major source of carbon emission and waste production both in the primary and secondary production level. Yet, the industry lacks a proper framework to implement lean, green and innovation simultaneously. This study explores the synergies and divergences among the supply chain paradigms and intends to investigate the relationship among lean management, environmental sustainability practices and innovation and to understand the role of the lean management and environmental sustainability practices on food manufacturing firm's environmental performance. Plant level survey data is being collected from 2000 UK Food manufacturing firms to test the proposed model. Factor analysis (Principal Component Analysis), Correlation and Multiple regression analysis is used to measure the psychometric properties of the study. The study contributes to both theory and practice.

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

Third Sector O.R.: Modelling for a Better World

Organisers: John Holt and Simon Pegg

09/09/2014 : 11:00 : Room Windsor 1.03   Code: OR56A1265
Pro Bono O.R. in the Third Sector
Mrs Felicity McLeister *(The OR Society)*
Providing Pro Bono O.R. to third sector organisations is an idea that has been around The OR Society for quite a while. A pilot project was started in 2011 and the interest it generated let to a formal Pro Bono O.R. imitative being set up by The OR Society in September 2013. Since September Pro Bono O.R. has received over 40 enquires, has completed 6 projects and is currently working with a further 8 organisations (as of June 2014). This session will provide details about Pro Bono O.R., talk briefly about some of the case studies, provide an overview of the experience from both a volunteer and organisational perspective and provide further information about how you can get involved.

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

09/09/2014 : 11:30 : Room Windsor 1.03   Code: OR56A1362
Measuring the Impact of Community-Based Interventions to Improve Health and Well-Being
Miss Samantha Mackay and **Mr John Newman** *(Apteligen Ltd)*
This presentation will demonstrate recent work that has been undertaken with national care and support providers from the third sector: • To develop a measurement and evaluation framework for assessing the impact of an innovative, community and asset-based intervention for vulnerable people that aims to improve independence and quality of life, and • To design and build a modelling tool to demonstrate early impact of the pilot project, based on a sample of typical cases

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

09/09/2014 : 12:00 : Room Windsor 1.03   Code: OR56A1420
Developing a Tool to Help Dog Breeders Predict Genetic Risks
Dr Sophie Carr *(Bays Consulting Limited)* and **Mr Ian Seath** *(Improvement Skills Consulting Ltd)*
There are a growing number of DNA tests to help dog breeders identify potential breeding pairs that could be affected by inherited diseases. In particular, Miniature Wirehaired Dachshunds known to suffer from a form of Epilepsy called Lafora Disease. Whilst there are two different tests available to determine if a Dachshund carries the autosomal recessive mutation, not every dog is tested. Consequently this creates 4 populations: tested; untested; clinically affected (i.e. showing symptoms) and clinically not affected. What was required was a simple, robust approach to support informed decisions about which pairs of dogs could breed whilst minimising the number of puppies with Lafora disease. As part of an OR Pro bono project an Excel tool was developed to evaluate the risk factors associated with the mutation status of DNA tested and untested dogs. The results of the project will be used as part of an education programme to help breeders

understand why DNA testing for Lafora Disease is so important. This presentation will explain the maths and probability theory that lies behind this problem and show how the tool was developed.

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

09/09/2014 : 13:30 : Room Windsor 1.03   Code: OR56A1359
Probabilistic Weather Information for the RNLI
Mr Ed Wheatcroft *(London School of Economics and Politics)*, **Mr Russell Hocken** and **Ms Cath Reynolds** *(RNLI)* and **Prof Leonard Smith** *(London School of Economics and Politics)*
RNLI is the charity that saves lives at sea. Every year, volunteer lifeboat crew are called out around 8,000 times. Difficult operational decisions about what a lifeboat is capable of in rough seas sometimes have to be made. This project aimed to provide a risk visualisation tool to help inform these operational decisions by combining academic work around weather risk analysis with RNLI knowledge and data about incident rates. The project will also help determine timescales on which existing weather forecast products might better inform RNLI activities.

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

09/09/2014 : 14:00 : Room Windsor 1.03   Code: OR56A1317
Never Too Late To Learn - Lessons from a Recent Assignment
Mrs Susan Merchant *(Blue Link Consulting)*
Planning for a recent 3 hour strategic planning workshop for a charity's board of trustees was challenging because of personalities and timeframes. After much deliberation, the author hit upon a manageable method which worked well on the day and from which satisfactory feedback was obtained. Nevertheless there are lessons to be learned which the author will share and will look for look for suggested improvements from the audience.

