

**Impact template (REF3a)**

**Institution:** University of Hull

**Unit of Assessment:** B8: Chemistry

**a. Context**

The research associated with the UoA has led mainly to impact associated with economic activity in particular spin-out and new or improved products/technology. Examples of how such impact has occurred across the three research themes within the UoA are shown in Figure 1, which covers the period 1999-2013. The Figure shows how research supported by RCUK, EU and industrial grants (below the time line), is directly linked to translational funding and commercial investment (above the time line).

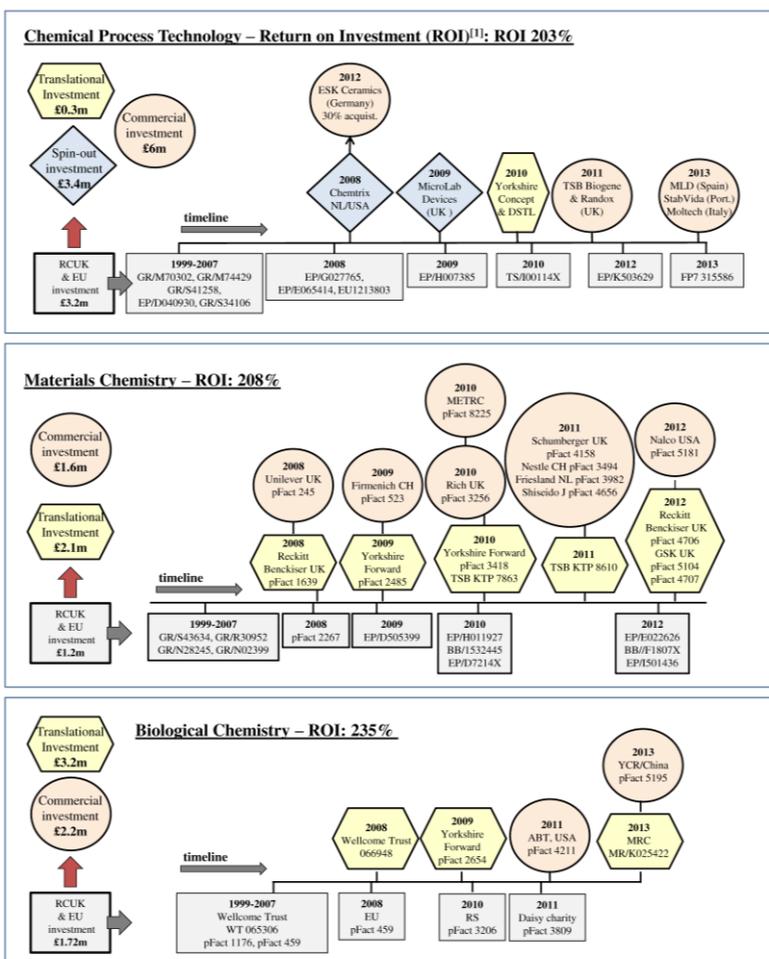


Figure 1: Examples of route to impact.

[1] <http://www.investopedia.com/terms/r/returnoninvestment.asp>

Grant investment in research has been identified by either RCUK grant numbers or in the case of industrial/charity funding University pFact codes both of which are auditable income. The impact examples account for around 80% of the UoA staff working in key areas of research such as lab-on-a-chip (Chemical Process Technology), surfactants and liquid crystals (Materials Chemistry) and photodynamic therapy and positron emission tomography (Biological Chemistry). From the data, the calculated Return on Investment (ROI) currently stands at just over 200% for each research theme but this will obviously increase with time as investment grows in all areas. In addition the ROI does not account for direct industrial investment that supports research activities which can be very significant but difficult to quantify.

A specific example drawn from the Chemical Process Technology theme is research funded through EP/D040930 attracted follow-on enterprise funding EP/H007385 and then subsequent investment funding from Yorkshire Forward and dstl which led to industrial interests in partnering the TSB projects TS/100114X/1 and EP/K503629/1 that included over £4 million industrial investment in developing new products due to be launched in 2014 by the industrial collaborator Radox (also see case study #1 Chemtrix). One of the notable strengths of the UoA is the cross talk that exists between the research themes, for example, a joint venture involving industry (ABT Louisville, TN, USA pFact 4211), a medical charity (Daisy Appeal East Yorkshire pFact 3809) and the University of Hull draws together the basic science of the Chemical Process Technology and Biological Chemistry themes with ABT cyclotron engineering technology to develop novel on-demand and patient-specific, PET imaging agents, custom synthesised and analysed prior to

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administration to patients using a lab-on-a-chip device. Such research will clearly have economic and health related impact and is a good example of scientific innovation, which in this case has clear health benefits for patients and providers at regional, national and international level and supports associated employment opportunities.

