Institution: Buckinghamshire New University

Unit of Assessment: 19 – Business and Management Studies

a. Overview

The focus of this submission is Supply Chain Forecasting, Planning and Policy (SCFPP). Since 2008, work on Supply Chain Forecasting has been augmented by a new stream of research in Supply Chain Planning and Policy. Building on previous research on practices in the wood industry, this new stream of research focusses on sustainable international manufacturing processes. Work in this area is included as one of the Impact Case-Studies in the Business and Management Studies submission.

b. Research strategy

Evaluation of previous strategies and changes to strategy:

With regard to Supply Chain Forecasting, significant progress has been made towards the achievement of the objectives documented in RAE 2008 to advance its work in intermittent demand forecasting, modelling of the Bullwhip Effect and seasonal forecasting. The EPSRC project "Forecasting and Inventory Management: Bridging the Gap" was successfully concluded, with several journal articles and a spin-off EPSRC project resulting. The theoretical work on Integer Autoregressive Moving Average models was extended and published (Mohammadipour M and Boylan JE (2012) Forecast horizon aggregation in integer autoregressive moving average (INARMA) models. *Omega*, 40, 703-712). Work on bootstrapping methods has been developed and presented earlier this year (Boylan JE and Babai MZ (2013) Forecasting Percentiles using Empirical Distribution Functions, EURO-INFORMS 2013, Rome) and is currently being prepared for journal submission. The work on Group Seasonality led to a successful EPSRC project at Salford University and to two publications: i) Zhang K, Chen H, Boylan JE and Scarf PA (2013) Generalised estimators for seasonal forecasting by combining grouping with shrinkage approaches, Journal of Forecasting, 32, 137-150, and ii) Boylan JE, Chen H, Mohammadipour M, Syntetos AA (2013) Formation of seasonal groups and application of seasonal indices, Journal of the Operational Research Society, doi:10.1057/jors.2012.126).

With regard to Supply Chain Planning and Policy, there have been several externally-funded research projects, supported by, for example, the UN Development Programme and the Ghanaian government. The applied work on sustainable resources and chain of custody certification and standardisation (UNDP and the Ghanaian Forestry Commission) was published by Ioras F *et al* (2009) The voluntary partnership agreement, the Ghanaian and Malaysian experience, International Forestry Review, 11 (3), 311-318, and by Ioras F *et* al (2011) Chain of Custody certification, an assessment Ghanaian timber sector, European Journal of Wood and Wood products 69 (1), 113-119).

Main objectives for the next five years for five years following submission: The Supply Chain Forecasting, Planning and Policy group have the following objectives:

1. **Develop and deepen our international research network.** In Supply Chain Forecasting, research collaborations leading to peer-reviewed publications have been established, in the UK, with the universities of Bangor, Cardiff, Coventry and Salford and, in Europe, with Kedge Business School (France), and Tilburg University (Netherlands). In Supply Chain Planning and Policy, research collaborations have been established with Transilvania University (Romania), University of Sarajevo (Bosnia-Herzegovina) and the University of Putra (Malaysia). These collaborations have all led to peer-reviewed publications. The objective for the next five years is to extend the research network further and for the Forecasting and Planning & Policy sub-

groups to utilise one another's networks to develop research projects with industrial partners.

2. **Pursue projects which cross the boundaries of Forecasting and Planning & Policy.** The aim is to conduct research on longer-term forecasting, which informs the planning and policy decisions needed for sustainable manufacturing practices and standardisation. This fits well with the EPSRC's emphasis on addressing mathematical challenges to the forecasting of environmental change.

3. **Develop applied research with external industrial partners.** In collaboration with researchers at Coventry University, the group aims to develop its research on information sharing in supply chains, by investigating the inhibiting factors that prevent such sharing. A dozen companies are already involved in this research, including DHL and Oxford Instruments, and it is planned to extend it further, to include Norbert Dentressangle and Tata Consultancy Services. Additionally the established links with partner companies is envisaged to contribute to projects informing the European Union's policies on employability.

