Institution: Robert Gordon University
Unit of Assessment: 11 Computing Science and Informatics

a. Context

Our research has impact on beneficiaries and user groups including: medicine; oil and gas; journalism, social media; and industrial R&D in telecommunications, geoscience and aerospace. The impact depends on user group need and how particular research expertise adds value.

Our research vision is computing science research applied to industry and so largely the type of impact we have is economic. Decision support tools with underlying smart components improve the performance of businesses through improved decision-making. The Computational Intelligence (CI) group has developed software to support the real time control of truck movements for a large haulage company. The Smart Information Systems (SIS) group has embedded case-based reasoning in an NHS electronic patient records system for clinical diagnostics. These systems are in active use. Other applications improve business performance by boosting productivity. SIS uses data mining techniques to analyse twitter feeds, to support journalists in identifying breaking news stories. Socio-Technical Systems (STS) brings expertise in agile methods into technology SMEs.

Our success in KTP has an economic impact by transferring high-skilled employees into new roles created within partner companies. These employees regularly take on permanent positions beyond the end of the project, transferring knowledge into the companies and cementing an ongoing relationship with the unit. SIS has generated a spin-out company, AmbieSense (see Case Study 3) and a further spin-out (from CI) is currently seeking first-round investment.

Our research has health impact by providing improved diagnostics through computer science applications. For example, the Wireless and Video Communications (WVC) group has developed a novel video codec that enhances perceptual quality through low-bandwidth video communications, improving diagnostics through telemedicine. Other health diagnostic impacts include CBR on electronic patient records (SIS) and prostate cancer staging (CI).

b. Approach to impact

A holistic approach drives our interaction with non-academic users of our research across the entire lifecycle, through initial dialogue, project development, full interaction, and post-interaction follow-through. Public events, workshops, our website and press releases disseminate information about our research and generate initial dialogue with potential research users. Repeat interaction, word-of-mouth and personal and social contact is also a significant generator of initial dialogue. Full advantage is taken of business development programmes, INTERFACE, SEEKIT and KTN.

When initial dialogue leads to project development, different modes of interaction are possible. A key factor in successful interaction is to understand how research expertise can translate into value-added to an organisation or company. Often therefore, short proof-of-concept studies are used. These take a number of forms including: research-driven student projects, short consultancies by academic staff and research fellows; and short research student internships. A proportion of proof-of-concept work leads to more substantive interactions, for example Knowledge Transfer Partnerships (KTP), bespoke projects funded directly by industry and partnership on EU projects. Impact is followed through in a number of ways: identification and joint development of foreground IP (KTP projects explicitly require the production of post-project reports that explicitly identify impact on the company); follow-on projects; and dissemination through press-releases, commercial workshops, demos and case studies. Our aim in any interaction is to build a long-term relationship with beneficiaries of our research.

Evidence of the nature of those interactions

A strong exemplar of our approach in generating initial dialogue was the (£640k, ERDF and SEEKIT-funded) dePICT project, led by RGU in partnership with Dundee and Aberdeen universities. dePICT funded short proof-of-concept studies (typically up to 10 days academic staff time) with SMEs seeking to develop software products. The grant also supported industry-facing

workshops and publicity materials and a full-time Business Development Manager (BDM) to generate initial dialogue with companies requiring research input and a Project Manager to assist academic staff in managing the relationship with companies. The project was led by a 60% FTE Director, **Holt**.

As an example of a typical dePICT feasibility study, **Holt** investigated the feasibility of designing and implementing a novel blended learning system using web technology for Polaris Ltd. The study demonstrated that a new approach might be possible and this resulted in a KTP project. Similarly, **Wiratunga** worked with Open Brolly Ltd. to explore use of CBR to intelligently search the company's MovieSite database. This resulted in a detailed technical report on feasibility.

Overall, dePICT feasibility studies were conducted with 30 SMEs during 2010-12 involving several staff from the unit: **Bass**, **Elyan**, **Holt**, **Massie**, **McCall**, **Petrovski**, **Wiratunga**. Five of these led to KTP projects with RGU. A follow-on study by Systems Insight Ltd., commissioned by dePICT, interviewed 11 participating companies and found almost universal satisfaction with the quality of interaction and the outcomes. Typically, the studies accelerated R&D within the companies. The unit has incorporated best practice from dePICT into our interaction model going forward.

Our strategy of generating interactions with industry has led to a significant increase in KTP projects during the period. One such is a project with James Jones Ltd. A short dePICT project led by **Elyan** identified the need for advanced 3D CAD software for the company which is involved in the timber construction industry. This effort led to a KTP project, led by **Elyan**, to develop the software. As a by-product, the KTP project identified a need to optimise floor-decking layouts automatically from CAD diagrams. An Honours project, supervised by **McCall**, was used to develop this idea into software, which has now been purchased by James Jones Ltd.

Another mode of interaction is through research student internships with industrial labs, including British Telecom, Total E&P and British Geological Survey (BGS). An internship at BGS supervised by **Wiratunga** developed a system for generating and delivering geo-referenced maps on the web. An internship at Total E&P supervised by **McCall** identified efficiency gains in vessel scheduling for the offshore oil and gas market and is being developed as a spin-out software company.

