Lancaster University
MANAGEMENT SCHOOL

THE DEPARTMENT OF MANAGEMENT SCIENCE

Background

The Department of Management Science was formed from the merger of the two Departments of Operational Research and Systems Engineering in 1993. These were established in 1964 and 1967 respectively, as the first of their types in a British University and were amongst the earliest departments of the University of Lancaster. Set up under the direction of Professor Pat Rivett and Professor Gwilym Jenkins, the departments made their mark by their research, scholarship and co-operative attitude to collaboration with industry and the public sector. Since then, the departments have enjoyed distinguished leadership from Professors Gwilym Jenkins, Mike Simpson, Alan Mercer, Peter Checkland, Robert Fildes, Mike Pidd, Richard Eglese and Linda Hendry.

The Department of Management Science combined Professor Peter Checkland's work in Soft Systems Methodology and its application in information systems, with the formal, quantitative modelling skills of the Operational Research staff. It is now an international centre of excellence for research and teaching in Management Science, covering the disciplines of Information Systems and Information Technology, Operations Management, and Operational Research. It thus embraces a rare combination of research skills, from the hard quantitative skills through to qualitative research approaches including action research, often based on collaboration with industry and the public sector.

Since 2001, the Department has roughly doubled in size. It doing so it has strengthened its work in information systems, the mathematics of OR, logistics & supply chain management and business & marketing analytics. With a complement of over 30 research-active staff, the Department is now one of the largest of its kind in Europe.

In co-operation with Lancaster's Department of Mathematics of Statistics, the Department runs the STOR-i Centre for Doctoral training (CDT) in Statistics and Operational Research. This is funded by a grant of £4.5 Million by the Engineering and Physical Sciences Research Council (EPSRC). The Department is also a partner in the EPSRC-funded HighWire CDT to train doctoral students across information systems, computing science and design. It hosts NATCOR, an EPSRC-funded scheme that provides a national training course for doctoral researchers in OR (NATCOR). It leads the LANCS Initiative, which is an EPSRC-funded initiative based on consortium of four universities (Lancaster, Nottingham, Cardiff and Southampton) to develop the foundations of OR. LANCS enjoys £13M of funding across the four universities, mostly from EPSRC. Professor Kevin Glazebrook directs both NATCOR and the LANCS Initiative.

Academic staff

Professors	David Brown	MA Lancaster
	Sue Cox OBE Dean of the Management School	PhD Nottingham
	Mike Chiasson	PhD British Columbia
	Richard Eglese	MA Lancaster
	Robert Fildes	PhD California
	Kevin Glazebrook	PhD Cambridge
	Linda Hendry	PhD Lancaster
	Adam Letchford	PhD Lancaster
	Mike Pidd Head of Department	PhD Lancaster
	Stein W. Wallace	PhD Bergen
	Mike Wright	PhD Lancaster
Professors Emeritus	Peter Checkland	MA Oxford
	Alan Mercer	PhD London

Senior lecturers	Jerry Busby	PhD Lancaster
	Graham Rand	BSc Liverpool
	Martin Spring	PhD Stirling
	David Worthington	PhD Reading
Senior Teaching Fellow	Paul Dunning-Lewis	PhD Lancaster
Lecturers	Roger Brooks	PhD Birmingham
	Sven Crone	PhD Hamburg
	Paul Devadoss	PhD National University of Singapore
	Chris Kirkbride	PhD Newcastle-Upon-Tyne
	Nikos Kourentzes	PhD Lancaster
	Stephan Onggo	PhD Singapore
	Zhan Pang	PhD Chinese University of Hong Kong
	Nicos Pavlidis	University of Patras
	Paul Ralph	PhD British Columbia
	Patrick Stacey	PhD Bath
	Mark Stevenson	PhD Lancaster
	Marta Zorzini	PhD Milano
Teaching Fellow	Mark Westcombe	BSc Lancaster
Research staff	Dinos Kaparis	PhD Lancaster
	Nikolaos Kourentzes	PhD Lancaster
	Juan Ramon Trapero Arenas	PhD Universidad de Castilla-La Mancha
Visiting Professors	Kjetil Fagerholt	PhD Norwegian Univ of Science & Technology
	Tor Larsen	PhD Univ of Minnesota
	Jim Scholes	PhD Lancaster
	Edward Truch	DBA Brunel
Visiting Lecturers	Adam Hindle	PhD Lancaster
	Ruth Kowalczyk	PhD Lancaster

