Institution: University of South Wales

Unit of Assessment: B11

a. Context

The Unit's research has made significant contributions across a broad spectrum of impact types and key users – outlined below by research group (see Environment).

Economic Impact

Mobile Communications: Key non-academic user groups include over 60 SMEs via Centre of Excellence in Mobile Applications and Services (CEMAS); also General Dynamics, Orange and France Telecom R&D for specialist next-generation test bed network services; local authorities for energy and utility monitoring, smart metering and home automation.

Security Information Systems: Users include a wide range of commercial and government organisations: QinetiQ, Northrop Grumman, StoneSoft (MCafee), EADS/CASSIDIAN and MOD/DSTL for intrusion detection and analysis; BT and Sims Recycling for forensics.

Geographic Information Systems (GIS): Web application work with West Coast Network Services, Kestrel, Admiral Insurance; Marine GIS via the GeoVS spinout company.

Impacts on public policy and services

Security Information Systems: Users include the Home Office Scientific Development Branch (now Centre for Applied Science and Technology), various Police agencies including Police Service of Northern Ireland CCTV Unit; National Technical Assistance Centre, Roke Manor, Australian Police Force, DSTL/MOD Cyber and Influence Centre for cyber security; DfT, DVLA and HMRC. The group's members acted as expert witnesses for national and regional Law Enforcement Agencies.

Geographic Information Systems (GIS): Users include Welsh Assembly Government, Wales Council for Voluntary Organisations and Welsh Statistical Liaison via the WISERD GeoPortal work (see Environment); various projects with Ordnance Survey; Disability Wales and RNIB Cymru for studies of connectivity.

Health impacts

Intelligent Systems: Users of medical image processing research include Swansea NHS Trust, Philips Research Laboratories, Clearspeed Technology Ltd.

Impacts on practitioners and professional services

Intelligent Systems: Users for semantic interoperability work in cultural heritage include the Archaeological Data Service, English Heritage, Royal Commission on the Ancient and Historical Monuments of Scotland/Wales, Wessex Archaeology Ltd; the studies of minority language use online have informed the Welsh Language Board's IT Strategy.

b. Approach to impact

The Unit's approach during 2008-2013 has been to encourage and support the cultivation of strategic, long term collaborations with key users for each research group, embedding research outcomes in user contexts. The Unit has been proactive in seeking support for impact via different means, according to the particular strategies followed by the different research groups.

Consultancy work has provided one route, particularly for the Security research group (>£500k to Security - see users in Context section). The Commercial Services department has provided support and project management for commercial contracts. For example, significant impact has resulted from advances in techniques for forensic data recovery including malicious corruption of disk firmware. Another commercial route to exploitation of research results has been Knowledge

Transfer Partnerships (KTP) and spin-outs assisted by our Technology Transfer Service. During 2008-2013 there have been KTPs with West Coast Network Services Ltd. (Ware, GIS) and ITSUS Consulting Ltd. (Xynos, Security). Also facilitated by Commercial Services, Ware was able to draw on HEFCW Strategic Insight Programme (SIP) support for cross sector partnerships, to establish new collaborations for GIS with Acclimatise and Admiral Insurance. Also via a SIP, Al-Daher was able to develop relationships with Sub10 Systems Ltd. - the collaboration has led to high-speed wireless infrastructure (see Environment). Other strategic collaborative partnerships furthered by Commercial Services are the Intelligent Systems (Tudhope) knowledge transfer consultancy with English Heritage applying AHRC project outcomes, as well as the Mobile Communications (Al-Begain) "Care for Business" Collaborative Welsh Assembly A4B Project and a General Dynamics contract for a novel Mission Critical Voice over 4G system. Three spinout companies have been in operation during the period (see Environment); GLAMEX forms part of the Mobile Communications impact case study; the GeoVS spinout based on GIS PhD work was bought in October 2013 by Software Radio Technology, the Bath-based specialist in maritime domain technology (the transaction valued GeoVS at about £955k).

Intelligent Systems (Tudhope) has built up key collaborations (described in the Linking Archaeological Data case study) through strategic targeting of AHRC funding programmes. It has also been able to tap the pump priming University Research Investment Scheme (RIS) to facilitate collaborations; Tudhope has investigated automatic metadata generation from the Corpus Vasorum Antiquorum with the Beazley Archive (associated with the Ashmolean Museum). Roula's grant from High Performance Computing Wales with Neuradaptix Ltd. on Brain Computer Interfaces for Stroke Rehabilitation using High Performance Computing was prepared by a preliminary RIS grant. GIS has been influential (Higgs is co-Director) in the Welsh Assembly's WISERD partnership across Welsh Universities in the Social Sciences supported by %staff buyout. The GIS relationship with Ordnance Survey has been cultivated over an extended period, with a recent OS funded PhD studentship and datasets.

Mobile Communications, Intelligent Systems and Security have all been successful in obtaining FP7 funding to pursue strategic research with major collaborative partners. This has been supported by the European and External Resource Office. In addition, the CEMAS Centre of Excellence (£6.4M total, described in Mobile Communications case study) is making significant impact, drawing on match funding (over £3M) by the University.

