**Institution:** University of Portsmouth

**Unit of Assessment:** 11 Computer Science and Informatics

## a. Context

Our research scope and core competencies cover a wide range of inter-disciplinary subjects, often combining computer science with health professions, electronic, mechanical, systems engineering and mathematics. Since 2008, the majority of impact generating activities have been in two of our core research themes: **Computational Intelligence** (design and development of intelligent solutions and systems in collaboration with large, medium and small enterprises); and **Health Informatics** (modelling of patient care and standardisation of patient data).

The **types of impact** of our research include: (1) **economic impact:** enabling enterprises to design and manufacture innovative products to retain their competitive market position (e.g. Smart-e Ltd); participating in an active programme of knowledge transfer partnerships leading to efficiencies through process improvement (e.g. Xyratex Ltd). (2) **health impact:** with particular reference to research in modelling of patient care which has been adopted nationally with significant impact on patient mortality (*refer to ICS: UOP11CLINICAL*). (3) **societal impact:** enhancing public understanding and awareness as a result of the concerted outreach activities of our researchers.

Our **beneficiaries** include organisations responsible for the provision of healthcare (e.g. NHS); a range of companies in the health technology sector (e.g. members of South East Health Technologies Alliance), large industries (e.g. BP, Airbus), small and medium enterprises (e.g. Xyratex Ltd, Smart-e Ltd, PassivSystems Ltd, Lane Telecoms Ltd), consultancy firms (e.g. ESROE Ltd, PPA Energy); third sector organisations (primarily charities supporting sufferers of particular conditions); and the general public, including special interest groups such as patients and children with disabilities.

## b. Approach to impact

Our approach is guided by the principle that impact is largely underpinned by international quality research. Our strategy has focussed on extending the reach of existing research strengths whilst also building capacity in a newly developed thematic area (e.g. Networking and Security). Typically, we promote and support a variety of approaches to impact-related engagement including networking and collaboration, pump-priming projects, interaction with user groups, and public engagement and outreach.

*Networking and interaction with user groups*

During the 2008-13 REF period, our researchers have developed collaborative research relationships with key stakeholders and pursued a focused strategy to capitalise on areas of our research strengths. The majority of these have been initiated through **direct contacts between academics and relevant industries,** often as a result of their research reputation and profiles. For example, our track records of applied research in our core competencies (*clinical outcome modelling, powered wheelchairs and sensor systems, and the interoperability of health record systems*) have allowed us to build an extensive network of practitioner contacts over the years. This has been achieved through our participation in national and international conferences, workshops and training events, as well as hosting events at the University of Portsmouth. Several key researchers (*Liu, Sanders, Briggs*) are members of relevant Knowledge Transfer Networks (KTNs), and this has led to collaborative work and KTP projects. The collaboration with the South East Health Technologies Alliance (SEHTA) resulted in 5 projects that were funded or match-funded in the last 5 years. Through SEHTA, we have also gained access to the EU-supported JADE[1] and InnovAge projects in the area of independent living for the elderly, giving us scope for developing further impact in the future. We have actively participated in the Wessex Health Innovation and Education Cluster (HIEC) and will do so in its successor, the Academic Health

[1] Joining innovative Approaches for the integration and Development of transnational knowledge of clusters policies related to independent of Elderly

Science Network (AHSN).

*Collaboration with industry*

We have benefited from and engaged with the University **Research and Innovation team (RIS) to broker contacts between academic staff and the business community**, and advise and assist in consultancy and knowledge transfer activities. RIS works with researchers to develop collaborative projects such as Knowledge Transfer Partnerships (KTPs) and Collaborative Research & Development programmes. For example, we have engaged in a series of collaborative projects with Smart-e Ltd (3 projects over the REF period) to design and manufacture high quality audio and video switching and distribution equipment. The company used to specialise in proprietary analogue technologies designed for dedicated cabling installations. Using our expertise in embedded systems, web programming, computer networking and artificial intelligence, we embedded in the company the capability to engineer new hardware and software solutions that take advantage of existing computer networks and are compatible with the emerging digital media distribution standards and consumer devices. This is an excellent example of a business development relationship which has had multiple impacts: transfer of knowledge and expertise to the company; appreciation of commercial drivers by academics; and employment of several KTP associates on completion of projects, with one now holding a senior position in the company.

