

**Environment template (REF5)**

<p><b>Institution:</b> University of Bolton</p>
<p><b>Unit of assessment:</b> 36</p>
<p><b>a. Overview</b></p> <p>This submission to Unit 36 arises from a multi-faceted research team with a combined focus on research associated with system thinking and the application of information systems to bring about economic and social change. Within this context “information systems” is defined as the study of networks of hardware, software, and people to analyse, process and distribute data to improve communications and operational efficiency with the net effect of bringing about social change and supporting economic growth. The research bridges business, computer science and people management and has applications in small and large businesses as well social media. An underlying theme is the interdisciplinary nature and interconnectedness of the work, which through a systems thinking approach leads to a multi focussed output in terms of economic and social impact.</p> <p><b>The research can be divided into the following key distinct areas:</b></p> <ol style="list-style-type: none"> <li>1. <b>Information systems for online management of industrial processes and knowledge based systems</b> – This work centres on the development of information systems to improve profitability, working practices and environmental sustainability. The work is based on several Knowledge Transfer Partnerships (KTP’s) and an international research programme in collaboration with a university in Germany. It is also leading to significant collaborative research in Africa, where we currently support 25 doctoral students. The work has significant impact economically but also socially insofar as it changes working practices, employment patterns and in some cases leads to improved environmental sustainability.</li> <li>2. <b>Educational Cybernetics</b> – The mission of this group is to conduct research into the implications and potential impact of technology on the organisation, and provision of education, focusing in particular on higher education. The approach is based on the discipline of cybernetics, the "science of organisation" which can be applied to build models of the education system at multiple levels - political, institutional, social, pedagogic and personal. This group is concerned with the use of open source software tools for multi-media applications with mobile communication technologies. A significant part of its work is the development of open national and international specifications and standards for learning technology and beyond, coupled with the development of open source software tools that implement, test and then make widely accessible the relevant emerging specifications and standards.</li> <li>3. <b>Information Systems for Social Change and Employability</b> – The research of this group centres on the development of innovative approaches to facilitate the adoption and implementation of information systems to enhance employment, and change the ways in which people use social media to network and share information. It has applications in the creative industries and in particular the music industry where self-employed DIY artists are in a majority. The implications this mode of working on employment and contract law is becoming an important aspect of this work evidence by the appointment of an employment law specialist within this group. The use of cloud computing technologies for information transfer and hosting of software platforms is also an important part of this work.</li> </ol>
<p><b>b. Research strategy</b></p> <p>The team associated with this submission are drawn from several academic divisions, comprising business, computing, information sciences and law, following a reorganisation within the University. The research has a common theme of using information technology to bring about changes in working patterns and social interaction. It also involves research into the legal aspects of employability and employment contract law.</p>

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The foundation for this work is based on research undertaken over a number of years within the University's Business School and concerned with support for SMEs in the use of information technology for knowledge management, supply chain management and procurement with a focus on improving business performance. The work resulted in a submission under UOA 36 Business and Management Studies. This research strategy was fundamentally based on the relationship between industry and academia, offering applied research, which fitted the needs of local, national and international collaboration and joint ventures. At that time the research was supported by a number of European and UK Government grants. (The submission received rating of 10% 3\*, 30% 2\*, and 45% 1\*)

Since then the work has continued but the generic support to SMEs within the North West of England has declined due to the cessation of available grant funding. As a consequence the work has focused on specifically helping individual SMEs through Knowledge Transfer Partnerships and direct funding from collaborative partners.

Importantly the model generated for applied research undertaken in conjunction with industrial partners has led to the generation of the African Doctoral programme operated in conjunction with the Malawi Institute of Management. This research programme is addressing economic and social issues associated with African countries. Areas of research impinge on education, health and social care, water management, telecommunications, and energy sustainability. A common underlying theme is the use of information technology for data management, improved working practices, improved operational efficiency, and social impact. The uniqueness of the approach has the ability to produce significant outcomes in terms of publications and impact on the Malawian economy and society. A similar programme is also being developed in Zambia and will recruit students this year.