Research activity

The Department has active research programmes spread across the broad areas of Information Management & Systems Theory, Operational Research and Operations Management. Its world-leading research record was a major factor in the Management School's excellent performance in the 2008 Research Assessment Exercise in which 75% of the School's research activity was assessed as world leading or internationally excellent in terms of originality, significance and rigour. On this measure Lancaster was 3rd equal in RAE 2008. This outstanding result follows three previous RAEs (1992, 1996, 2001) in which Lancaster was the only full-spectrum business school to receive the top rating on every occasion.

Because we believe that the ultimate test of our research is its impact on the real world, most staff collaborate, in various ways, with external organisations. A common research theme is that model-based approaches are used to explore practical management problems experienced by IS, OR specialists and operations managers. The increasing complexity of decision making in modern economic and social systems and the power of IT to collect and analyse larger amounts of data has increased the need for and use of these approaches.

PhD research is a major feature of the Department and full details of the PhD programme are given in our web pages, including information about some of our many PhD students. We put considerable effort into the training of our PhD students, including the EPSRC-funded STOR-i and HighWire CDTs and our leadership of NATCOR. There are associated MRes programmes for students who are not fully prepared for PhD work.

Main current research activity
The Department's research is focused in three main areas, though there is considerable overlap between these and many faculty work in more than one.

Operational Research:
Richard Eglese, **Adam Letchford** and **Mike Wright** all conduct research on solution techniques for discrete optimization problems. Richard Eglese concentrates mainly on heuristic methods for problems arising in logistics, such as vehicle routing and scheduling problems. Richard has a particular interest in Green Logistics, building on a recent research project funded by the EPSRC, and his 1990 paper on simulated annealing is one of the 30 most cited articles in the European Journal of Operational Research. Adam Letchford is a recognised authority on exact solution methods for optimization, especially those which use cutting planes. He is a frequent contributor to the Mathematical Programming journal and has collaborated with many overseas researchers, for example in Aarhus, Bologna, Heidelberg and Valencia. Adam was the first OR academic to receive a 5-year, EPSRC advanced research fellowship and also received an IBM faculty award. Mike Wright specialises in meta-heuristic approaches for highly constrained, multi-objective problems, such as timetabling, scheduling and packing problems. Mike's work on sports scheduling has been particularly influential.

Kevin Glazebrook and **Chris Kirkbride** lead the Department's work at the interface between statistics, applied probability and OR. Their research has included contributions to stochastic scheduling, queuing, sequential statistics and Bayesian decision theory; the latter including applications to research planning, screening methods and optimal search. A prime cohering theme is the optimisation and control of complex stochastic systems and, within that, the role of state based calibrations of decision options. Current EPSRC-supported activity involves several PhD students and includes work on inventory management, maintenance/reliability and dynamic resource allocation. Recent work has been the subject of papers in Operations Research, Management Science and Mathematics of Operations Research. **Zhan Pang** recently joined the Department, under the LANCS initiative, and uses similar methods in the analysis of inventory systems, including pricing and revenue management systems.

Stein W. Wallace was appointed under the LANCS initiative. His focus is on decision-making under uncertainty, with publications relating to mathematical, algorithmic and modelling aspects of stochastic programming. He has been active in applications in energy (electricity as well as oil and gas production), logistics, fisheries management, finance, and telecommunications. His main activities now are related to analyzing stochastic effects in integer programs, to understand what constitutes robustness and flexibility in planning, as well energy modelling where he works closely with Zhan Pang.

David Worthington continues research into discrete time modelling of queuing systems to provide means of solving practical problems which are mathematically intractable. He applies such approaches to queuing models in healthcare and manufacturing systems, with a view to providing better estimates for planning times to use in practical planning systems. Dave has also applied new approximations for time dependent queues to explore how the scheduling of key healthcare professionals can improve performance in relation to government targets.

