Institution: De Montfort University

Unit of Assessment: 11 Computer Science and Informatics

a. Context

The majority of research in this Unit, which resides in the School of Computer Science and Informatics, goes hand-in-hand with stakeholder collaboration. Many projects are undertaken either in direct partnership with industry, or with the aim of improving and adding to industrial technology and practice through subsequent consultancy and knowledge exchange. Our research has benefitted, and continues to benefit, the community, economy and public policy-making, providing economic, cultural and societal benefits at local, regional, national and international levels. For example:

At an **international level**, the Centre for Computing and Social Responsibility (**CCSR**) are a key advisor to the EC about European policy on computing and ethics. The Centre for Computational Intelligence (**CCI**) won an IEEE Computational Intelligence Society (CIS) award to make a video for the general public that has now been viewed by nearly 13,000 people across the world.

At **regional level**, the DMU Interdisciplinary Group in Intelligent Transport Systems (**DIGITS**) has been working very closely with a number of local authorities, helping them make a positive change in their traffic management systems and air quality control. Researchers from the Virtual Reality and Assisted Living (**ViRAL**) Special Interest Group have been working with VISTA (a sight loss charity helping people from Leicester, Leicestershire and Rutland) to develop interactive Virtual Reality to improve people's lives. The **CCSR** has given guidance and advice to Leicester City Council (LCC) on their Customer Data Integration project.

At a **national level**, the Software Technology Research Laboratory (**STRL**), **CCSR** and **CC**I have engaged with a number of commercial, government and policy-making organisations. The CCI/DMU spin-out VenueSim is an industrial partner with Northrop Grumman UK Airport Systems and East Midlands Airport; STRL is part of the Defence Technology Centre in Data and Information Fusion, a research consortium led by General Dynamics UK for the Ministry of Defence; CCSR was commissioned to prospectively analyse electronic voting by the Dept for Transport, Local Government and the Regions, Office of the e-Envoy, Electoral Commission, LGA, IDeA and Solace.

At a **local level**, the **CCI** is working in a number of different ways with the local community, particularly in the area of supporting disabled children through eye gaze research; and in DMU's award winning Mile^2 project by developing a research-informed pedagogic Robot Club with local secondary schools to give youths in the area a chance to experience degree-level robotics at a much earlier age. Some of the participants were able to meet the Duke of Edinburgh at the start of the Jubilee Tour to present robots they had built and programmed, and went on to compete in a major international robotics competition.

Impact derives from a broad range of activity within the School, and encompasses indirect and non-linear impact from internationally excellent research, as well as planned and collaborative impact generated during the census period.

b. Approach to impact

The Unit's approach to impact during the census period has been **to encourage work in areas that demonstrate potential impact and sustainability**. To achieve this, significant investment in staff and physical resources has been made available by a broad range of highly selective competitive mechanisms that include 'pathways to impact' as one of the assessment criteria. These mechanisms include research scholarships, research leave, and pump-priming research and innovation funding. The School particularly encourages and facilitates work with international, national and regional communities to disseminate the results from our research for the benefit of wider society. We collaborate with businesses and other professional partners in our focus areas to ensure that as much of our research as possible is turned into new services and products. Events dedicated to the promotion of KTPs and a Technology Showcase are held annually providing businesses and organisations with the opportunity to explore and experience a range of cutting edge technologies in computing, information science, sustainability and the creative fields. Our Technology Showcase has been delivering expert information and partnership opportunities to

businesses since 2004 and has been responsible for a number of successful collaborations, e.g. **Dr Gongora's** KTP with Park Air Systems Ltd to apply innovative Graphical User Interface approaches and embed a capability to present complex information to the different user communities across an airport.

The School works to actively identify and seek key local, national and international organisations that can benefit from our research. To help achieve this, the School set up an Industrial Liaison Committee, dedicated to creating and strengthening mutually beneficial relationships between the School and corporations worldwide, by providing advice and support to help increase levels of engagement in collaborative research and development activities. Evidence of the success of this ongoing work is the strategic relationship developed with Hewlett-Packard (HP) to better connect academia and business, as well as to start research collaborations in cloud, information security, networking and sustainability technologies. The School encourages staff to look for opportunities to exploit the Intellectual Property in their research, e.g. **Dr Gongora** has a spin-out company funded by Lachesis (2008) that offers its clients, including East Midlands Airport, software to manage the security provision and for planning deployment of retail concessions. The School can draw upon the support of a dedicated Research and Innovation Office when an agile approach is needed to commercialise our research for the benefit of society and the economy.

Our approach also includes **seeking opportunities to engage with the public** in order to demonstrate the relevance of our internationally acclaimed research, to disseminate our work to the wider public and to increase awareness of the effect and benefit our research has in the quality of life of society in general. For example, the **CCI** won the best video award of the IEEE CIS for explaining fuzzy logic to the 'man on the street' (http://www.youtube.com/watch?v=P8wY6mi1vV8). Also, **Dr Coupland** and **Dr Passow** regularly attend Europe's largest robotics competition (http://www.robotchallenge.org) and present public lectures to groups of amateur enthusiasts. They have given similar talks at a number of local schools and FE colleges. DMU is the only institution to have won the BCS Machine Intelligence competition twice; an annual event aimed at demonstrating progress towards machine intelligence judged by a public vote.

