Institution: Lancaster University

Unit of Assessment: B11 Computer Science & Informatics

a. Context

Impact is fundamental to our research activity: The School of Computing and Communications is housed in *InfoLab*, a £15M strategic investment in 2005 to create a purpose-built flagship centre for research-with-impact. In InfoLab, we have our own unit of specialists in business and enterprise, and extensive Knowledge Exchange (KE) facilities. Over the REF period, the University has invested c. £1m of HEIF money into InfoLab for impact activity; with ERDF providing c. £3M of additional funds for KE. InfoLab is a model for impact activities in other areas of the University. It is a recognised part of the business innovation support landscape in the Northwest region and across the UK, with strong links to public business innovation support agencies (the former NWDA, local authorities, Local Enterprise Partnerships and the Dept. for Business Innovation and Skills).

Connecting our research to the real world has always been important to us, and our experience is that the best results are achieved through *ab-initio* collaborations with beneficiaries. We work with the following main classes of beneficiaries:

- **Large enterprises** in ICT, new media, security, defence, etc., who rely on cutting edge computing and communications innovation; and who benefit from collaborative research, adoption of outcomes, and the technical standards to which we contribute.
- **Public services**, for example in law enforcement and public safety, who benefit by adopting new technology resulting from, or strongly influenced by, our research.
- **SMEs** who benefit from research consultancy/ collaboration, and from our business specialists;
- **Local communities** who benefit from our extensive community-based research activities.
- **End-users of research**, with whom we engage in participatory research and public outreach.

We look to such collaborations to throw up challenging, non-incremental, problems and we then address these with fundamental and adventurous research. Through these collaborations we generate a range of types of impact, reflecting the diversity of activity within the School, as follows:

i. **Contribution to international standards**: for example, we have contributed substantially to TETRA and WiMAX, thereby delivering global economic and societal impacts affecting the business development of entire sectors, and the quality of products/ services used by millions.

ii. **Business performance**: we create new products (e.g., display technology commercialised internationally with MK Illumination), create spin-outs (e.g., ISIS Forensics who exploit our research on online protection of children), and train highly-skilled people for business (e.g., 20 PhD graduates have been assisted by our Graduate Academy to start their own businesses).

iii. **Public services improvement**: we generate both direct and indirect impact, e.g. improving the communication standards used by public services, and through the adoption of our research resulting in law enforcement in online child protection.

iv. **Regional socio-economic development:** for example, in the REF period we have supported 500 local SMEs, creating 264 new jobs, and safeguarding 1084 jobs (ERDF audited impact); and have hosted 40 companies in our company location wing in InfoLab.

v. **Community regeneration/ development**: for example, we contributed to a UK programme on global threat reduction in Chernobyl; and brought advanced communication services to rural areas in the RuralConnect Living Laboratory in Wray, Lancashire.

vi. **Societal impact**: our research informs the public (e.g., raising the awareness of children about online safety), develops creative ways of engaging with the public (e.g., David Willetts MP, in a speech in the Houses of Parliament, cited our *VoiceYourView* project as "an incredibly fresh way" to enable the public to register their views), and contributes open source software for public use (e.g., our OpenCom middleware has thousands of downloads).

b. A managed approach to impact

The consolidation of all our research and KE activity in a single entity (the new School of Computing and Communications) has been transformative in how we approach impact. Governance of impact-oriented activity is implemented at executive level in the School: our *Head of Business Partnerships and Enterprise* is a full member of the School's strategy committee and its management team. And there is every-day embedding of business-facing activity in our

research environment, with KE staff represented at academic staff meetings and on the School's research committee. We also have a long-established Industrial Advisory Board, comprising members from (e.g.) Google, IBM, the BBC and innovative SMEs, which provides us with external advice. All this has facilitated a **managed approach** to impact, with the following core elements:

- Collaborative research, in which we carry out research in partnership with beneficiaries, has always been at the core of our approach. We have collaborated with ~150 companies over the REF period. According to HEBCIS data, almost 80% of our annual research income stems from collaborative and contract research with business and users; for example, £2.4M in 12/13. As an example of how this translates into impact, collaboration with Rinicom Ltd. contributed to the company winning a Queen's Award for Enterprise in 2013 (see WiMAX impact case study). Many of our partnerships, e.g. with BT, Microsoft, and the BBC, are both long-standing (spanning multiple projects in the REF period) and strategic for both parties. We also routinely demonstrate agility by developing new partnerships; for example with Interpol, to respond to new opportunities for software technologies to tackle cyber crime. Internationality is crucial to us, and we have a proud record in EU projects, always in collaboration with industry partners. In RAE2008, we had the highest per-staff income from EU projects in this UoA (£38k p.a.), and we have built on this in the REF period with over £50k p.a. of EU funding for collaborative research per returned staff FTE.

- Research centres support impact by acting as hubs for stakeholder engagement**.** We engage with four Research Centres in the University, three of which were created during the REF period. We highlight here the *Security Lancaster* centre, which we lead, and which is one of eight EPSRC-GCHQ Academic Centres of Excellence in Cyber Security. Externally-facing activities in Security Lancaster are supported by a partnership manager, giving partners access to training and consultancy and to research expertise via (e.g.) contract research and partner secondments to research teams.

- Research with user communities frequently enables us to make real-world deployments of novel technologies in user communities. This plays a key role in our research, with the social impact of our computer networking research being recognised by a Queen's Award in 2006. Over the REF period, this strand of our research has evolved to include membership of the European living laboratories network (www.openlivinglabs.eu/) which promotes human-centric and user-driven research; and the Catalyst project (£1.9M, EPSRC), which develops novel social computing approaches to public engagement, working with ~50 community groups, social enterprises and charities. In Catalyst, these communities define and actively participate in joint research problems in the use of digital innovation to effect social change (www.catalystproject.org.uk/).

