Institution: Edge Hill University

Unit of Assessment: 11 - Computer Science and Informatics

a. Context

Researchers in the Department of Computing work across many of the core disciplines of computing. As a small unit without a long history of research we have reflected carefully on the research interests and expertise of our academic staff to identify core groups of research users with whom we are most likely to generate impact and on whom we can focus our efforts. Much of the research undertaken is highly applied in nature, with our researchers collaborating with non-academic partners in order to solve problems and create new capabilities. This is reflected in the focus of each of the three core research groups – Data Analysis and Representation, (DAR), Distributed and Creative Technologies (DisCreat) and Computer Assisted Teaching and Learning (CATL). Increasingly, interdisciplinary collaboration with researchers in health, social care, psychology, performing arts and others is opening up new, direct channels for our work to have impact on a wider range of beneficiary groups including healthcare providers and patients, social care providers and service users, teachers, students, museums, businesses and audiences. Our key research users include:

Industry and community: Work on software quality assurance, data representation on mobile devices and 3D modelling has direct relevance for a wide range of businesses and business processes. Work on autonomic and cloud computing, content distribution networks and on distributed and mobile sensor technology (as part of the Smart Cities agenda) will benefit IT service providers and users, businesses and citizens.

Health and social care providers, patients and service users: research on data analysis and the visualisation of Big Health Data, on gathering remote data from mobile devices, and interdisciplinary research with health researchers and psychologists in order to develop personalised mobile applications is intended to aid chronic disease management, prevention, and detection. Work on assisted living technologies for older people will have social, economic and personal impact on health and social care providers, sheltered housing, supported living operators and the elderly (allowing them to live more independently longer).

Education institutions, students and pupils: pedagogic research on the use of advanced visualisation techniques and the development of simulation software for teaching and learning can have impact on students and university courses worldwide. More locally, our work on 3D visualisation modelling is finding direct application with schools and museums.

b. Approach to impact

The development of collaborative relationships with research users has been central to our approach to achieving impact, ensuring that the needs of research users are the central focus of many of our projects, and that other research is shaped by insights into user requirements. We have supported, encouraged and enabled staff to work directly with and for research users in the following ways:

Supporting partner identification: we work closely with an *Enterprise Team* within the Department. This helps to increase our profile with research users, to communicate our areas of expertise and research interest and showcase our work. Alongside direct academic engagement with users, the Enterprise Team provide an additional channel through which discussions with potential collaborators are initiated and progressed. In the last twelve months two Knowledge Transfer Partnership (KTP) projects were identified, developed, submitted by the Enterprise Team in close conjunction with our researchers and funded by the Technology Strategy Board. The Enterprise Team operates under the management of the Head of Department, ensuring that all collaborative and commissioned research and knowledge exchange promotion is under single management. We also participate in various employers forums and Technology Expos organised by the University or external organisations, giving us the opportunity to present our work to a wide audience and find suitable partners for collaborative projects. Through the University's Research Capacity Building Programme, training for staff supports active, goal-orientated engagement in networks to develop their network capital (goodwill, profile, contacts, reputation) in order to identify potential partners. Close liaison with the University press office ensures that we raise awareness of our work and are able to bring it to the attention of target audiences. We establish a dedicated web presence for key projects, ensuring that (subject to contracts) up-to-date information is accessible to potential research users. Where appropriate, we deliver project presentations at non-academic forums and workshops in order to help identify new partners and users.

Engaging with research users on flexible terms: where we identify users and collaborators whose concerns align with our research expertise and research interests we adopt a flexible approach to engaging with them. The University's Research and Enterprise Support Office (RESO) and the Enterprise Team support a strategic and facilitative approach to pricing, cost recovery, and ownership of/ access to intellectual property and academic publication. This expands the pool of organisations we can work with and the projects that we can undertake. We also work closely with users to identify funding support to enable collaborative and commissioned research to be undertaken. We provide close support to potential collaborators to develop applications for KTP, Innovation Vouchers and other schemes and continuation strategies for their projects.

Building stronger relationships and identifying follow-on opportunities: our flexible approach to engaging with research users on collaborative projects often provides us with a strong foundation on which to build relationships that will yield long-term benefits for both the user and our researchers. We require all researchers to identify continuation strategies for their collaborative research and monitor this through our Annual Academic Return system (for personal academic planning). This may involve working with the research user in order to identify shared priorities for further work, or other organisations with whom to collaborate: e.g. **Mustafa's** KTP funded work on assistive living technology has continued beyond the KTP in order to assist the company partner in the development of new hardware to be installed in social housing. **Anderson's** work on quality assurance of Weather Forecasting Model is now leading to related work with the UK Meteorological Office and KTP projects with companies in a range of sectors. In pursuing our approach we have engaged with a wide range of commercial and non-commercial organisations, including Securecom Ltd (assistive living), SimCon Ltd in Dartmouth (Fortran engineering specialists); BigLift Ltd based in Wigan; NHS Trust, local schools, Liverpool World Museums; and internationally with National Center for Atmospheric Research (UCAR) based in Boulder, Colorado, Fujitsu USA and the US Air Force. Furthermore, a number of Universities worldwide (e.g.in USA, Canada, Chile, Malaysia, Brazil and Sri Lanka) are using the CPU/OS Simulator, which was developed within our unit.

