

Institution: Brunel University
Unit of Assessment: 11 Computer Science and Informatics
<p>a. Context</p> <p>A broad range of non-academic users benefit from impact generated by the unit's research. The nature of that impact is significant in reach and has public benefit as a key objective. The unit's research structure, its strategies and a culture emphasising industrial collaboration ensure that impact is felt across a wide audience spectrum. The unit can be viewed from the perspective of two Centres: Software and Systems (CSS) and Intelligent Data Analysis (CIDA). The work in CSS has impacted <i>practitioners and professional services</i> in organisations (such as BancTec Ltd.) and benefitted IT system stakeholders and software users. Research into the use of simulation tools in industry (for example Ford, Saker and Sellafield) has led to <i>environmental</i> and <i>societal</i> impact through, for example, improved industrial processes and safer waste disposal. This has generated <i>economic impact</i> as well as <i>commercial impact</i> through benefits to society. The work at CIDA has generated <i>Economic</i> impact through ontology research, resulting in improvements in alignment between the business and IT system representations at several commercial organisations (including Shell and Unisys). Research using intelligent data analysis has generated <i>health</i> impact through more accurate diagnosis of Down's syndrome conditions in hospitals in China. Rapid early prediction and diagnosis of birth defects from a wide range of populations has helped to reduce incidence of birth defects with significant <i>societal</i> impact.</p>
<p>b. Approach to impact</p> <p>A core component of Brunel's mission and strategic plan since it received its Royal Charter in 1966, has been engagement with industry and demonstrable impact derived from this activity; the research culture at Brunel reflects enterprise 'for the benefit of individuals and society at large'. In keeping with this mission, approaches to achieving impact can be seen from two perspectives: those which are unit specific and those supported at the institution level.</p> <p>Within the unit, strong emphasis is placed on industry-wide initiatives. This is evidenced by Industrial secondment of staff and funding received from Knowledge Transfer Partnerships (KTPs) and the Technology Strategy Board (TSB), which currently stands at £1M over the REF period. Promotion of industry CASE awards and consultancy in the unit has resulted in £220k funding during the current REF period (with eight CASE studentships having been awarded). The unit also promotes the appointment of industry practitioners as Visiting Industry Fellows at the University, complemented by a vibrant short-term research visitor programme. Additionally, EPSRC and EU-funded projects, in collaboration with companies and other universities, have been a key means of delivering impact from the unit's research, alongside traditional dissemination of results at leading conferences. In the REF period, researchers in the unit have obtained over £11M in external funding, including over £6M from Research Councils UK and £2.5M from the EU. More than 60 companies have been involved in research projects across the unit during the same period, reflecting the commercial, end-user value seen in our research.</p> <p>The unit's Industrial Advisory Board (IAB), on which there are representatives of a variety of SMEs and large organisations (including senior executives from Allport, BBC, GlaxoSmithKline, Hillingdon Borough Council, Huawei, Microsoft, The Salvation Army, Three Telecom, Sporting Index and UBS), provides insights from 'the field' to test the practical value of our research. This approach also fosters research and knowledge transfer relationships, allowing us to react in an agile way to emerging industrial, commercial and societal issues and to tackle them through a range of activities in addition to our core research, from undergraduate and Master's projects, through student placements, to knowledge transfer activities with staff. This real-world focus of our work has also led to the formal establishment of industry-based MSc Dissertations, each of which seeks to create impact in a specific organisational setting through the student's work, supported by an academic advisor. Separate projects involving application and visualisation of large ontologies with Boro Solutions and the NHS National Cancer Action Team, business requirements modelling and risk management with DHL and assessing agile software practices and perceptions with Pitney Bowes are just some of the examples of our successful MSc projects completed within companies, showing impact flowing from our teaching as well as our research. Staff are also encouraged to develop new collaborations and projects through industrial placement visits and</p>

Impact template (REF3a)

student alumni. A recent, funded EPSRC grant to explore software fault prediction with data provided by BSKyB, London and expertise from Simula, Norway (EP/L011751/1) was a direct result of interest in our research by a graduate (now working at BSKyB) who had taken software engineering modules as part of their course. Our longstanding, successful student placement scheme promotes links and has led to our expertise being applied in organisations including GSK, Ford and Microsoft, and is a mechanism through which networks with, and impact in, industry, government and charities have been established. Simulation research with Ford for example, through an EPSRC-inspired project, has led to tool adoption at the Brentwood Plant.

At the institution level, research collaboration with users is encouraged through financial support and the provision of Knowledge Transfer (KT) Leave, Research Leave and KT Secondments. These initiatives and impact approaches allow staff to spend a dedicated period of time outside the institution often interacting with non-academic users. Research on mobile phone usability techniques by an academic member of the unit while on Research Leave with Orange mobile has led to national rollout of guidelines for user-centred design across stores in the UK. The establishment by the University of the formal Concordat for career development of researchers in 2010 has, as a key principle, increased emphasis on impact in the unit. This emphasis is reflected in the importance of impact being embedded in a range of different institutional mechanisms for supporting, developing, recognising and rewarding colleagues. For example, the 'BRIEF' award, a University-wide funding stream to which new members of staff may apply, provides resources for a PhD Scholarship, and the application process includes consideration of impact to stress its importance to institutional work and research planning. In the current REF period, four members of staff in the unit have benefitted from BRIEF awards totalling over £40k. Further, all new academic staff and colleagues on the 'University Future Research Leaders' scheme require evidence of impact-related research and engagement and understanding impact forms part of the Professional Development of Academic Practice (PDAP) scheme undertaken by all probationary academic staff; in this REF period, five new members of academic staff in the unit have completed this qualification.

