**Institution: University of Westminster**

**Unit of Assessment: UoA11; Computer Science and Informatics**

**a. Context**

There are distinct non-academic user groups who are the beneficiaries and audiences for the School of Electronics and Computer Science's (ECS) research. Selected examples are listed below:

Businesses

- The methodology of designing power efficient digital signal processing systems called Balanced Model Truncation has been used to design hearing aids, subsystems for mobile phones and in the space industry. These products benefitted from longer battery lives.
- Research on semantic computing led to efficient methodologies for constructing search engines and question answering systems has been used in the products of ActiveStandards Ltd in order to provide better online database-querying services, to their customers.
- The users of powerful computing facilities such as grids and clouds improved their productivity by having installed and used dedicated scientific gateways, based on the P-Grade system, developed through joint research with European partners.

Government / International

- NHS units, such as Primary Care Trusts (PCT) and hospitals, improved management of their operations by using the tools based on our research on mathematical modelling of processes in the health and social-care institutions.
- The concept of Grid Component Model supporting creation of invisible grids, co-developed with EU partners, was incorporated in four industrial standards issued by ETSI and affects industrial practices of European institutions.
- Research into understanding the relations between the objective and subjective quality measures of video and images led to informing the decision of Transport for London on the acceptable level of CCTV video compression on London buses.

Society

Research into efficient augmented reality environments have led to the development of products for the entertainment industry allowing the public to interact with the performances or exhibitions hence adding a dimension to their experience.

**b. Approach to impact**

While School recognises the academic freedom of staff in selecting the directions of their research it also guides, steers and supports them to maximise the relevance of all research activities to the needs of the potential users. This is complemented by post-research activities where our research teams are supported to liaise with the end-users to materialise the impact from their work.

| Project | Participating End-User(s) |
|---|---|
| SHIWA: **Sh**aring **I**nteroperable **W**orkflows for Large-Scale Scientific Simulations on **A**vailable DCIs; (funder: EU) | Correlation Systems Ltd, See case study on "P-GRADE" for details |
| SCI-BUS: **Sci**entific Gateway **B**ased **U**ser **S**upport; (funder: EU) | Simsoft Ltd and E-Group See case study on "P-GRADE" for details |
| Extending the Applications and Improving the Efficiency of Positioning Through the Exploitation of New GNSS Signals; (funder: EPSRC) | EADS Astrium See case study on "Balanced Model" for details |

Table 1. Examples of end-user participation in research projects

The interactions with the non-academic users start at the early stages of research. The projects that we undertake do normally involve partnerships with institutions representing the consumers of the work. This approach helps maintaining the relevance of research to the needs of the institutions and social groups targeted by the projects. The presence of non-academic partners and their influence throughout the lifecycle of projects, commencing at the planning stages of the work, then bidding, project delivery and finally in the follow-up actions, plays a vital role in aligning the

project work with the needs of the potential beneficiaries and audiences, and streamlines the process of developing impact from research. The partnerships are set up either by forming project consortia with non-academic institutions appropriate to the character and objectives of the work or through arranging direct sponsorship of the projects by industrial partners. In fact 56% of our externally funded projects during this REF cycle involved close collaboration with representations of end-user partners. This figure increases to 88% if the cash-value rather than a simple count is used as the measure. Selected exemplars are listed in the Table 1 above.
A number of working relations with end-users were initiated by our staff by directly approaching the companies to discuss consultancy, professional support, training programmes etc. or by the companies themselves seeking our support. Some links were initiated by our alumni who often play ambassador's roles promoting our expert skills. These relations are used to seek opportunities for other engagements related to research, knowledge transfer etc. Exemplars of such contacts are shown below:

| End-user | Details |
|---|---|
| LPP (London Procurement Partnership) | LLP requested help to develop a demand planning tool for use by Primary Care Trusts in NHS. After successful completion they provided additional funding to continue receiving our support for another three years. |
| PCT Hounslow | The initial contact was requested by the company who were aware of our reputation in healthcare modelling. After they received initial consultancy services they requested fuller transfer of knowledge and help with the development of modelling tools. The work is continued as a large knowledge transfer project (KTP). |
| Sutton Hoo | Sutton Hoo is an archaeological site around an Anglo-Saxon burial ship. Our research team was approached by the site to help them developing augmented reality application that will help improving the experience of the visitors with use of their own mobile devices. The project involves now the British Museum and National Trust so that the exhibits from the British Museum can be blended into augmented reality through a network link |
| Ministry of Defence | On the recommendation of one of our alumni we have been approached to provide expert advice on the required quality of the next generation imaging devices to be used by the British Army. The aim is to prevent spending unnecessarily large budgets for imaging systems that surpass the human visual limits. |
| Astrium Ltd | Astrium Ltd was an ECS' industrial partner in an EPSRC-funded project. After learning about our potential of designing low-power digital architectures they approached the School to work jointly with them to provide the European Space Agency (ESA) with on board satellite instrumentation. ECS participates now in ESA funded projects as a partner of Astrium Ltd. |

