Research Impact

In the Year of Innovation, Architecture and Design
Foreword

In support of the Scottish Government’s Year of Innovation, Architecture and Design, Universities Scotland is pleased to highlight the contribution of our universities to these three areas.

In order to appreciate the breadth of this contribution, we have presented the impact (benefits to people) of research undertaken in Scottish universities; identifying who benefits from research, the pathways between research and impact, and how impact is achieved. We have focussed on architecture and design, just a fraction of the total research conducted in our universities, to illustrate the diverse benefits arising from research.

We have also explored universities’ role in delivering economic impact as a critical pillar of the innovation ecosystem, through our graduates and our research.

All Scottish universities can be proud of the impact we have delivered, and are fully committed to continuing to deliver, to benefit people in Scotland and around the world.

Professor Andrea Nolan OBE
Convener, Universities Scotland Research & Knowledge Exchange Committee
Principal, Edinburgh Napier University

Understanding Impact

*Impact: any effect on, change or benefit to the economy, society, culture, public policy or services, health, the environment or quality of life, beyond academia.*

The Research Excellence Framework (REF) is the way that the quality of research in UK universities is assessed, and a core component is impact case studies. All Scottish universities submitted impact case studies to the REF describing and evidencing impact occurring between January 2008 and July 2013, with the underpinning research conducted since 1993. In this publication, where we refer to ‘impact case studies’ we mean the 795 unique case studies used in our analysis. These are a fantastic resource, providing a snapshot of how research underpins and delivers impact. [1]

Structure of the REF

Case studies are organised into Main Panels (usually referred to as *Panel*). The four panels are: Life Sciences (Panel A), Engineering & Physical Sciences (Panel B), Social Sciences (Panel C) and Arts & Humanities (Panel D). Panels are further divided into 36 *Units of Assessment* which are more manageable topics. [2]

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**Beneficiaries of Research**

Research within Scottish HEIs has had an impact on a wide range of stakeholder groups, often via unexpected channels.

From 795 impact case studies we have identified 2,193 beneficiaries across 45 different stakeholder groups. Every case study describes benefits to at least one stakeholder group, and most describe benefits to many groups.

A large majority of stakeholders are benefitting from research conducted in all four main areas (Life Sciences, Engineering & Physical Sciences, Social Sciences and Arts & Humanities). The beneficiaries of all four areas include large groups like ‘companies’ and ‘governments’ as well as more specialist groups like ‘museums’ and ‘engineers’.

In many cases, the links between research and beneficiaries do not seem obvious. For example, there are links between Arts & Humanities and ‘NHS’, Engineering & Physical Sciences and ‘families’, and Social Sciences and ‘manufacturers’.

This shows that the benefits of research are far-reaching, extending beyond traditional links and crossing discipline boundaries.

*From our further analysis it is clear that the high proportion of media beneficiaries reflects the public engagement activities undertaken by researchers to increase understanding and stimulate debate.*
The diagram shows that there are 117 fields of research underpinning the Scottish REF impact case studies across the 36 Units of Assessment organised into four panels, relating to 58 impact topics.

‘Field of research’ is a way of classifying the methodology used in the research, rather
Impact Pathways

Research underpinning impact is diverse and interdisciplinary, and it often gives rise to more than one type of impact.

There are 1,307 unique pathways to impact across a snapshot of university research; there is no predictable route from a type of research to a given impact.

The diagram shows that research in Scottish HEIs is interdisciplinary because different fields of research feed into each UoA. Interdisciplinary research is important because it has ‘great potential to contribute to research breakthroughs, address societal problems and foster innovation’. [3]

The case studies do not just have one type of impact: 1,639 impacts were identified across 795 case studies. There are 1,307 distinct routes to impact which demonstrates the critical importance of a diverse research base. There is no such thing as a standard route to a certain type of impact.

than relying the description of the research subject (Unit of Assessment, UoA). Impact topics were identified by text mining and describe the substance of the impact. Each case study was assigned one field of research and up to three impact topics.
Impact Mechanisms

Understanding how research leads to impact

Research has delivered far-reaching and significant impact. On this basis, 86% of Scottish research impacts were judged to be ‘outstanding’ or ‘very considerable’ in the REF. Below we consider some of the ways in which research reaches beneficiaries in these 795 case studies.