All researchers seeking research funding from the University's internal resources must prepare an *impact statement*, outlining their views on the potential for impact to be generated and the steps they will take to maximise this. If funded in principle, staff may then be required to prepare, price and implement an impact plan as a condition of their funding. The University will meet the direct costs of impact plans (e.g. travel and subsistence, event costs, etc.) subject to value for money tests. Where possible staff are encouraged to develop these impact plans in conjunction with users and intermediaries and work together to secure match funding (where appropriate), e.g. we plan to continue our work with a British SME on assisted living technologies with funding support through the Horizon 2020 (under *Societal Challenges)*.

Beyond these collaborative research relationships, consultancy projects provide a direct channel for us to learn about the needs of research users. Staff are encouraged to present at events and workshops attended by potential research users and to produce summaries of their findings and their applicability. The university is exploring software solutions to aid the tracking of developments and the identification of impact arising from our work. We currently record activity and updates in a structured impact tracking document with scheduled updates, reported to departmental managers through our Annual Academic Return.

We believe that our approach to impact can be maintained and enhanced in the long term future by ensuring that all academic staff engaged with knowledge exchange are recognised and rewarded for their effort and commitment. Their activities are recognised and valued in performance reviews and the departmental workload model includes time allocation for activities such as: research dissemination with users, knowledge exchange, knowledge transfer partnerships, consultancy and collaboration.

c. Strategy and plans

Our strategy is founded on our assessments of our current and emerging expertise, the needs of research users, the needs and ideas of our researchers established through consultation, our assessment of the research funding landscape and a structured review of recent, current and emerging research within the Unit. It also draws upon and feeds into the wider research strategy outlined in REF 5b. Our strategy for impact has the following key elements:

Strengthening and extending collaboration with research users: Collaboration with research users will continue to be central to our strategy for achieving impact. We will seek to deepen these relationships through the identification of shared agendas and shared priorities. These relationships will be marked by shared resources, joint funding of posts and post-graduate researchers, collaborative bidding for resources, joint management of projects and programmes, well-defined impact objectives for key projects and mutual support. We will continue to adopt a flexible approach to resource allocation and pricing in order to facilitate this but will draw on a broader pool of funders (see below) in order to support future re-investment. Research projects and programmes identified include the creation of a *Living Lab* to allow more accurate testing of the assisted living and mobile technology worked on by our DisCreat research group. We are seeking to engage partners internationally, including industry, care home operators and housing associations in this work. This will include working with them to access funding under Horizon 2020 and other European funding streams currently being aligned with it. Our DAR research group is continuing to identify opportunities to work with industry (with a strong KTP proposition) and with users and developers of large scientific software models (including the UK Meteorological Office).

Formalising our approach to interdisciplinary research: Researchers in the unit are now working more closely with those from the Faculty of Health and Social Care as part of a new university initiative, the **Postgraduate Medical Institute (PGMI).** We will be working together to bring forward applied research to aid prevention, detection and management of long-term conditions. New projects are underway, focusing on public health challenges, diagnostics and medical technologies. Collaboration with health researchers and healthcare providers will accelerate the testing, approval and adoption of new solutions based on our research.

Shaping and drawing on institutional support to enable our staff to achieve impact: We will work with the Enterprise Team, the Faculty Business Development Manager and RESO to develop toolkits for staff to help them engage with external organisations more effectively. An internal University Impact conference will be used to raise awareness of good practice, funding for impact activities and engagement with users.

Promoting a research culture in which impact is sought and celebrated: We believe that the impact agenda is already reflected in the research culture within the Unit. We will maintain and enhance this through awareness raising activity, scrutiny of internal research funding, progression, reward and recruitment.

Enhancing our *impact skills, capacity and capability*: Our strategy places increased emphasis on the importance of commercial awareness and skills in order to achieve the outcomes desired, satisfy funders and manage/price risk appropriately. Working with RESO and the departmental Enterprise Team we will ensure that staff undergo training and are well-supported.

Working strategically with a broader pool of co-funders: We will work with a broader range of funders, and use these funders strategically in order to support impact-orientated research. This will include increased use of KTP funding (TSB and Research Council), Horizon 2020 schemes (particularly priorities and programmes to support to work with SMEs and funding partners e.g. ICT under the Industrial Leadership theme, LEITs, Innovation in SMEs; Societal Challenges to support our work on assistive living), EU Cohesion Funds (ERDF etc.) and other national and EU funding available through Local Enterprise Partnerships.

d. Relationship to case studies

The QACC (Quality Assurance of Climate Codes) case study exemplifies our approach to engaging collaboratively with users on flexible terms where their needs and interests are aligned with our own research interests, expertise and agendas. We have used the experience and profile gained in this work to identify a range of related projects with other research users, including a number of KTP projects, and continue to identify further opportunities to develop both our research and the impact it has with users.

The development of the CPU/OS simulator led by Mustafa exemplifies our approach to meeting the needs of potential users. This research was initiated by users' needs and has resulted in a unique set of tools integrated into a single simulation software not available elsewhere. Our approach to dissemination to users is exemplified in the publicly available, dedicated website and free to download software, generating a significant amount of interest amongst the users and informing further development and enhancement of the tool.