Robert Fildes and **Sven Crone** are the directors of the Lancaster Centre for Forecasting and work with **Nicos Pavlidis** and **Nikos Kourentzes.** With their doctoral students and post-docs they form the largest academic research group in Europe working on a wide variety of forecasting-related and business analytics problems from the technical to the organisational. A particular research has concerned with the evaluation and utility of time series forecasting models, developing further the literature on 'forecasting competitions'. As well as being heavily cited, this research has impacted on software design of commercial packages. Sven and Nikos's interests include a concern to make non-linear Neural Network Methods more effective and applicable and, with substantial industrial support, include applications in method selection in manufacturing. The Forecasting Centre also

includes research on Marketing analytics and Modelling. The main research interests are in forecasting new product diffusion, developing effective CRM tools, retail forecasting and online marketing strategy.

Mike Pidd, **Roger Brooks** and **Stephan Onggo** conduct research in computer simulation, including discrete event and agent-based approaches. Their work ranges from the highly technical challenge of efficiently simulating large systems using high performance computers, to the study of how models are built and used, including work on conceptual modelling. Their work is summarised in research papers in leading OR journals, as well as the dedicated simulation literature and refereed conferences. Stephan Onggo enjoys collaborations with high performance computing colleagues in Japan and Spain. In recent years, Mike Pidd has been especially active in simulation for the improvement of healthcare systems, including the EPSRC-funded work on simulation modelling for the analysis of hospital performance. Though not directly related to simulation methods, Mike's AIM (the UK's Advanced Institute of Management Research) funded work has led to a new book, *Measuring the performance of public services: principles and practices*, to be published by CUP later this year.

Operations Management:

Linda Hendry has an international reputation for her work on the management and planning of make-to-order manufacturing companies, with particular emphasis on the marketing/production interface, order acceptance and release policies. This has been achieved via the application of and further development of Workload Control, an approach to production planning and control in which Lancaster is recognised internationally as one of the leading research centres. This approach to production planning, which has influenced many active researchers in German, Dutch, Italian, Greek and Portuguese universities and research institutes, has attracted international collaboration with the Universities of Groningen and Coimbra for the dissemination of this work. **Mark Stevenson** is furthering this research, examining case study implementations. Linda Hendry has developed definitions of world class manufacturing for make-to-order (MTO) manufacturing and service companies with particular reference to SMEs, partly funded by BAE Systems.

Jerry Busby's interests are in the areas of analysing risk and its management, examining systemic failure, human and organisational error, design organisations and design processes. His work is published in leading journals such as Risk Analysis and Risk Management, and has earned substantial funding from EPSRC. His work includes collaboration with the Dean, **Professor Sue Cox** in the area of safety, especially in the nuclear industry. He and Mike Pidd are engaged in patient safety research with a local NHS Trust.

The application of quality management to particular countries and organisations is a continuing research interest for **Graham Rand**. Recent doctoral students have investigated quality practices in Malaysia and Mexico. Current research students are studying issues in the Insurance industry in Kenya, the UK and Greece. Linda Hendry is also working in this area, with a current doctoral student studying the Implementation of Six Sigma in the insurance industry.

Research in supply chain and logistics includes **Martin Spring**'s work on power relationships, servitization, and links to marketing issues in the supply chain and Mark Stevenson has interests in supply chain flexibility. **Marta Zorzini** researches the concept of off-shoring. Together with other staff members interested in modelling this makes the group one of the largest in the UK with interests encompassing all aspects of the supply chain and operations. Graham Rand has developed, in collaboration with colleagues at Renmin University, China, heuristics for ordering and stocking decisions under changing demand conditions. Robert Fildes continues to examine how uncertainty and forecasting errors impact such decisions in ERP and MRPII systems, showing those circumstances where improved forecasting is valuable. Martin Spring has recently completed a prestigious AIM Services Fellowship examining the development of novel business models for firms in a variety of sectors, using a collaborative research approach based on close involvement with

firm's management teams. This reflects Martin's associated concern with the development of more engaged qualitative research methods in operations and supply management.