This change in focus of the research is leading the team to consider more the social issues of its research and its ability to change working practices. Examples of this within current research include:

- Improved energy sustainability through the use of information systems to manage and control both business and technological aspects of smart grids. This work is changing the way in which consumers use and pay for electrical energy and has the ability to significantly impact on environmental sustainability.
- Improved use of information systems for social media networking, employment and business management.
- Improved business planning and customer relationship management. (Alliance Learning)

The combined success of the group is demonstrated by:

- 45 publications in refereed journals, conferences, books and edited chapters
- £1.5m research income
- 5 KTP Programmes
- 31 postgraduate students achieving the award of PhD (Incorporates non-returnable PhD awards i.e. PhD by published works and professional practice.)
- The establishment of an international Doctorate programme based in Malawi, Africa and supporting 25 Doctoral students, 10 of which are expected to complete within 2014.

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### c. People, including:

#### i. Staffing strategy and staff development

The University's recruitment and selection policies comply with the European Charter and Code, and are in line with the requirements of the Concordat. All research positions are job evaluated and the role aligned to the university's new pay and grading arrangements, which ensure that all researchers are rewarded according to the requirements of the role irrespective of the type and duration of contract. Vacancies are advertised on websites, which attract applicants across EU countries. All person specifications for lecturing posts include the requirement to undertake research and interviews are designed to confirm that the researcher has the capability and capacity to develop into an independent researcher in order to progress a career in research. The University has a PDP process, which in year 2 of the employment of research staff encourages post doctoral researchers to start to make their own applications for funding to develop their future and research as independent researchers with the University. Each staff member has a Personal Development Plan reviewed annually through which career development and time and resources for research are negotiated.

#### ii. Research students

The PGR recruitment and selection policies comply with the European Charter and Code. All funded PhD vacancies are advertised on websites which attract applicants across EU and other countries. Research student numbers remain at healthy levels sustained by internal and external studentships and partnerships with external funders. The University supports its research students and requires participation in personal and professional development addressing Vitae's Research Development Framework. Students' core documentation includes the Postgraduate Skill Record, which records progress with the acquisition of research-specific and transferable skills and on programmes of related studies, including relevant modules from taught masters' programmes. Participation in external, discipline-focussed postgraduate courses, attendance (and participation) at internal and external research conferences and seminars and training in specific approaches, techniques, etc., is encouraged and supported, partly via the University's active involvement in Vitae's North West Hub. An annual university research forum enables all research students, PDRAs, research staff and administrators to contribute, encouraging presentations and discussions on the national context, university policy and strategy, individual research projects, etc. Student representatives are members of several University committees, helping to ensure that their views are heard; PRES is used to capture and respond to the student voice across the subject group.

### d. Income, infrastructure and facilities

The total countable income for the Unit of assessment 36 during the period 2008 - 2013 was £1,566,654, up from £1,133,000 in the RAE2008 submission. This came from projects funded by DUIS research Councils of £87,000, from EU government Bodies of £729,019, from UK Central/Local Government of £641,358, from UK Industry and commerce of £30,391 and from other sources £15,520. In addition we have attracted some £558,000 in non-claimable funding through a number of KTP projects (detailed above) which was classified by the university accounting rules as enterprise funding given the commercial nature of the work. This work has yielded some 10 PhD completions and a number of conference and journal publications.

The university's strategy on income generation has shifted since the RAE2008; for example, we can only participate on European projects as co-investigators. It is envisaged that future research income will be primarily sourced from collaborating organisations through the Industrial Doctoral scheme and Knowledge Transfer Partnerships, augmented with some grant funding from UK research councils. A focus on employer engagement and developing short and long term research relationships is set to boost research income in this sector, especially as the sector is beginning to show signs of economic recovery. A strategy for ensuring continued flow of income independent of the economic position of the sector is currently being investigated to ensure

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sustainability of research.

The research groups have been impacted by three structural reorganisations in the last 6 years, as part of the wider university programme. It currently sits within the Creative Technology academic subject group, which has created new opportunities for shared resources with regards to laboratories, IT resources (hardware and software), and technical support. The group has specialist labs in gaming and special effects, both virtual and physical. The groups additionally share resources both social and physical with the Institute for Educational Cybernetics, where a future focus on research in these areas will yield results for the next research exercise.