Monitoring of progress against these goals is conducted by the University Research Committee, chaired by a Pro-Vice-Chancellor, and reporting to Senate.

c. People

Staffing strategy and staff development

The University's staffing strategy is underpinned by its Applied Research Strategy (2009), with its commitment to employ research-active staff, to use the Professional Development Review process to agree research goals and staff development activities, and to increase research outputs and grant income. This approach has been successfully adopted by the SCFPP research group. From a base of just one researcher in 2008, the group has expanded to three researchers in Supply Chain Forecasting (Boylan, Babai, Mohammadipour) and two in Supply Chain Planning & Policy (Ioras, Dutca). The group is well-balanced in terms of experience, with two well-established researchers (Boylan, Ioras), two researchers who are becoming well-established (Babai, Dutca) and one Early Career Researcher (Mohammadipour).

During the period of assessment, the first appointment to the group was Dr Mohammad Ali, who had undertaken a PhD, under Boylan's supervision, on information sharing in supply chains. Ali went on to publish journal articles arising from his PhD and on subsequent projects during the assessment period (Journal of the OR Society, 2011; International Journal of Forecasting, 2012; Omega, 2012; and the IMA Journal of Management Mathematics, 2012 – one of the five most downloaded articles of that journal in 2012). These articles are not listed in this submission, as Ali moved to Coventry University in autumn 2013. However, he is engaged in a number of ongoing and new collaborative research projects with his former colleagues at Bucks New University.

The SCFPP group was successful in securing two Leverhulme Research Fellowships to run from autumn 2012 to autumn 2013. One fellowship was awarded to Dr Zied Babai, Kedge Business School. Babai had collaborated previously with Ali, and wanted to extend the collaboration by working with Boylan too. The second fellowship was awarded to Dr Ioan Dutca, Transilvania University, who wished to extend his previous collaboration with Ioras.

The Leverhulme scheme has proven so successful that both fellows were offered one year extensions to their fellowships, funded entirely by the University. These offers have been taken up, on a full-time basis by Dutca, and on a fractional (0.33) basis by Babai. The plan over the next year is for Babai and Dutca to work with other members of the group to develop substantial bids to allow further collaboration and the appointment of funded PhD studentships and post-doctoral assistantships.

In spring 2013, the University appointed Dr Mona Mohammadipour to a permanent lecturing post.

Mohammadipour had previously undertaken PhD research at Bucks and acted as a contracted researcher on an EPSRC project, based at Salford University, for which Boylan was an external advisor. Her PhD research, on Integer Autoregressive Demand Models, fits very well with an established research theme at Bucks on intermittent demand forecasting. Her post-doctoral research, on seasonal demand forecasting, also fits very well with established research at the University. Commencing in autumn 2014, a Readership post is planned for the SCFPP group, to strengthen the research group and to provide succession planning.

Staff development opportunities are offered in the following ways:

Support for Doctoral Completion: lighter teaching loads and remission has been made available to staff following recommendation through the University's Professional Development Review process, for staff completing research degrees. This support was made available to Ali, to facilitate the timely and successful completion of his PhD.

Early Career Researcher support: reduction in teaching loads have been allocated to enable researchers to develop their research careers in the years immediately following PhD completion. Structured support for Ali and Mohammadipour has been undertaken in accordance with the principles of the Concordat.to Support the Career Development of Researchers. This takes the form of academic mentors, teaching cover and research group meeting support and have proved (Ali) and are proving (Mohammadipour) effective. The development has supported Ali to gain appointment as Deputy Head of Department at Coventry University, after only five years since completion of his PhD.

Support to Present Research and build Research Networks: Funding is made available throughout the year to enable researchers and research students to participate at international conferences, All staff in this return were supported to attend research events within the past academic year.

Research Group Meetings: Regular whole-day research gatherings of members of the research group are held at Bucks, with collaborators from other universities being regular attendees. This has encouraged early career researchers to test their own ideas and to become involved in larger research projects.

Ongoing Staff training: Through the year, research staff training programmes, Supervisor Forums and Supervisor Away days; annual events reinforce the collegial research and supervisory environment at the University. Again, all staff in this return have availed themselves of this support.

Equality and Diversity considerations continue to be embedded into the University's working practices, with more individuals taking advantage of a flexible working policy and other policies related to the protected characteristics. The University is supporting increasing numbers of individuals through disability disclosure and reasonable adjustments. Online programmes in equality and diversity, and anti-bullying and harassment were completed by the whole senior management team before being rolled out to all other employees; all employees are required to complete the modules. All new employees now have an Equality and Diversity session as part of induction, as well as having the opportunity to attend other awareness modules.