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

09/09/2014 : 14:30 : Room Windsor 1.03   Code: OR56A1383
It's a Dog Life: Modelling UK Dog Population
Mr Alessandro Arbib *(DECC)*
The breeding, ownership and welfare of dogs in the UK is a complex social area. Although there has been research into the size of the dog population, nobody has pulled all this together into a single model that everyone can use to help focus priority issues. A consensus understanding of the population and how it is stratified is crucial to allow proposing meaningful welfare improvement policies. From November 2013 to May 2014 a group of 3 OR analysts and an engineer from DECC worked with the RSPCA (the UK's leading animal welfare charity) and Dog-ED (a Social Enterprise applying Systems Thinking to canine welfare) to provide analytical evidences about the number of dogs currently present in UK and how they move through the system. The project involved a significant literature review to collect the data necessary to produce a snapshot of the UK dog population; designing and building a "stocks and flows" model to investigate the flows of dogs from the different categories; and developing recommendations for possible uses and future development of the model. Lack of consensus amongst the data sources, and considerable variation in data quality and definitions used made it difficult to provide accurate answers to the customer's problem. We will describe our main outputs including estimated upper and lower bounds for the dog population, a "stocks and flows" model developed in Excel, and a list of the main data gaps and issues we met in our work. Last but

not least, we will focus on the valuable experience of working for the Third Sector, summarising the main lessons learnt and the value that OR was able to add in this 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?: Highly

09/09/2014 : 15:30 : Room Windsor 1.03   Code: OR56A1356

Keynote: What's So Special about the Third Sector? What makes Third Sector O.R. Different
Ms Ruth Kaufman
The OR Society's Third Sector initiative has two main components: a Special Interest Group, to promote knowledge and understanding of Third Sector O.R.; and a Pro Bono scheme, where O.R. people offer to do free O.R. work for a third sector organisation. But is there really any difference between doing O.R. in the third sector and doing it with a government or private sector organisation? Is "it's for charity" really a good enough reason to work for free? This talk explores these issues, taking charities as an example of third sector organisations. It considers three areas of inherent difference between charity, private and public organisations – legal form, governance, and resourcing – and other factors such as organisational size, culture, and business environment. It goes on to consider the implications for practising OR in three broad areas: strategy, efficiency, and profitability. It argues that many of the fundamental organisational problems, and therefore the fundamental O.R. responses, are essentially the same across sectors; and that it is not possible to draw hard and fast distinctions between sectors, especially given the blurring of the lines between charities and other bodies that is part of the current government's strategy to shrink the welfare state. Nonetheless, it concludes that there are a number of features that characterise Third Sector O.R. as a result of the differences between charities and the rest. Of course, one of these differences is that charities are set up because someone, somewhere, thinks that something is a Good Thing to do, regardless of democratic mandates, statutory requirements, or market imperatives. The talk concludes with a discussion of what it is that may inspire the OR volunteer to buy into that Good Thing enough to share their time and expertise for free.

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

11/09/2014 : 11:30 : Room Windsor 1.03   Code: OR56A1339

Business Planning for a New Not-For-Profit Nursing School in Remote Rural Sub-Saharan Africa
Mr Andrew Dobson
In this talk, the speaker will describe work done with local managers responsible for starting up a nurses' training school, in a remote part of rural sub-Saharan Africa, alongside a small locally-run not-for-profit hospital. The physical infrastructure and early running costs had been funded by the generous donations of some tourists who had visited the area, but with no ongoing commitment, and some overoptimistic planning assumptions about income. As a result the school, and by default the hospital alongside it, were facing a substantial year-on-year deficit with no substantive plan for how this would be financed. They urgently needed to address this. The speaker will describe the facilitation, analysis and modelling work done to help the school's, and the hospital's, managers develop a financial and business plan to minimise its short-term funding gap and move towards a more sustainable footing, in spite of the difficult geographical and economic environment. He will also describe the current conclusions; and various possible developments for the future. One possible development is for the school and hospital in combination to become a specialist location for operational research in rural sub-Saharan African health care, on which any thoughts would be welcomed.
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

11/09/2014 : 12:00 : Room Windsor 1.03   Code: OR56A1277

High Capability Tools for Complex Disaster Management
Mr John Holt

In the process of conducting Pro Bono work with charities to support the Dallets (Untouchables in India and Pakistan) dealing with very complex Disaster Relief issues, a number of very useful tools were found by the author to be freely available on the Internet (possibly free). Following further investigation, few in the charity domain appeared to recognise these particular tools. The aim of this talk is to make the methods more widely publicised. The tools are described using Maslow's Hierarchy of Needs, a very influential tool in Applied Psychology, using the author's many years experience as a Practitioner in that area. Maslow proposed a hierarchy of five basic human needs. Using Maslow's framework will allow the coverage by the tools to be more clearly understood. The models covered are: • Physiological need using the UNICEF - Water, Sanitation and Hygiene website • Safety need using Sphere Project (NGOs) • Love, Affection and Belongingness need using Participatory Vulnerability and Capacity Assessments (PVCA) (Christian Aid) • Esteem needs using Cognitive Mapping (from a UK Peacekeeping study by the author) • Self-Actualisation need using Repertory Grid from the same UK Peackeeping study by the author)

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

11/09/2014 : 13:30 : Room Windsor 1.03   Code: OR56A1319

Improving Customer Satisfaction and Driving Out Waste in a Responsive Repairs Process by Revealing and Analysing "Hidden Data".
Mr Ian Seath *(Improvement Skills Consulting Ltd.)*

This is a case study on a process improvement project with a Housing Association's Responsive Repairs process which discusses the "hidden data" which was unearthed from their CRM system. It will also present some "quick and dirty" data collection approaches that gave the organisation unique insights into customers' perceptions and the sources of waste and delay in process performance. It will present some of the simple solutions adopted to improve and manage the repairs process.

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