Information Management and Systems:
The IS group continues to grow and broaden in scope. Through collaborative research, including joint PhD students, the group is linked with other LUMS research groups in operations management, innovation, strategy, computing and organisation and technology. Soft Systems Methodology (SSM), pioneered at Lancaster, continues to influence the field heavily. Peter Checkland and Sue Holwell's book provides a seminal contribution to the practice of systems specification. In recent research, Mike Pidd examined the links between hard and soft OR/MS, summarised in his book *Systems Modelling: theory and practice* and in the widely used text *Tools For Thinking – Modelling in Management Science* has provided wide exposure of the ideas. Application of SSM and other information management concepts in the field of E-commerce has been instigated by **David Brown**, in a research programme originally funded by Hewlett Packard and SAP. David is also Director of the Lancaster China Management Centre, which conducts collaborative research with institutions in China.

Mike Chiasson's work focuses on key socio-technical issues and approaches to the design, development and implementation of information systems. Typically Mike's approach has been as a participant observer – using action research - which has involved him directly in the design and implementation of information systems, for example in professional domains, including health care, where IS issues are complex. Mike recently completed an AIM Fellowship and worked on IS based service-sector innovation in chronic health care. His work is published in leading journals such as Management Information Systems Quarterly and the European Journal of Information Systems.

Paul Devadoss's research interests are related to organizational issues in technology adoption, and the role of cultural interactions. In particular Paul has explored the use of IS in different institutional settings including E-government, crisis management, knowledge management, customer relationship management and ubiquitous computing. Paul is Director of the Lancaster University India Centre, which develops and manages partnerships with academic institutions in India.

Paul Ralph and **Patrick Stacey** recently joined the Information Systems area of the Department. Paul's research aims to improve software development methods, tools and practices by studying designers and their projects using a medley of qualitative, quantitative and conceptual research methods. Patrick researches the social dynamics of design and innovation processes; multi-disciplinary collaboration, computer game design, sense-making, structuration theory, emotion, improvisation, distributed work. Their work is published in journals such as Human Relations and the Information Systems Journal.

Teaching
The Department offers undergraduate, postgraduate and post-experience courses and most staff are active in all three types of teaching.

Undergraduate
Lancaster University first degrees are based around major schemes of study in which students concentrate their efforts, accompanied by minor courses that also count towards the degrees. Thus, students who major with the Department might take minor courses such as accounting, marketing or industrial relations from within the Management School, or might choose topics from outside the School, such as computing, mathematics, statistics or some other suitable subject.

The Department offers the following major schemes of study.

- BSc in Business Computing & Information Systems (joint with Department of Computing)
- BSc in Business Management Information Systems (joint with Department of Computing)
- BSc in Management Science
- BSc in Operations Management

- BSc in Project Management
- BSc in Management Mathematics (joint with the Department of Mathematics and Statistics).

The course units that make up these degrees range from the highly technical (such as mathematical programming and computer simulation), through applications courses (such as quality management, and developing business information systems) to courses that emphasise personal transferable skills, (such as the project management courses, e-business). The units are taken by students from elsewhere in the Management School and the university as well as by the department's own major students.

Postgraduate

The Department has a Masters degree portfolio with four programmes:

- MSc in Operational Research & Management Science,
- MSc in Logistics & Supply Chain Management,
- MSc in Management Science & Market Analysis
- MSc in Project Management.

The MSc programmes have a strong applied focus and take high quality first degree graduates and hone their skills and knowledge to make them more useful. They are also intellectually challenging and very hard work! The courses include a project, usually with an external organisation, that runs for about 4 months from May each year. Projects are closely supervised by the academic staff who, with the students, find these one of the most rewarding parts of the MSc courses.

The Department is a major contributor to other Masters programmes in the Management School, including the full-time MBA and the MSc programmes in E-Business & Innovation and Information Technology and the Management of Organisation Change. It works on the MSc in Quantitative Finance with the Departments of Accounting and Finance, Economics and Mathematics and Statistics.

The Department also offers occasional post-experience open courses under the Lancord name and through the Forecasting Centre, including some organised directly for specific organisations to meet their particular needs. Staff are paid over and above the normal salary scale for this work.