The School assesses annually existing and potential opportunities of engaging in projects that make use of our academic specialism and have impact potential. Those most viable are supported either financially (e.g. to acquire equipment, software, data bases) or organisationally (e.g. space, adjusting teaching and administrative load of engaged staff). Such activities are expected to be followed with a business plan leading to financially viable ventures. The researchers who engage with creating impact and generate income for the University receive up to 90% of the surplus, either for their disposal to support University related work or in some cases as a personal payment. The Business Development Officer (BDO) (Mairembam) is a dedicated to ECS non-academic member of staff whose role is to provide a wide range of administrative, marketing and legal support, and financial advice to staff engaging in impact. In this capacity BDO guided our teams.

**c. Strategy and plans**

The University underwent a reorganisation completed in August 2013 during which the Schools were replaced with Faculties. All ECS departments are now within the Faculty of Science and Technology which also comprises the former School of Life Sciences and the Department of Psychology. This situation creates opportunities for streamlining engagement with inter- and multi-disciplinary work. For example Ambient Assisted Living – creating environments allowing people with serious debilitating diseases (e.g. Alzheimer) live longer in their homes rather than being moved to places of care, has already been identified as an area where the Faculty can use the

skills and past experience across all its units to create impact. The emerging strategy described below will guide our activities for a few years.

Strategy

- The Faculty will establish Business Committee that will oversee the impact agenda;
- During annual appraisal individual academics will be presenting their "research impact" profile that will be discussed with the appraiser. Plans will be drafted and monitored on the development of the profiles;
- The Faculty will support short-term placements in industry to help academics develop personal contacts, improve understanding of their operation and explore possibility of further collaboration resulting in creating impact from their research;
- The Faculty will organise annual open day during which the research achievements are presented in the exhibition event style, with practical demonstrations, specialist lectures designed for end-users rather than academia, hospitality and social events. The guests will be invited from relevant institutions and organisations that could benefit from our work.
- The Faculty will provide financial and organisational support for academics willing to take part in external events such as exhibitions or workshops where they could present their impact potential to end-users
- The Faculty Industrial Advisory Board for Research and Impact (comprising representatives of businesses and professional organisations relevant to the Faculty expertise areas) will be set up to inform strategic decisions on research and impact.
- Annual review of research will explicitly address impact issues within the unit.
- All new research projects, submitted for approval by the Faculty, explicitly address impact including actions, timescale and effects.
- The role of the Business Development Officer will be continued in the Faculty to provide widespread support with non-academic issues related to creation of impact.

Immediate Plans

- To maintain and develop our long-term relations and impact creating activities with the existing partners such as NHS, Astrium Ltd and ActiveStandards Ltd.
- To continue the work on P-Grade and expand its use throughout industry, research institutions and academia to ease the use of parallel computing facilities.
- To expand our collaborative links with Sutton Hoo, British Museum and National Trust to support virtualisation of their exhibitions.
- To forge cross-organisation links with Dementia Action Alliance (bringing together more than 150+ organisations) and similar organisations to undertake projects supporting Ambient Assisted Living to help coping with the burgeoning older population and maintaining their independence. This work will involve know-how skills from the ECS that we developed through the EU funded PERFORM project as well as other Departments of the newly created faculty (e.g. Psychology).

**d. Relationship to case studies**

The experience of research teams behind the presented impact case studies guides to large extent our strategic approach towards impact.

All three research teams behind the presented case studies organised events such as seminars, training courses, exhibitions, or took part in such events organised by third parties to promote their skills, research achievements and impact potential among end-users.

One of the teams (case study on "Balanced Model") maintained informal advisory board that allowed the team to strategically choose directions of research and find impact and related business opportunities.

Engagement with industry, businesses and governmental departments requires much wider, complex and more agile support than traditional academic activities such as teaching and research. Timely and accurate legal, administrative and financial advice is important. This role has been for some time fulfilled by the Business Development Officer. Our experience arising from the presented impact case studies and other activities indicates that his / her role will have to be extended in the Faculty to streamline impact activities while protecting the legal and financial interests of the University.