Institution: University of Strathclyde



Unit of Assessment: 9

a. Context

The successful transfer of research knowledge from academia to industry and other societal beneficiaries is a fundamental objective of the University of Strathclyde's strategic plan and is reflected in its founding ethos as 'a place of useful learning'. In 2012, the University was awarded the Times Higher Education UK University of the Year award and in their citation the judges praised it for its close links with business and industry and its commitment to making an impact on the global economy. The Department's approach to generating impact from its research reflects the University's strategy and its success has been a major factor in attracting the UK's first Fraunhofer Centre to the University and in the development of the £89M Strathclyde Technology Innovation Centre (TIC).

The main types of impact arising from the Department's research are:

- Economic impact and job creation: Evidenced by a growth in turnover and personnel employed by spin-off companies since 2008, now totalling ~£116M and ~200, respectively.
- Societal impact: New tools resulting from our research have been used to screen ~12 million passengers at Glasgow Airport and are installed in BP's global commercial marine fleet.
- **Public interest and engagement in science:** Examples include science outreach activities and engagement with the Glasgow Science Centre and Glasgow City of Science.

The main non-academic beneficiaries of our research are, therefore:

- **Industry (national and international):** Products arising from our research are manufactured and sold by local (e.g. Cascade Technologies) and global (e.g. Coherent) companies.
- **General Public:** Indirectly through the widespread adoption of security and environmental monitoring instrumentation and directly through promoting the understanding of science.

b. Approach to impact

The Department's various approaches to its interaction with non-academic users and beneficiaries and to achieving impacts from its research, during the assessment period, are described below.

Building relationships with industry and end-users:

Engaging with beneficiaries of our research is a core pillar of research practice across the University and this is reflected in the Department's approach to creating impact. Our approach includes developing high-value strategic alliances with leading industrial companies, including where possible, growing our relationships with industry through the provision of industry-relevant Continuing Professional Development (CPD) training courses (e.g. in high power radio-frequency methods) and consultancy. We have appointed a CPD Champion to lead on this strategic initiative.

During the REF period the Department has averaged ~£810k per year in income from consultancy, CPD course provision, industry commissioned research and licensing. Our approach of fostering and building relationships with industry has directly led to new opportunities for commercialising IPR. For example, new types of microwave and millimetre wave sources, based on IPR generated by Strathclyde Physics, are being manufactured and sold by companies such as e2V and TMD Technologies Ltd. The sale of the first prototype source in 2012 generated ~£0.8M income to TMD Technologies and the potential market going forward is substantial (~£200M across the Defence (radar) and Healthcare (imaging) sectors, based on the numbers and costs of existing systems using lower power technology). In return, since 2008, these industries have invested more than £1M in developing the underpinning research in the Department, which ensures a continuing route for generating impact from this research activity.

We have adopted a staged approach to SME engagement, which starts with pump-priming funding, growth of the relationship to include, for example, placement of project students and internships, and escalation into longer term partnerships, for example via KT Partnerships. The success of this approach is evidenced by the achievements of the Atoms, Beams and Plasmas



(ABP) group in growing their industry-income via staged-engagement from £160k/year to £740k/year since 2008.

The Department also encourages and supports staff in building collaborations directly with end users of its research, where applicable. For example, researchers working on nano-medicine diagnostic technology have established and developed collaborations with clinicians at Kings College London School of Medicine and Guy's Hospital. The resulting KE on the development and testing of the new devices in clinical environments directly informs research in the Department.

Making use of institutional facilities, expertise and resources:

The Department's approach to creating research impact includes use of relevant University facilities, expertise and resources, and involves engaging in emerging opportunities driven by the University. A key institutional impact-generating initiative, of which the Department is playing a central role, is the Strathclyde TIC project. This major project, involving a substantial investment (£89M) by the University, aims to take our partnerships with industry to a new level and is already driving a step change in KE activities across the University. The Physics Department is playing a key role in this, with three of our academics (Professors Jaroszynski, Martin and Birch) leaders or deputy leaders of TIC research themes. We have hosted a number of TIC workshops bringing together our academics and non-academic research beneficiaries and plan to continue this route to developing engagement with end users of our research.

Another example in which the Department makes use of institutional expertise and resources is staff training and development in Impact and KE-related skills facilitated by the Strathclyde Programme in Research and Leadership (SPIRAL) scheme.

Supporting and enabling staff to achieve impact:

Central to the Department's approach to achieving research impact is the provision of support to help our staff identify and pursue opportunities for KE and KT. The Department has appointed a KE Champion to communicate opportunities for participation in relevant schemes and end-user engagement activities to staff. It also hosts the Scottish Universities Physics Alliance (SUPA) KT directorate (3 FTE staff), whose mission is to increase commercial engagement between SUPA and industry. This helps to identify KT and impact-generating activities that are appropriate for our various research programmes, to share best practice in pursuing such activities and to raise staff awareness of the various KE/KT support schemes available. The provision of subject-specific KT support to our staff helps in the identification of potential industrial end users. It encourages impact-related activities and enables potential commercialisation opportunities to be identified by professional KT staff.