Research has influenced national and international policy (including health, justice, environment and education) in over 300 cases. There are 89 examples of research contributing to a change in, or new, policy for Scottish Government.

At least 2.6 million people have attended cultural events arising from research.

There are 102 examples of a new or improved product or process creating economic impact, and examples of 55 spin-out companies creating 869 jobs.

There are 41 cases which have informed the development of clinical guidelines. These are best practice guidance for healthcare professionals that reach huge numbers of patients both internationally and in the NHS.

Research has informed the education of young people in Scotland with 12 examples of direct influence on the Scottish national curriculum and at least 3,000 teachers receiving training.

Impact of Research in Architecture & Design

These examples are based on impact case studies and show the benefits and beneficiaries of architecture and design research.

Design research at the University of Dundee led to the V&A Dundee, a £45m centre for design at the heart of Dundee’s £1bn waterfront regeneration, opening in 2016/17. The ‘Making it Happen’ exhibition had 16,000 visitors in Dundee and 60,000 visitors in London. In its first nine months, the related Design-in-Action hub connected with 450 businesses and funded six new products.

Impact topics most frequently related to Unit of Assessment 34:

Art & Design: History, Practice and Theory
Materials developed at Glasgow Caledonian University have been delivered to over 100,000 industry practitioners, leading to a 30% drop in accident rates in a participating company, and changed UK regulations.

Impact topics most frequently related to Unit of Assessment 16:

Architecture, Built Environment & Planning

Research at Edinburgh Napier University has developed the ‘Robust Details’ approach to sound insulation, leading to a new regulatory approach and 16 patents. Since 2008 over 300,000 robust detail homes have been built. Noise complaints have fallen four-fold, and site compliance has gone from 35% to 99%.

Research at Glasgow School of Art led to a fuel poverty-fighting Combined Heat and Power system in Wyndford. Over 1,500 tenants and 200 owners are benefiting from cheaper fuel bills, plus improved comfort and health.

Over 250 UK companies (mostly SMEs) have achieved 75-90% reductions in energy use, thanks to research at the University of Strathclyde.

The University of Glasgow restored six Stirling Castle Palace apartments and replicated the ‘Stirling Heads’. The restored Palace was voted the UK’s top heritage attraction (Which? 2012), visitor numbers increased by 17% and annual revenue increased by £1m.

Research submitted by the University of Edinburgh and Heriot-Watt University described the creation of the world’s first Mobile Visual System, linking digital data to physical environments. The technology has changed the way National Museums Scotland displays collections, increased participating Oxfam store sales by 53%, and is now used by companies including Nike, Vodafone, Disney, Nokia, Tesco and P&G. MVS has also led to a patent and a spin-off company.
Universities’ Contribution to Innovation

Scotland’s universities are committed to delivering economic impact as full partners in the Scottish innovation ecosystem. We do this, in part, as contributors to the Scottish Government’s CAN DO strategy. This strategy seeks to achieve sustainable economic growth by accelerating entrepreneurship and innovation across Scotland. We achieve impact through the mutually reinforcing links between our three key missions.

Three Key Missions of HEIs together make innovation possible

- **Teaching** to produce graduates with the qualities and attributes for success, including research and enquiry skills. All HEIs are committed to employability skills and building students’ entrepreneurial mindset.

- **Conducting world class research.** Outputs include new knowledge (in the form of publications, technologies, processes & materials), skills and know-how of researchers and commercialisation of great ideas.

- **Linking with other sectors through knowledge exchange (KE).** This describes a broad range of activities to support collaborations between universities, businesses, the public sector and the public.