*Pump-priming initiatives*

Realising the potential of a selection of key projects, we applied and received support from the University internal funds to pump-prime several activities that delivered impact in the REF period. Through HEIF (Higher Education Innovation Fund) funding, for example, researchers from this UoA were granted £158K to support projects in Health Informatics related to "digital well-being" (*refer to ICS: UOP11CLINICAL*). An additional grant of £30K was allocated to Prof Liu's team to develop 'a software package for controlling prosthetic hands via user manipulation intent'. These projects enabled (i) the realisation of 'proof of concept' prototypes (e.g. prosthetic hands: http://www.liuh.myweb.port.ac.uk/SJTUhand.mov) that are currently being considered for adoption by a Chinese Manufacturer (Danyang Protheses Ltd); (ii) creation of a virtual environment to showcase the use of Telecare in the workplace to support employees in maintaining their general health and fitness (see http://www.chmi.port.ac.uk/projects/dw/ ); and (iii)building networks of partners in the UK and EU in digital well-being to extend our expertise in sensor technologies used to monitor the health and wellbeing of the elderly.

*Public engagement and outreach*

Our impact agenda has evolved to include the running of symposia and conferences to attract user groups and industrialists and planned interaction with the media as part of a co-ordinated and professional impact strategy. Since 1998, we have been involved with organising the Southern Institute for Health Informatics (SIHI) conferences for the purposes of maintaining an international high profile, keeping abreast with national initiatives and essentially disseminating our research work to practitioners and researchers. In September 2013, the most recent SIHI conference received excellent reports in the media, e.g. http://telecareaware.com/from-big-data-to-collective-wisdom-sihi-conference-report/. We also encourage our researchers to engage the general public through: popular events such as "Café Scientific Portsmouth" where science is discussed in a café atmosphere organised in collaboration with Portsmouth City Council and is part of the world-wide "café scientifique" movement. We issue press releases to promote our research excellence and impact and bring it to the media attention, following the publication or realisation of significant innovations of particular impact on the general public (e.g. development of the world's first mobile phone app which automatically colour codes messages so people know before reading them if they are likely to make you feel good or bad http://www.port.ac.uk/uopnews/2012/06/12/new-phone-app-protects-peoples-moods/). We also provide opportunities for the public and industry to attend our research events through a series of public lectures, CPD activities, and student project days.

**c. Strategy and plans**

Our research is largely of an applied nature and, as such, we work closely with practitioners, business and industry. The focus of our impact strategy is to provide direct benefits to end-users,

with particular emphasis on addressing national challenges related to health. Key to a successful impact strategy is the ability to establish and maintain research excellence and provide the necessary support to engage and share our achievements with external stakeholders.

Our future strategy includes:

- Supporting staff in identifying the potential impact of their research, and identifying appropriate avenues to exploit it. Impact-related activities will be included as part of our annual staff appraisal process.
- Continuing to provide strategic investment to support existing research and to pump-prime new activities that involve key partners and include impact-driven goals. In particular, we will enhance our internationally leading position in computational intelligence, robotics and their applications, focusing on vision-based human motion analysis for surveillance, and prostheses for rehabilitation driven healthcare solutions.
- Extending the range and scope of engagement with business and industry through a sustained growth in KTP, CPD, Collaborative R&D, and consulting activities.
- Establishing effective mechanisms for the measurement of impact and the collection of evidence for all research groups and centres.
- Further developing relationships with key stakeholders involved in the care and provision for the elderly through the recently established cross-faculty network UPAN (University of Portsmouth Ageing Network).
- Encourage further public engagement with our research through traditional broadcast, web-based and social media and through hosting conferences and symposia aligned with our research groups, with the aim of at least one significant event annually.
- Encouraging and supporting industrial secondments of academic staff to forge stronger links with business and industry.
- Appointing visiting industrialists from key organisations to facilitate a more integrated approach to working with industry in new potential areas of impact.
- Proactively publicising our research via our web pages and social media and continuing to make effective use of our institutional support, like our press office, to promote our research and its impact.

**d. Relationship to case studies**

*UOP11MOBILITY* arose from research that began in the late 1990s from networking activities with the NHS and charities. Through funding from multiple sources, the team led by *Sanders* has been able to introduce a steady stream of new developments, which have been keenly adopted and exploited by their industrial and charitable partners.

*UOP11CLINICAL* grew out of close links with Portsmouth Hospitals NHS Trust. Over several years, the research led to the development of models with clear operational application in hospitals, and through a KTP with The Learning Clinic Ltd. The team led by *Briggs* and *Prytherch* has seen the work adopted across the NHS.

Both case studies exemplify our inter-disciplinary approach and the inclusion of key stakeholders. One benefited from the University's strategies for investment in research with potential for impact and the University's strategic focus on research relating to ageing and well-being.