The University's Equality and Diversity Policy (2008) insists that "Recruitment and selection of employees and students are based entirely on relevant criteria". The recruits to this research group over recent years were born in Pakistan, Iran and Tunisia, indicating that nationality has been no barrier to recruitment. The paternity leave provision was relevant to, and taken up by, one member of staff.

The University is committed to upholding the highest standards in its research. A University Research Ethics Panel meets every month to consider project applications. The Panel is chaired

by a visiting professor, and reports to the University Research Committee which is responsible for broader policy decisions relating to ethics and governance.

Research students

Research students have played a vital role in the development of research in Supply Chain Forecasting, Planning & Policy at Bucks, not only during their time as PhD students but also in their continuing research with the University after gaining their research degrees. Both Ali (lecturer from 2008 to 2013 and now at Coventry University) and Mohammadipour (lecturer at Bucks from 2103) are former doctoral students of Boylan. Dr Huijing Chen (completed 2005 now at Portsmouth University) and Professor Aris Syntetos (completed 2001, now at Cardiff University) are also former doctoral students. All of these students gained their PhD studentships through a competitive process to win 'funded places' awarded by the University, including fee waiver, and an annual bursary to cover living expenses. Attah was a PhD student of Ioras, and has continued to collaborate with his former supervisor on projects relating to sustainable manufacturing processes in Ghana.

Since Bucks changed its validating institutions for research degrees from Brunel University to Coventry University in 2009, competitive funded places have been made available for PhD studentships for students jointly supervised by Bucks and Coventry researchers. Lech Birek won one of these places, to research fuzzy forecasting, under the supervision of Boylan and Professor Dobrila Petrovic (Coventry). Birek is registered as a research student at Coventry University and it is anticipated that this PhD research will be concluded in 2014. Ioras is currently supervising Camelia Marinoiu (self-funded) and Alex Offei (funded by the Ghanaian government). A further student is expected to commence PhD study in 2014 also funded by the Ghanaian government.

The record of doctoral completions is given below:	2008-09	2009-10	2010-11	2011-12	2012-13
PhD completions	3	1	1	1	0

There have been no Professional Doctorate completions over the assessment period. Although the University has had validated Professional Doctoral Awards for three years, they have been in the subject areas of Nursing, Social Work and Education. The validation of a Professional Doctorate award in Management is planned for the next academic year.

PhD research students are supported in a variety of ways. They are offered bespoke research training in such areas as research philosophy, methodological issues, data visualisation methods, presentation of research, preparation for viva, and influencing and networking. John Boylan currently chairs the University's Research Degrees Committee, which oversees this training, and leads some of the training sessions himself.

PhD students are also offered access to the Professional Doctorate modules in Qualitative Research Methods and Quantitative Research Methods. The University is affiliated to the Consortium for Research Excellence, Support and Training (CREST), which has 14 affiliated Higher Education Institutions. CREST co-ordinate training throughout the year and organise research networking events an Annual Conference of poster and paper presentations. Bucks research students receive University funding to enable attendance at these events. Further support is available for students through access to Epigeum's 15 online research skills courses, which enables researchers to develop key skills, including preparation for the postdoctoral workplace. Faculty funding is available to support students who wish to present their work at national and international conferences.

Research students are encouraged to take responsibility for their own development as

researchers. At the beginning of their research, they complete a 'Working Agreement' which, in addition to detailing student and supervisor responsibilities, also requires students to assess their own skills, using the online Vitae Researcher Development Framework Planner. This is then discussed with their supervisors and training and development priorities are agreed. Developmental progress is reviewed on an annual basis with a panel (chaired by a senior researcher) and new research objectives are agreed for the coming year. Employability skills are addressed as part of this review, and strengthened by the requirement for research students to present an updated CV as part of their Annual Review.

Beyond PhD graduation, Early Career Researchers are encouraged to continue to use the Researcher Development Framework as part of the planning for their own continued development. Mohammadipour is currently using the framework in this way. She will also be involved in delivering part of the research student training programme when she has her own students.