Our approach to encouraging and supporting staff to achieve research impact includes setting and reviewing individual targets for growth in KE activity. This process is managed through staff annual performance reviews conducted as part of the University's Accountability and Development Review (ADR) process. Due recognition and reward (via promotions or pay awards) is made for growth in KE activity leading to impact.

Participation in knowledge exchange and partnership-building schemes:

Our staff are actively encouraged and supported to maximise the non-academic impact of their research via participation in industrial and end-user knowledge exchange (KE) and partnership-building initiatives. Examples include:

- The EPSRC-funded Impact Acceleration Account and Knowledge Transfer (KT) Account have been used to enhance our links with industry and the industrial impact of our research, with ~£250k awarded since 2008 to a wide range of projects across our three research divisions;
- £1.2M funding in 2013 from the Technology Strategy Board and industrial partners (Shell, Gravitec, Guardian Global, and Fugro) for the first phase of the £2M Amadeus project a joint Strathclyde-industry venture on monitoring carbon capture and storage;
- The SFC Horizon-funded INSPIRE programme has, in 2011, funded an initiative at the Physics-Life Sciences interface of our research to develop instrumentation for applications in medicine;
- The STFC Innovations Partnership Schemes (previously PIPPS) is being used to develop commercial exploitation from our STFC-funded research programmes. For example, £400k was awarded in 2009 for '*Transfer of enabling high power Ka-band design capability to Industry*'.



c. Strategy and plans

The Department has a bold vision for excellence in its research impact and knowledge exchange and has an innovative strategy to achieve, enable and support this, which includes:

- Fostering new KE opportunities, building on our areas of research excellence and seeking new opportunities for impact in areas of national importance, such as energy and next-generation healthcare technologies. Strathclyde TIC is revolutionising the way researchers in the University and industry collaborate and innovate together, and is central to this part of the Department's future impact strategy. Not only are we fully incorporating the TIC philosophy across our research divisions, but significant numbers of our researchers (e.g. from the ABP and Semiconductor groups) will relocate to the new TIC building in 2015 to directly facilitate new KE opportunities.
- The development of new avenues for economic impact from our research through direct engagement with the Fraunhofer Centre recently established at the University the first of its kind in the UK.
- Targeted investment in KE-relevant research areas. Examples include: investment in the £12M flagship Scottish Centre for Applications of Plasma Accelerators (SCAPA), which will be established as a platform for developing applications of a transformative new laser-driven accelerator technology; new laboratories for the £2M Amadeus TSB-industry-funded R&D project; and, expansion of the ABP group's industry-facing research within new laboratories in the TIC building. These research areas have been targeted for specific growth due to their future impact potential.
- Investment in our staff resource targeted at developing new KE opportunities, including the
 appointment of new academic staff in targeted research areas with high potential impact.
 Recent examples include the appointment of a Reader in the ABP group and two Chairs
 associated with the SCAPA project. Generally in the recruitment of new academic and research
 staff, appropriate recognition is given for experience in industry and for applied research with
 the potential to lead to significant impact. Our strategy includes, investment in our existing staff
 through training them to spot and pursue new impact opportunities (facilitated via the SPIRAL
 initiative and SUPA-KT support), and in funding staff exchanges with industry.
- Continuing to develop and strengthen our collaborations both within the SUPA research pool and across pools (e.g. with West-Chem, SINAPSE) to grow activities focused on interdisciplinary application-based aspects of our research.

d. Relationship to case studies

The case studies chosen have arisen because dedicated KE support has been embedding within our research strategy over a significant number of years. We are actively building on the successes of these cases, to maximise our on-going impact and to inform the Department's strategy for creating impact in the future.

The *Microwave and Millimetre Wave Sources* case study is an excellent example of how engagement and impact can escalate from small beginnings, through KT-funding projects, to substantial industry-funded programmes of R&D (>£1M contracts), and of very successful transfer of expert knowledge from academia to industry. This has informed our approach to nurturing relationships with industry and other end-users of our research.

The *Cascade Technologies* and *Microlase-Coherent* case studies demonstrate the potential for successful spin-off companies to emerge from the research activities of the Department. This has informed our strategy of actively identifying new opportunities for commercialisation of our research using SUPA KT resources and through the appointment of a Department KE Champion.

The *Fluorescence Spectrometers* case study has illustrated how close collaboration between academia and industry, nurtured and sustained over a significant period of time, can lead to repeat innovations in product functionality and resulting successes in the market place. This has informed the Department's approach to identifying research commercialisation opportunities.