**b. Approach to impact**

The UoA's approach to impact is summarised in Figure 2, which shows transformative research informed by a wide range of public and private organisations that delivers scientific innovation and economic impact as outlined in Figure 1. Much of the scientific innovation relates to areas such as healthcare, environment and public services and leads to regional, national and international

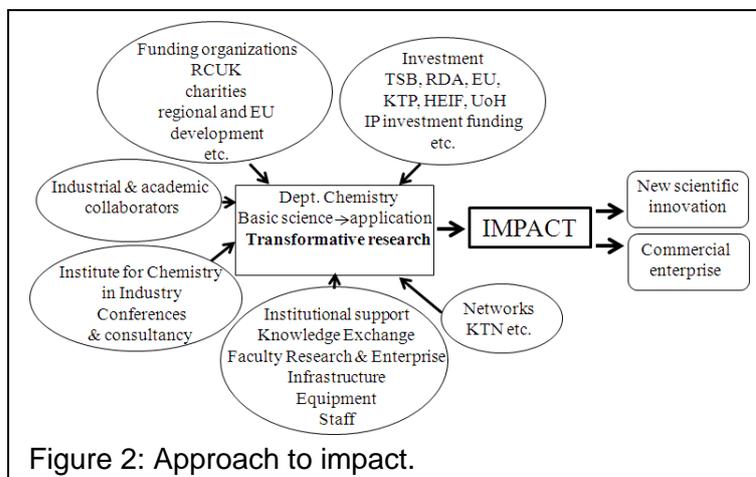


Figure 2: Approach to impact.

collaborations. For example the UoA has been instrumental in establishing a regional Centre for Integrated Care Technologies (HEIF investment) which now works closely with the Kings Fund to establish informed policy on future health management in the community. The UoA has also developed a number of formal strategies to ensure the effective delivery of impact. The Institute for Chemistry in Industry for example hosts networking activities that have been successful in establishing a number of TSB-KTP funded projects (e.g. KTP 8610 – AAK and KTP 7863 – Microgard see Figure 1 Materials Chemistry) which have led or are leading to new products. The Microgard project developed a new protective coating for fabric and was rated an outstanding project by the TSB, the AAK project is ongoing and is developing new food formulations. The Departmental Research Forum (see also Environment Template) enables staff to share experience and good practices related to impact across the UoA such as the KTP projects indicated above together with public engagement, health and environmental impact outlined below. Forum activities range from staff sharing experience gained from involvement on industrial (e.g. Fletcher, Mackenzie), professional (e.g. Archibald, Haswell), RCUK funding (e.g. Greenway, Francesconi) and TSB advisory boards (e.g. Wadhawan, Haswell), through public and industrial engagement (Café Scientifique - Lorch, science fairs – Kelly, and showcases – Pamme, Wadhawan) to formal interaction with Faculty and Institutional initiatives.

The UoA has also implemented a number of specific management policies and processes which are in addition to the normal activities such as staff work-load adjustments (see Environment template), in-house review of proposals to ensure relevant external collaboration/investment, public engagement and IP protection and exploitation with relevant end users. One such measure is research impact mapping, introduced by the Faculty with the assistance of the University's Knowledge Exchange in 2012, which seeks to maximise both the direct and potential impact which may go beyond that generally identified in a proposal, this could for example include the development of materials or processes that are intrinsic to delivering a project but which also have direct benefits to third parties. One example is the preparation of glass substrates by the Chemical Process Technology theme for lab-on-a-chip devices using CNC equipment that has enabled the supplier (Datron), who traditionally worked in metal and plastic materials, to expand their business into new manufacturing markets.

**c. Strategy and plans**

The strategic aim of the UoA is to ensure impact is embedded into all research project proposals and that there is an effective route for realising the breadth of impact associated with the research carried out. In meeting these strategic aims the Department of Chemistry has well established in-house peer-review processes to ensure impact is addressed fully at the application stage. More importantly the introduction of research impact mapping and the Departmental research forum have been instrumental in identifying impact in its widest context. To ensure the UoA is effectively achieving impact a number of key performance indicators have been or will be used. These will include for example, in the area of economic impact, the ROI data shown in Figure 1 to benchmark current and future research internally and where possible nationally and internationally. In the areas of societal, health and environmental impact, the mapping approach will be extended to capture potential collaborative and partnership opportunities. One such example is the recently formed PET/CT imaging research group set up by Archibald which has members drawn from a number of University Departments, the NHS and instrument manufactures. The current plan is to widen this group's activity to other university groups in the UK and internationally and to engage patients, charities and the public in evaluating research developments and the implementation of new technology. In short the UoA aims to make more of what it does in terms of impact by looking at both intrinsic and extrinsic research-led opportunities. This will include both scientific innovation with benefits in areas such as public engagement, healthcare and the environment and enterprise where follow-on funding for spin-out activities, licensing or partnership investment will be important. To meet this strategic aim the UoA will be targeting research funding sources that seek a high impact from research (e.g. TSB and EU) and often include structured follow-on staged funding and industrial/collaborative partnerships. In addition to assist in maximising impact the UoA will build on the impact mapping approach which has been developed and attracts support from the Knowledge Exchange to ensure new enterprise (e.g. public engagement, supply chain and strategic partnerships with vendors and end users) provision is most effectively implemented.

**d. Relationship to case studies**

The case studies represent two of the three research themes included in Figure 1 and relate in different ways to economic impact. It should be noted that the underpinning research for all three case studies has a strong legacy in the Department of Chemistry and in all cases precedes the current period of assessment. It is also important to stress that the strong culture of multidisciplinary applied research that has been embedded in the Department of Chemistry at Hull for the past 40 years has been influential in facilitating research impact in areas such as materials, formulation and microfluidics, which is not always the case for research carried out under this UoA. It is therefore the combination of a well-founded science research base with applied industrial interaction and a good understanding for impact that is reflected in the three case studies that epitomises the impact culture of the UoA (see Figure 2). The nature of the impact described ranges from direct commercial spin-out of research (case study #1 Chemtrix also Chemical Process Technology Figure 1) to translational research which was instrumental in developing a new product (case study #2 Nalco also Materials Chemistry Figure 1) to one that represents a combination of both types of impact (case study #3 liquid crystals).