LANCASTER UNIVERSITY MANAGEMENT SCHOOL

The Department is one of six that make up the Management School (LUMS); the others being: Accounting & Finance, Organisation Work & Technology, Economics, Management Learning, the Institute for Entrepreneurship & Enterprise Development and the Management Development Division. LUMS also includes a number of interdisciplinary centres including: the Lancaster Leadership Centre, the Centre for Performance-led HR, the Centre for Strategic Management and the Lancaster China Management Centre. LUMS is a faculty of the university and Professor Sue Cox OBE is the Dean. Within the School, teaching and research is conducted both within single departments, across departments and on a School-wide basis.

School-wide taught programmes include:

- BBA (Bachelor of Business Administration)
- European BBA
- BSc in Business Studies
- Full-time MBA
- Consortial, part-time MBA
- Global MBA
- International Masters in Practicing Management
- MSc in Management

In addition, there are many specialist masters programmes run through the departments and the Management Development Division runs programmes for external organisations.

LUMS, including the Department of Management Science, is housed in closely-located, purpose-designed buildings at the south end of the university campus. Working conditions are excellent and LUMS enjoys an attractive learning and social environment. The buildings include offices, teaching rooms, computer labs, fully networked study space, common rooms and a cafe; the most recent building, named after Sir Charles Carter, the University's first Vice-Chancellor, was opened in 2011. All staff have networked PCs or laptops and can access a full range of other computing resources through the campus network and its world-wide links.

LANCASTER UNIVERSITY

The university was founded in 1964 and it has established itself as one of the UK's top research-led institutions. The Bailrigg campus is situated on the southern outskirts of Lancaster and is set in 250 acres of landscaped parkland, close to the lively, friendly and historic city of Lancaster. The campus is just 30 miles south of the beautiful Lake District and about the same distance from the Yorkshire Dales. It is about one hour's drive from Manchester International Airport and about two and a half hours by train from London.

From a distance the University is identified by the brilliant white spires of the Chaplaincy Centre and by Bowland Tower, a 14-storey residence block. The Lancaster campus is designed around the Spine - a covered walkway which runs the length of the site, from north to south. The residences, teaching rooms, research laboratories, library, and shops extend along and either side of the Spine, which gives a large and safe pedestrian area, with all cars confined to the perimeter road. Over £100M has been invested in the campus in the last 5 years and a new £20M Sports Centre opened this summer.

At the heart of the campus is Alexandra Square (named after the University's first Chancellor, HRH Princess Alexandra), which provides a focus for the life of the University. The central administration building (University House), the Students' Union offices, the Library, shops and banks are in or close to the Square.

As well as providing accommodation and academic facilities, the campus has eating places, a newsagent, supermarket, bakery, bookshops, Students' Union shop, hairdresser, drugstore, gift shop, a Post Office, two banks, an NHS dental surgery, Health Centre and pharmacy. When our students wish to shop, eat or be entertained further afield, Lancaster city centre is only a l0-minute journey away on the regular bus service which leaves from the Underpass, directly underneath Alexandra Square.

Though its facilities are excellent, the university is, above all else, a place of academic enterprise in which its staff and students extend the boundaries of knowledge and develop their understanding of difficult issues. It has been outstandingly successful in research and teaching and is now in the top ten British Universities as assessed by UK newspaper league tables, performing well in the National Student Survey.

Lancaster University's mission to excel in research at the highest international level was boosted further by the results of the 2008 Research Assessment Exercise, which revealed that 92% of its research is recognised as world leading or internationally significant. Taking into account the high proportion of staff (90%) submitted to the RAE, Lancaster emerges in the top ten in the UK overall for research quality.

The environs of the university

The university is situated in a delightful part of the north west of England, close to the Lake District and Yorkshire Dales National Parks. The City of Lancaster encompasses three towns, Lancaster, Morecambe and Heysham, as well as a number of villages. The rural landscape is superb, with the Lakeland fells in full view across the expanse of Morecambe Bay. The River Lune runs from the Trough of Bowland, an area of outstanding natural beauty, past many of the villages, into Lancaster

and thence to the sea. Two National Parks, the Lake District and the Yorkshire Dales, are within a few minutes' drive.