The ultimate aim of this approach **is to encourage high quality applied research that impacts both academically and on society whilst identifying projects with potential for impact at an early stage to facilitate the realisation of this future impact**. Key projects have been identified where we anticipate there will be significant future impacts. These include:

- **CCSR's** leading work in the ethics and society section of the 2013 European ICT Future and Emerging Technologies Flagship **Human Brain Project** (http://www.humanbrainproject.eu), which aims to develop a simulation of the human brain and to develop ICTs to support this and benefit from it. The CCSR is responsible for the ethical reflection of members of the project, to explore how project participants and external stakeholders think about ethical and other responsibilities and to contribute to the development of appropriate ways of realising such responsibilities. This success underlines the central role that the CCSR plays in the area of ethics and ICT on a European and worldwide level.
- Over the past two years developing the **iTRAQ** concept (through **THE-ISSUE** project and other high-level projects) **DIGITS** has worked towards making a positive change in traffic management and air quality control to improve the environment and health in close partnership with a number of local authorities (Leicester, Northampton and Northamptonshire).
- The application of computational intelligence techniques by **Dr Seker** to develop a THz-based intelligent device to help not only with the early detection of malignant melanoma but also provide accurate information about the precise area and size of the tumour, helping to avoid removing unnecessary skin and hence speed up recovery.
- The Gaze Group, part of CCI, researches into how best to use eye gaze as a means of enabling people with physical disabilities to communicate with computers, and gaze interaction with online multiplayer computer games and virtual communities. The gaze interaction techniques are adapted to an individual child's capabilities and needs via automatic dynamic accessibility techniques using simple diagnostic tests. This enables children with little or no verbal communication and severe motor impairments to control game characters independently. This has had considerable social impact on the motivation and esteem of these children by empowering them to interact independently with the online virtual world of the game. A free to

download software platform to enable various commercial eye trackers to control different games is being developed (http://wiki.cogain.org/index.php/Snap_Clutch).

c. Strategy and plans

The School has been developing its strategy for achieving impact of research since 2008 through department, school and faculty research committees in line with the university's overall research strategy and the evolving understanding of ”impact”. The School’s goals for supporting and enabling impact from its research in the future include:

- To continue to maintain a **dynamic and pervasive research environment** supported by a robust research infrastructure, and to encourage a scholarly culture where staff undertake ambitious, innovative and rigorous research with impact on the wider society.
- To ensure, through the **allocation of resources and appropriate staffing**, that world-leading and internationally excellent research undertaken in the School is disseminated to as broad an audience as possible with the aim of maximising its impact.
- To continue to **work with our stakeholder community** through knowledge exchange, collaboration and partnership, as well as working with national and international partners, to promote research, technology and education and to increase our research profile and the level of impact of our research on the wider society
- To ensure that **internal research funding** is made available for projects that aim to establish links for the purpose of maximising impact. Public engagement activities will also be encouraged by placing more emphasis on the implementation of outreach activities in the criteria for the award of internal funding.
- To develop a public face that communicates equally effectively to both academic and non-academic audiences, both through the continual improvement of our web presence and through the strategic targeting of events that engage with stakeholders in order **to disseminate our research and to reflect successes and impact**.
- To ensure that there is a pipeline of information from the School to the press office at DMU so that any and all opportunities to **enhance the research profile and successes of the School** in national, international and sector media are exploited.

d. Relationship to case studies

The case studies demonstrate the link between the research for which the School is internationally known and the reach and significance of this work outside academia. They also exemplify aspects of the School’s approach to impact during the census period and our ongoing impact strategy.

The **“Core Underpinning of Fuzzy Logic”** case study clearly exemplifies the School’s approach to impact by engaging with national and international academic, industry and other bodies through knowledge exchange, collaboration and partnership. This case study explores in detail a KTP and a spin-out company that have applied research findings to real world problems, to highly innovative solutions to problems that could not be realised without the underpinning excellence research which has taken place within the CCI.

The School’s approach to support and encourage a scholarly culture where staff undertake ambitious, innovative and rigorous high-quality applied research that impacts both academically and societally through economic benefit and governmental policy-making is exemplified by the case study entitled **“Using Research to Change Policy”**, which explores how world-leading research on social issues of computing and information systems influences policy decisions at national and international levels. This approach is also supported by the case study entitled **“Programme Transformation”** which focuses on the commercialisation of **Dr Ward's** research on program transformations through a spin-out company (now called Software Migrations Ltd) selling the FermaT Assembler Workbench and FermaT assembler migration services to an extensive list of national and international clients.