Boylan and Ioras have acted as first supervisor to six PhD research students who have completed their doctorates. Evidence of successful supervision is illustrated by the following: i) all students have completed their degrees (including revisions) within the equivalent of four years of full-time study, ii) three passed with minor amendments, and three received straight passes (no amendments required), iii) all have continued to work with their supervisors beyond their PhDs.

c. Income, infrastructure and facilities

Boylan was co-investigator, with Syntetos (Salford University) on the EPSRC project, Forecasting and Inventory Management: Bridging the Gap (EP/F012632/1). The project also involved two industrial partners, SAF Simulation Analysis & Forecasting AG and Ventana Systems Inc. The project was conducted from 2007 to 2008, and received funding of £50,194. Two of its principal research outputs were: i) "On the interaction between forecasting and stock-control: the case of non-stationary demand", authored by Strijbsoch, Syntetos, Boylan and Janssen, published in the International Journal of Production Economics (2011), vol 133, pp 1170-1180, and ii) "Forecast errors and inventory performance", authored by Ali, Boylan and Syntetos, and published in the International Journal of Forecasting (2012), vol 28, pp 830-841.

Boylan also acted as co-investigator on a follow-up EPSRC project with Syntetos and Professor Brian Dangerfield (Salford University), Cognitive Mapping, System Dynamics and the Bullwhip Effect (EP/G070369/1). This involved collaboration with Brother International Europe Ltd and Valves Instruments Plus Ltd and the contribution of a Visiting Professor, Nicholas Georgantzas, Fordham University Business School, New York. The project was conducted in 2009, and received funding of £16,432 from the EPSRC. One of the principal research outputs was the article, "Judgement and Supply Chain Dynamics", authored by Syntetos, Georgantzas, Boylan and Dangerfield, and published in the Journal of the Operational Research Society (2011), vol 62, pp 1138-1158.

Ioras was the grant-holder for a multi-country collaborative research project in Environmental Security and Management, funded by the Erasmus Multilateral Projects Programme. The project was conducted between 2012 and 2013, and received funding of £118,462. Ioras also conducted research, on a sub-contracting basis, for OBF Consulting, Austria, which was conducting research funded by the UN Development Programme. Ioras' research was disseminated in the journal Biodiversity and Conservation (2009), vol 18, pp 3395-3406.

Ioras was also grant holder or main partner on applied research projects between 2008 and 2013, and received £38,281 for work on sustainable and renewable resources management under commission from DEFRA, SEEDA and non EU government bodies.

Boylan acted as Lead Academic, from 2008 to 2010, on a Knowledge Transfer Partnership (KTP) with Acorn Engineering Ltd (Partnership Number 6627) which focussed on designing a dynamic

job scheduling system, using innovative algorithms and mobile communications. It received funding of £67044 from the Technology Strategy Board, with additional funding from the company. He also acted as Lead Academic, from 2010 to 2012, on a KTP with Red House Group of Practices (Partnership Number 7339) which was concerned with improving the planning of a group of General Practices. The project received funding of £81,450 (25% from the ESRC and 75% from the Technology Strategy Board), with additional funding from the group of practices.

Babai (Kedge Business School, France) was awarded a Leverhulme Research Fellowship for the academic year 2012-13, to undertake research at Buckinghamshire New University. The award value amounted to £23500. Dutca (Transilvania University, Romania) was also awarded a Leverhulme Research Fellowship for 2012-2013, for the same amount.

The research group has adopted two main strategies to generate research income, in accordance with the distinction drawn in the University's Applied Research Strategy between 'concept development research' and 'concept implementation research'. For 'concept development research', the group has adopted a strategy of applying to research councils, in collaboration with other universities. Initially, this collaboration focussed on Salford University, as two former doctoral students, Syntetos and Chen, were based there. In addition to the projects listed above, John Boylan also acted as External Advisor for the EPSRC project Using the Grouping and Shrinkage Approaches to Forecasting Subaggregate Level Seasonal Demand (EP/G003858/1), conducted between 2009 and 2012, and receiving funding of £219,938. This project was initially led by Chen and, after her departure, by Syntetos. The network has now extended to Bangor University (Prof Kostas Nikolopoulos), Cardiff University (Prof Aris Syntetos), Coventry University (Dr M Ali, Prof Dobrila Petrovic), and Portsmouth University (Dr H Chen). More collaborative bids are planned from partners in this network. For 'concept implementation' research, the research group has adopted a strategy of targeting Knowledge Transfer Partnerships, building on the successes noted in the 2008 Research Assessment Exercise.

When the University consolidated three campuses into one, in September 2009, it spent £62m on the construction of a new Gateway Building, which houses the University library. The library contains many bookable study / meeting rooms, with internet and visual display capabilities.