The university's library services provide both printed published works and electronic print resources and support for library services. Online reading lists are regularly updated by academic supervisors. Students also have access to other university libraries through the SCOUNL scheme. Electronic resource access is open to all staff and students across the university and remotely via OpenAthens.

There are two dedicated postgraduate research student rooms with hotdesking facilities for part-time and off-campus students under the Business Informatics Group and applied Creative Technologies research groups. The hotdesk computing facilities have installed, specialist software (e.g. NVivo) for use as a shared resource. Postgraduate researchers also have access to printing and reprographic services.

Students are encouraged to contribute suggestions for library books or material from their wider reading. The library is funded through book donations and purchase of relevant text from project funds. This dedicated student space houses a library of books, research papers, conference proceedings, theses, project reports, journals, professional magazines and other relevant literature to the research area. In addition there is a meeting/projects area, where students can work either quietly or in groups. This promotes cross fertilisation of ideas, and provides added support for researchers.

**e. Collaboration and contribution to the discipline or research base**

The research groups have extensive evidence of collaboration both nationally and internationally. Partners include:

- The University of South Westphalia in Germany – The work in this area led by Professor Danny Morton has been on-going for over 15 years. It involves collaboration with Senior Academics at the University of South Westphalia (Professor Egon Ortjohann, Professor Berthold Bitzer and Professor Werner Krybus). It has resulted in the joint supervision of a number of PhD's and the joint publication of Journal and Conference papers. It has involved collaboration with other European universities and research Institutes
- The Malawi Institute of Management, Africa. This collaboration is yielding a number of benefits to the social fabric of Malawi development, our initial partnership was supported by
- The University of Tongji, China. In collaboration with Prof Qin Lui and the British Council we have delivered engagement with ideas around systematic innovation, to both students and industrial partners, such as Kodak, Autocad, and paypal including working with EBay China on systems development research and methods.
- UKAIS - The UK Academy of Information Systems is an academic group which offers significant support to the information systems research community. We offer an annual conference, the proceeding of which are available through the AIS library offering the results of our research to the global community. This academy has members from across the UK and internationally and offers a rich network of academics who liaise to deliver PhD examiners, external examiners and conference and journal paper reviews and

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editors.

IEC - The application of the IEC's broad theoretical framework, its work on international standards and its software development strengths, directed towards early open source implementations of emerging specifications and standards, all create real world benefit. IEC engages in a range of related collaborative activities. Some further examples of specifications supported through software development include:

- the IMS Global Consortium, which creates international eLearning specifications, we have helped to develop and provide open source implementations of specifications that include:
  - Content Packaging, and US DoD SCORM (the content packaging tool developed by IEC, RELOAD, was adopted by the US DoD and has been, and still continues to be, widely downloaded from their Website);
  - the Learning Design specification implemented in the ReCourse tool (developed in the TEN Competence project);
  - we now are the lead for the IMS QTI (Question and Test Interoperability) specification, now gaining wide traction.
- We have also implemented Transcoder, which translates between various content packaging formats as an implementation of the recently ratified IEEE RAMLET (Resource Aggregation Model for Learning, Education and Training) specification, which we co-led;
- work on European portable learner records with CEN (Centre for European Normalisation/standards), and ISO-SC36; leading on INLOC (Integrated Learning Outcomes and Competencies) specification;
- worked on the LRMI (Learning Resource Metadata Initiative) led by the US Association for Educational Publishers and funded by the Gates and Hewlett Foundations.
- This work has also extended beyond education to the implementation of Archi, funded by the JISC Flexible Service Delivery (FSD) programme, a widely acclaimed implementation of the Open Group's Archimate Enterprise Architecture graphical modelling language standard, which from May-October 2013 has had downloads running at an average of c.20,000/month.
- We provide the technical lead to the ISB (Information Standards Board) jointly operated by the Department of Education and BIS.

The high quality of the code produced, and the attention paid to reliability, learnability and the user interface, have all been significant factors in the widespread adoption of the open source software that IEC has developed.