The Unit has been able to draw on competitive Faculty and University funding for PhD studentships and collaborative ventures. For example, leveraging interest from the company, Security obtained University 50% funding for two PhD studentships to strengthen its collaboration with EADS/Cassidian (who contributed 50%). Security has also drawn on the Knowledge Economy Skills Scholarships (KESS) EC Welsh programme to support collaborative PhD research with commercial partners in the Convergence area of Wales.

Security (Blyth) has been involved for over 10 years with the ESII (Enabling the Secure Information Infrastructure) consortia, which advises policy and decision makers within MOD. This government impact is reinforced by work with industrial partners on successive Centre for Defence Enterprise (CDE) projects, informing decision makers within Government on a wide spectrum of technologies from data visualization to computer forensics. Commercial and government users include major defence contractors such as Northrop Grumman, QinetiQ, EADS/Cassidian and DSTL/MOD. Security drew on University funds to help build the test rigs used for professional assessments for the Tiger Scheme (membership of Tiger is one of the qualifications recognised by MOD for joint cyber unit reservists).

c. Strategy and plans

The applied focus of the Unit's research supports an impact driven agenda with committed long-term users. This builds upon the strategic user partnerships, specialist infrastructure and centres of excellence built up by the internationally recognised research groups. The Unit will encourage and support the cultivation of long term collaborations with key users, building on current major projects and extending the application areas. The different research groups will develop their particular approaches to connecting with users and instruments of support, as outlined above. We will look

for opportunities for synergy between the groups and their user communities, as with Security issues in Mobile communications. A recent example (October 2013) brings together Mobile and Intelligent Systems combining in a research consortium supporting partnerships in the Welsh creative industry sector funded by an AHRC/NESTA scheme.

Investment in Mobile and Security research infrastructure by commercial and government sources has been reinforced by the Faculty and University and this will continue to form an important strand of strategy. These specialist facilities underpin impact work with a range of user groups (see Context) and also MSc provision which provides opportunities for developing contacts and sometimes involvement from companies and agencies. For example, the *Secure Computing Research Laboratory,* one of the very few government approved high security computer forensics laboratories in a UK university, is the outcome of a two year building project. It has informed the revision of data recovery methodologies used by police and government disseminated by the Home Office's Scientific Development Branch / Centre for Applied Science and Technology and the Centre for the Protection of National Infrastructure and continues to underpin consultancy and research. Specialist mobile facilities also underpin the CEMAS Centre of Excellence and this will continue to be a focus for growth (see Mobile Communications case study).

The Research Institutes (RIs) created in 2013 play a key part of the plan for realising an impact strategy. All the Unit's researchers are located in the Computing and Digital Economy RI (see Environment). The RI Directors (Professors Tudhope and Fyfe) conduct annual research appraisals with members, which feeds into line manager staff appraisals. Discussion of impact plans by institute members and creating and maintaining user partnerships form an important part of each appraisal. Dissemination plans also form part of each member's impact strategy, focusing attention on (social) media outputs and targeted user communities, in addition to the conventional academic audiences. Workshops where experienced researchers discuss practical impact issues form part of the strategy. A proportion of QR funding will be distributed through the RIs and this provides an additional strand of the impact strategy. A discretionary fund for RI Directors is available for 'light touch' proposals. This allows the RI to support promising impact activity in an agile manner to incentivise successful activity. While deliberately not prescriptive, activities can include bridging funding over short periods, travel funds for collaborative meetings, attendance at Research Funder workshops, pilot studies, etc.

d. Relationship to case studies

The selected case studies highlight the Unit's strategy to cultivate long term relationships and dialogues with strategic user partners. The *Linking Archaeological Data* case study builds upon strategic partnerships with (among other organisations) English Heritage (EH) and the Archaeology Data Service supported by three AHRC grants, including two funding programmes explicitly related to impact: DEDEFI (Digital Equipment and Database Enhancement for Impact) on enhancing impact from digital research outputs and FOF (Follow on Fund) on knowledge exchange pathways to impact for new audiences beyond academia. An EH collaborator (Keith May) has been awarded a University Visiting Fellow title and co-authors with Hypermedia staff. A competitive University Centenary PhD Studentship (2013) was awarded for a collaborative Hypermedia/GIS research project on spatial semantics, where the PhD student previously worked for a commercial user partner, Wessex Archaeology Inc.

The *Mobile applications and technologies making economic impact* case study similarly builds on long-term partnerships with various commercial companies, (including Orange and General Dynamics, and commercial users generally via the NGMAST conference (founded by Al-Begain). The Centre of Excellence in Mobile Applications and Services is the culmination of a longstanding dialogue by Al-Begain, assisted by USW's European Office, with relevant departments of the Welsh Government to widen the impact of the research and development at USW to benefit business throughout Wales. The partnership with several major mobile technology players (including Orange, Dialogic and Avaya) resulted in the creation of the next generation network testbed at USW that has underpinned several projects.