- Research training with industry enables impact through novel delivery mechanisms. We operate a *Graduate Academy* for graduate, doctoral and postdoctoral students, helping them gain vocational experience through short-term consultancy projects with industry. 73 students have been supported through the Academy over the REF period, with 20 subsequently starting their own business. Our HighWire CDT has digital innovation at its heart, and promotes interaction with research beneficiaries at all stages of the programme, including business placements and collaborative summer projects. Doctoral training with industry involvement is also provided via CASE studentships (19 in the REF period) and Marie Curie ITN fellowships (7). In practice, all our PhD projects engage students with industry or users groups, as this is the nature of our research.

- Standardisation work enables our research on new and emerging technologies to feed into the development of high-impact international standards. This has been particularly true in computer networking where we actively foster our links with the relevant standards bodies. In addition to major past contributions to TETRA/WiMAX, we have made important contributions to standardisation activities in QoS, and MPEG systems, and are currently active in resilience and security metrics, and in network virtualization.

- Commercialisation enables IP to be exploited through patents, licensing and spin-outs. With institutional support from an *IP Development Manager*, 20 patent applications have been submitted in the REF period. IP is managed by the University's subsidiary, LUBEL Ltd, with sharing in financial benefits, and easy-access IP development. Staff are engaged in commercialisation via spin-offs (6 have been created) and partnerships brokered by our business development team (e.g., a license agreement with MK Illumination, an international lighting company, to exploit IP in new visual display technology).

- KE networking, event organisation, and outreach for industry knowledge transfer. We are founding board members of the TSB's national ICT KTN, hosted the Network's NW launch in 2009,

and have since collaborated on a wide range of regional events (www.security-centre.lancs.ac.uk/events). One conference (CSC2012) was cited in the House of Commons as an embodiment of best practice in engaging small businesses. We routinely pursue outreach activities, including workshops in which our academics have engaged with over 150 NW SMEs over the past 3 years.

- SME support enables impact through company co-location (40 during the REF period) and innovative delivery routes. Support for SMEs is at the core of our research environment; as achieved through company co-location in InfoLab, consultancy via the Graduate Academy, student placements, and outreach events. Over 1000 SME jobs have been created or safeguarded.

- Impact generation support for staff is provided at both School and institutional levels. Staff are supported by the InfoLab business development/ KE team, who assist in identifying pathways to impact, building relationships, and organising outreach activities. Institutional support includes IP development and contract management. Impact is recognised and rewarded, e.g. as part of the University's Outstanding Contribution awards. Staff sabbaticals as industry secondments are strongly encouraged; e.g. recent sabbaticals include placements with MK Illumination for a commercialisation project, and with Google Labs to develop new collaborative research.

c. Strategy and plans

The integration of academic and KE activity in the School during the REF period provides a strong foundation on which to develop the following areas over the next assessment period:

- **Governance and management.** We will build on our managed approach to impact generation with the further development of processes for strategy planning, monitoring, and reporting. We will integrate external advice more strongly by diversifying our Industrial Advisory Board.
- **Develop an impact culture.** Progress has been made in supporting staff to generate impact, but more work is needed to achieve culture change. We will embed impact orientation in new academic and research posts, recognise and foster impact champions, and strategically use visiting appointments and seminar activity to address impact agendas.
- **Addressing impact in training.** We are augmenting our research training (both PhD and MSc levels) to have impact at its heart through new taught modules and impact-related placements.
- **Appoint impact specialists in strategic areas.** We have created a first *Impact Specialist* role (going out and bringing stakeholder communities to the School) in cyber security, and see this as a highly-effective route to growing impact in other areas of strategic importance.
- **Science Park.** The University is working in collaboration with the local authorities to develop a Science Park adjacent to the campus. This will extend our focus on co-located companies beyond those hosted in InfoLab. We will play a key role in the development of the Park.
- **Strategic partnerships.** The University is pursuing a range of strategic, institutional-level partnerships with (e.g.) the BBC, IBM and the University of São Paulo to collaboratively increase opportunities for impact. Our strategy is to take a leading role in these relationships; this is already starting to bear fruit with (e.g.) extensive FP7 collaboration.
- **Leverage structural funds (e.g. ERDF).** We will look to apply future tranches of such funding to link more directly impact with our core research activities.

We will measure our impact performance against the numbers achieved of the types of impacts, i-vi, identified in section (a).

d. Relationship to case studies (*superscripts refer to types of impacts, i-vi, from section (a)*)

The TETRA case study[i] is based on long-term collaborative research with an established spin-off, HW Communications. It is an exemplar of our ethos of real-world application of research, in this case leading to a significant contribution to TETRA Enhanced Data Services, with global reach.

The WiMAX case[i,ii,v] is also grounded in collaborative research, with Rinicom ltd., leading not only to impact on standards and significant growth of our partner's business, but also exemplifying the application of research to the benefit of communities (the municipality of Slavutych/Chernobyl).

The UCREL case[ii,vi] highlights the role of Research Centres as impact hubs. UCREL is a joint centre with Linguistics who have a separate case on impact on the publishing industry. Our own case highlights the impact of NLP research on learners, via internationally-licenced software.

The ISIS case[ii, iii, vi] highlights research motivated at its core by a fundamental societal challenge, the protection of children in an online world, and demonstrates impact along multiple pathways to achieve commercialisation, adoption by law enforcement, and increased awareness of risks.