In terms of wider development of the impact agenda, an Impact Toolkit, developed in-house by the University, supports academic staff, post-doctoral staff and research students in developing pathways to impact and in plans for exploiting research. With respect to recognition and reward, each member of staff with Research Council UK grant income, where securing such grants requires pathways to impact to be clearly articulated, is rewarded with a yearly research initiative fund as a small percentage of the total income as part of the Incentive Payments Scheme; in the current REF period, nineteen members of staff have benefitted from this scheme. The academic promotion process, at all levels from Lecturer to Professor, also incorporates impact as an integral feature on which colleagues are reviewed and against which their achievements are recognised.

The impact of the unit's research is also facilitated as a result of the increased visibility afforded through the Brunel University Research Archive (BURA) initiative and the institution's open access publishing fund. The University introduced BURA in 2007 as an on-line archive of all research outputs and an Open Access Publishing Fund in 2011 as part of an Open Access Mandate (2010); in the REF period, 1383 staff publications have been entered onto the archive. These initiatives support free, global access to the unit's research and help serendipitous creation of impact. Finally, the Research Support and Development Office (RSDO) at Brunel facilitates impact of the unit's research through expert advice on liaising with funding and charitable bodies and industry.

c. Strategy and plans

The unit is well-placed to further strengthen its research impact and existing processes, building on a research culture that has always been industry-led. The strategy of embedding impact in the research 'lifecycle' has been underway since the previous RAE and has been promoted throughout the current REF assessment period, facilitated by the existing initiatives, processes, staff development mechanisms and specific targets described in section (b). The strategy of the unit in relation to impact over the next six years is to make impact as natural and embedded an activity for colleagues as publishing. The plan to achieve this has two core strands; first, expansion of our existing, successful impact-based initiatives and, second, introduction of new impact-enabling schemes.

The unit's 'Impact Team' was established in 2012 and 'impact champions' in different sub-disciplines were appointed to spear-head on-going impact initiatives. The Impact Team will continue to meet to monitor impact at regular intervals. To further embed a culture of impact in the unit, all new academic staff will receive research impact training and impact will continue to be part of the existing academic promotion process. It is planned to place further emphasis on engaging end users in a) targeting their needs more closely at each stage of research and b) as key participants in 'co-designed' research, where users generate knowledge and evidence of impact. Importance will be attached to a greater understanding of the constraints and timescales under which industry operates; successful collaboration and impact can only be facilitated if both research partners have congruent priorities and goals. The IAB will continue to support collaboration with industry and inform the unit's research, teaching and knowledge transfer strategies to provide input on the industrial, commercial and societal relevance and potential impact of all strands of our activity.

We will also seek funding from diverse sources to generate impact in new spheres; we conceive a key role for the IAB here. This will include continued engagement with external stakeholders (e.g., non-academic advisory boards such as the British Computer Society and its special interest groups) and continued partnerships with international user bodies for large European funding applications (e.g., the Fraunhofer Institute, Germany). We also plan to expand existing collaborations with government-supported organisations in other parts of Europe (e.g., Simula). We will involve industry-based, not-for-profit user groups as part of the impact strategy and as a means of reaching an ever-wider practitioner and user base (e.g., the Agile Alliance). The number of guest industry speakers and expert seminars in a regular research seminar series and as guest student lectures will be extended and widened; increased focus will be targeted at student placement as a mechanism for nurturing research and user relationships and as a basis for funding applications. (The unit is currently planning a 100% cohort placement strategy amongst its level two undergraduates).

We will target links with industry as a mechanism for involving the student body in applied research methods through direct involvement in research projects. Expert advisory support for spin-off companies and commercial training for academic staff as means of generating impact will be extended. We plan to generate interest in our research through a media-based promotion process and emphasis on our past and present research successes (e.g., through public engagement initiatives, for which institutional funding has been offered in the past). By offering training courses on entrepreneurship and business skills as part of our strategy, we will complement the academic skills of staff; we will use external PR consultancy to support staff media engagement. This will be a mechanism for advertising impact generated by collaborative case-studies. Finally, we will publish in non-academic, practitioner-based sources and use the Internet to promote the visibility and research. This will take the form of blogs, existing resources (e.g., BURA), on-line resources and freely-downloadable research outputs.

d. Relationship to case studies

The case studies provide a benchmark against which the unit's strategy towards impact can be compared and future strategy mapped out. Impact in two of the case-studies was informed directly by RCUK-funded schemes (research at BancTec and application of 'ontologies' at a range of commercial organisations). A further two of the case studies have explicit and/or implicit commercial, economic and society-based impact (i.e., work on simulation and business process at Sellafield and Ford and improvements in medical diagnosis; these emphasise the need to exploit research for maximum impact). The case-studies have also helped to shape the unit's future research strategy. The drive towards increased numbers of visiting academics and guest lectures by industrial collaborators reflects the approach of proactively including the 'technology users' in the research culture; this will continue to feed into the Teaching and Learning strategy in the unit. Increased emphasis on exploiting research commercially through staff training and making impact a feature of new staff programmes is a direct result of lessons learned through the case-studies. Finally, publication in high-impact Journals and Conferences as a result of the case-study research has helped to co-evolve the Open Access Mandate and initiatives such as BURA.