The main Teaching Block was internally refurbished at the same time as the opening of the Gateway. One of the wings, on the third floor of the building, was designated for research. This wing contains an office for the Faculty Head of Research, offices for research-active staff, and a large office for research students, all newly decorated and furnished. The research student office includes individual desks for full-time research students and 'hot desks' for part-time research students, with a computer available at each desk.

Research is supported by a central University Research Unit and a Faculty Research Officer, who provides administrative support for research-active staff and the doctoral programme. The Knowledge Transfer Partnerships mentioned previously were supported by a central administrative team of two staff, one of whom supported the formation of partnerships and grant applications, and the other focussed on the administration of projects throughout their lifetime.

d. Collaboration or contribution to the discipline or research base

• As noted earlier, much of the work of the research group has been conducted in collaboration with other universities. Peer-reviewed journal articles have been published since 2008 based on collaborations with the universities of Salford, Warwick, Manchester, Lancaster, Bath, Cardiff, Bangor, Coventry, Athens, Tilburg, Transilvania, Putra and Fordham (New York).

• Ioras is currently editor of the International Wood Products Journal, Notulae Scientia Biologicae and Open Conservation Biology Journal and has served as co chairman of International

Seminars on Resources and Environmental Security (La Laguna - Spain, April 2013, Sopron - Hungary, September 2013). In recognition of scientific contribution to the field of resources management, Ioras has been made Honorific Professor of Transilvania University (October 2008) and Notulae Scientia Biologicae Fellow (December 2009) in recognition of research work on the sustainability of resources.

• UK collaborators from some of these universities (Bucks, Cardiff, Bangor, Coventry) formalised their links over the last two years, by supplementing the previous occasional meetings by regular whole-day research meetings held at Bucks New University.

• Boylan launched a new 'section' of the International Society for Inventory Research (ISIR) on "Forecasting for Inventories" in 2008 and, since then, has served as Section Chairman and as a member of the Executive Committee of ISIR. He is currently acting as one of the editors for a special edition of the International Journal of Production Economics, devoted to selected papers from the last biennial ISIR Conference, held in Budapest in 2012.

• Babai acted as organiser for the stream on "Inventory Forecasting" for the 53rd National Operational Research Society Conference, held in Nottingham in 2012. Babai arranged for this stream to be sponsored by the International Society for Inventory Research.

• Boylan served as a Director of the International Institute of Forecasters from 2008 to 2012. At the 2008 International Symposium on Forecasting, he co-delivered a one-day pre-conference workshop on Intermittent Demand. He has also served, since 2005, as Supply Chain Forecasting Editor for the Institute's practitioner-oriented journal Foresight: the International Journal of Applied Forecasting.

• Boylan serves as an Associate Editor for the IMA Journal of Management Mathematics. He co-edited a special issue of the journal on the subject of "Demand Forecasting for Inventory Management", published in April 2008. The issue contained an editorial and eight research articles. Boylan also co-edited a special issue on "Supply Chain Forecasting and Planning" in the Journal of the Operational Research Society (JORS), published in March 2011. The issue contained an editorial, four case-oriented papers and nine research-oriented papers. One of the case-oriented papers, by Roy Johnston and colleagues, went on to win the Operational Research Society's Goodeve Medal for 2012, which is awarded in recognition of the most outstanding contribution to the philosophy, theory or practice of OR published by JORS or OR Insight in the previous year. Most recently, Boylan co-edited a special part-issue on "Forecasting in Management Science" in Omega: the International Journal of Management Science, published in December 2012 (pages 681 to 773). It included an editorial and nine research articles.

• Boylan co-organised forecasting streams for the Operational Research Society Conferences in 2008 (York) and 2009 (Warwick). Since then, he has organised the Forecasting for Inventories stream at the International Symposium on Inventories, held in 2008, 2010 and 2012. He was invited to give a keynote presentation at the 2008 and 2010 symposia.

• Boylan has also disseminated his research to practitioner audiences, including as a Featured Speaker at the Forecasting Summit, co-organised by Business Forecast Systems and the International Institute of Forecasters, and held in Orlando in 2009. He spoke in 2012 at the Oracle SCM Summit, held in London. Boylan and Ali developed a link with the Hughenden Supply Chain Forum, which includes such companies as Kerry Foods, Mayborn, BDR Thermea, General Mills, McCormick, DS Smith, Knauf Drywall and Pernod Ricard. The last occasion on which Boylan addressed the Forum was in October 2013.