Evidence of follow-through to identify the impact

Our aim in all interactions is to build long-term relationships with research users. Impactful projects generate repeat interactions and we consciously promote this life-cycle in our approach. Different expertise becomes relevant as the interaction cycle repeats and so we adopt a team approach to opportunities for interaction. For example, in clinical decision-support, long-standing work with NHS Grampian by **McCall** on chemotherapy optimisation led to involvement by **McCall** and **Wiratunga** in a Telemedicine Booth presentation by NHSG at the Edinburgh Highland Show, where a case-based approach to clinical diagnostics was demonstrated. This led to a KTP, led by **Wiratunga** with AxSys Ltd. to develop a clinical diagnostic module for Excelicare™, the leading electronic patient record system in the UK NHS.

Evidence of an agile approach to opportunities

During the period, we set up a Business Development Committee (BDC) (**Allison**, **Bass**, **McCall** and dePICT BDM) to oversee our external interactions co-ordinating where multiple staff made independent contact and including staff with relevant expertise in new interactions. BDC built a strategic overview of the nature and reach of our interactions, building understanding of where impact can best be made. A powerful example of the success of this approach followed the NSRI ICAN study [See REF5], where **Craw**, **Holt**, **McCall**, **Petrovski** and **Wiratunga** interacted with a range of oil and gas majors and contractors to scope a blueprint for future research in intelligent condition monitoring and control of offshore installations. The understanding of the needs of research users gained from this exercise fed into **Allison's** coordination of oil and gas research users as part of the Scotland IS bid-writing team for the Data Lab Innovation Centre. The identification of this important group of research users was fundamental in establishing RGU as one of three hubs for this centre.

Support for staff to achieve impact: assessment, recognition and reward

The BDC routes external enquiries to appropriate academic staff. Interaction with external organisations with non-academic priorities and timescales raises difficulties in relationship

management. We encourage multiple staff involvement in interactions, spreading the load and easing response times. Support for staff to achieve impact included: series of 6 workshops on industrial engagement, led by **Holt** and **McCall**; annual funding for summer student internships to develop software demonstrators aimed; research retreats with sessions on industrial engagement.

All staff review their research annually with a senior mentor and identify objectives for the coming year, in line with unit objectives. Consideration of impact is now part of this process. Significant funded interaction is recognised in Research Institute membership level for staff, which directly relates to workload planning (see REF5). Several staff have increased activity recognised during the period. Reward contracts allow staff to share the benefits of net income received by the university as a result of commercial licensing of intellectual property.

Use of institutional facilities

The unit has benefited from purpose-built facilities since 2003 when the SmartWeb Computing Technologies Centre was opened. SmartWeb provided dedicated space for research staff, visitors, workshops, meetings and industry events. This facility moved to a new Research Hub at the RGU Riverside East building in July 2013, providing enhanced facilities and co-location with other research disciplines. The university Research and Enterprise Services unit (RES) provides support for academic staff in protecting intellectual property and negotiating bespoke contracts with industry. For example, each KTP requires an IP agreement which is negotiated by RES. RES also negotiate contracts with direct industrial funders, e.g. BT, Selex. RES works formally with investors Frontier IP to find first stage funding for spin-out companies seeking investment.

c. Strategy and plans

Our continuing vision is to achieve economic and social impact through interaction with industry, building on a track record of efficient and effective applied research that adds value. Our strategy is to foster a research team of diverse and complementary skills with a strong ethos of industrial application. In the next period, a major focus of this strategy will be to become global leaders in data analytics for oil and gas. This will build on existing strong relationships with the industry (O&G and ScotlandIS). RGU has supported this as a key strategic priority. Recent appointments, **Goker**, **Gaber** and **Tu**, bring complementary skills to the unit in support of this strategy. Further appointments are planned in the next year, with strategic support from the university as activity builds. Relationship building is well underway with key industrial partners in big data infrastructure, oil and gas majors and contractors. RGU will be the Aberdeen hub for the Data Lab Innovation Centre, which will play a strong role in our development of activity.

Our experience with dePICT continues to inform our approach to generating interactions. The BDM from dePICT is now permanently employed in RES and we continue to operate the dePICT engagement model, though feasibility study funding now comes directly from industry.

d. Relationship to case studies

Case study 1 (Craw, Wiratunga): exemplifies our approach to decision support by embedding intelligent components in the decision-making process. The case study shows that decision-support rather than decision-making is how AI components are most likely used in practice – the CBR component is only used for particularly difficult cases. This experience has modified our understanding of the value we can add.

Case Study 2 (McCall, Petrovski): exemplifies decision support as a way of adding value and also the increasingly data-driven nature of decision-making. This has influenced our understanding of how we can support big data analytics. The case study also shows how interactions are iterative – our relationship with British Telecom has built over a series of projects building awareness of company needs and how they can be addressed by our research.

Case Study 3 (Goker): exemplifies how research can be successfully spun-out from an EU project, with a sequence of follow-on R&D / investment funding leading to a sustainable company. The project has given us experience of how academic staff can move between industry and academia, informing our future approach to spin-outs and staff support and development.