Lancaster is an historic city with a 12th Century castle dominating the hill above the River Lune. It offers excellent shopping, a cinema, theatre and good restaurants, with many well-preserved older buildings. Morecambe is a seaside resort, which is undergoing something of a renaissance thanks to money spent on its regeneration. There are breath-taking views of the Lakeland mountains from its promenade. Heysham is the site of an ancient abbey, now owned by the National Trust, and ferries from its harbour sail to the Isle of Man.

The three towns and the villages have excellent schools and enjoy easy access to the M6 motorway, as well as to the main west coast railway line and Manchester International Airport. Housing is affordable and varied, ranging from country cottages through to town houses and flats. The City of Lancaster offers an excellent way of life for those who would rather avoid the noise and hassle of a major city, and yet who do not want to live in an isolated spot.

The LANCS Initiative

The following is an abbreviated and modified version of an article which appeared in the April 2008 issue of *OR/MS Today.*

Building Theory for Practice: A bold new $26M UK initiative to close the gap between OR theory and practice**

Background

On December 20 2007, the UK's Engineering and Physical Sciences Research Council (EPSRC) announced a £5.4 million ($10.8 million) grant to support the development of research capacity in OR at four British Universities (LAncaster, Nottingham, Cardiff and Southampton - LANCS for short), each of which has a substantial record of achievement in and support for OR. This, together with additional support coming from the universities themselves, means that during the period 2008-2013, a £13million ($26 million) investment will be made whose principal aim is to strengthen and grow theoretical OR in the UK with a particular emphasis on deepening our theoretical understanding of complex and uncertain real world problem solving environments.

EPSRC is the UK's *'leading funding agency for research and training in engineering and the physical sciences'* (www.epsrc.ac.uk). Since 2003, EPSRC has, along with other UK funding agencies, been overseeing a programme (under the title *Science and Innovation*) of targeted investment in strategic areas of scientific and engineering research in order to '*ensure the future international standing of the UK research base'.* OR was identified as such a strategic area for the 2007 Science and Innovation exercise. When the successful proposals in EPSRC's 2007 Science and Innovation round were announced, it emerged that for the very first time one of the grants had indeed been awarded in OR. The successful OR bid goes under the title '*The LANCS Initiative in Foundational OR: Building Theory for Practice'.*

Aims of the LANCS Initiative

The LANCS initiative will seek over its funding period to deploy the very considerable investment available to it to establish a major national hub of innovative research activity with the adventurous goal of closing the gap between applied OR and the theoretical issues which underpin it. The additional research capacity in theoretical OR which is the prime goal of the initiative will be secured in the context of this inter-institutional research programme which will embrace a multi-disciplinary agenda and which will actively seek to build upon an already extensive network of research and industrial collaboration both in the UK and abroad..

Specific aims of the LANCS Initiative include the following:

- A significant enhancement of research leadership in OR within the UK through the recruitment of senior scientists of international standing. Additionally, the development of a strengthened pool of more junior academic staff. The academic recruitment programme will aim to build UK capacity by attracting international candidates into the country to engage in this ambitious cross-institutional initiative

- A building of UK OR capacity in a new and exciting way by establishing a joint research strategy across the four participating institutions
- The development of a major programme of international outreach to support collaborations with colleagues from around the world. The goal is to complement the initiative's national capacity building strategy in order to make a major contribution towards setting the international agenda at the leading edge of work on the theoretical foundations of applied OR
- The development of a new generation of outstanding OR scientists in the UK, in part by creating non-traditional routes into PhD and postdoctoral positions by drawing upon inter-disciplinary synergies with other areas
- Long-term sustainability of the additional research capacity achieved in the initiative
- A closing of the gap between real-world inspired foundational OR and applications through a broad industrial outreach programme which will engage closely with the UK's Smith Institute in Industrial Mathematics and will draw upon a wide ranging network of international industrial collaboration and affiliation;
- Prioritising knowledge transfer activities at the interface of OR theory and practice.

**** Contributors to this article include *Kevin Glazebrook (Director, LANCS Initiative), Richard Eglese and Adam Letchford (Lancaster University), Edmund Burke (University of Nottingham), Jeff Griffiths (Cardiff University) and Chris Potts (University of Southampton).***

For further information on the current research programmes within LANCS, please visit the website at http://www.lancs-initiative.ac.uk