**Working with innovation partners**

**Government:** Public funding of the three missions is critical to enabling HEIs to deliver economic impact. For example, innovation funding is needed because working with businesses costs Scottish HEIs, on average, more than it earns.

**Businesses:** Universities collaborate with businesses across the three missions. Businesses input into curricula to prepare graduates for work, help to drive the direction of research, and utilise the knowledge arising from research.

**SMEs:** Small- and medium-sized enterprises (SMEs) make up 99.4% of all private sector enterprises in Scotland. We know that boosting innovation in SMEs is key to national productivity. Scottish HEIs work with 13,000 SMEs each year to innovate and grow. This has a big cumulative impact on the economy.

Scottish HEIs are ambitious to do even more to contribute to the innovation ecosystem and the Scottish economy. All Scottish HEIs are committed to the **Universities Scotland 5-Point Action Plan** to keep improving our innovation performance, and are working with partners through the **Innovation Scotland Forum**.
KE and Innovation activities are growing and improving

KE activities between research institutions and business continue to improve, with Scottish HEIs as a group outperforming the rest of the UK.\(^{[16]}\)

In 2013-14, the Scottish Government’s Knowledge Exchange Index was 9.2% above the baseline year (2007/08), showing sustained growth over the last seven years.\(^{[17]}\)

Pathways to economic impact can be complicated, mediated by external factors, and take a long time to be realised. It is therefore important to monitor our KE activity as it underpins eventual impact.

Economic impacts of Innovation activities in Scottish HEIs

Innovation activities are usually knowledge exchange activities undertaken with businesses, with the aim of turning research and ideas into new or improved products and processes.

Innovation activities include:
- Contract research
- Collaborative research
- Continuing professional development
- Licensing
- Spin outs
- Networks

2014 was Scotland’s 3\(^{rd}\) best year for Foreign Direct Investment (FDI), and scientific research is a key reason for FDI. Scotland is the most attractive UK region for FDI outside London, and ‘punches above its weight’ in securing FDI.\(^{[20]}\) This helps SMEs by providing role models and training pipelines.\(^{[21]}\)

In 2013/14 the minimum estimate of the economic impact of Scottish HEI Innovation activities was £441m.\(^{[23]}\)

Knowledge Transfer Partnerships (KTPs) place graduates in industry to link businesses and HEIs. KTPs have delivered £7.50-£8 net additional GVA for every £1 of funding.\(^{[24]}\)

Scotland has the highest share of UK spin outs: 28%.\(^{[19]}\)

Innovation Centres bring together researchers and businesses to tackle projects designed by businesses. They are predicted to generate £1.5bn and 5,000 jobs in five years.\(^{[18]}\)

This does not cover the entire economic impact of HEIs: a 2010 report valued the Scottish higher education sector GVA (gross value added) to the Scottish economy at £6.2bn.\(^{[25]}\)
Closing Remarks

Scotland has a rich research base, delivering high quality research which benefits a broad range of people.

There is no standard route to a certain impact, or beneficiary. The links from underpinning research, to type of impact and on to beneficiary are complex, realised over a long time and often unexpected. This highlights the need for a diverse research base.

Our research in architecture and design illustrates this variety, showing a broad range of research impacts.

A core function of universities’ impact in Scotland is delivering economic benefit as a key contributor to the innovation system. This contribution is possible due to the reinforcing relationships between research, teaching and knowledge exchange.

Universities have achieved a lot in terms of impact, and are committed to achieving more. To do so it is critical that the three key missions receive long term support as an investment in the future.
Note on the analysis

The analysis of REF Impact case studies (pages 1-3) was based on work conducted in the creation of:

King’s College London and Digital Science (2015). The nature, scale and beneficiaries of research impact: An initial analysis of Research Excellence Framework (REF) 2014 impact case studies. Bristol, United Kingdom: HEFCE.

This work was based on text and data mining. The full methodology described in the report.

The additional analysis of impact studies (pages 4-5) was conducted by staff at Universities Scotland.

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References

A full list of references is provided as an online appendix. Please visit: www.universities-scotland.ac.uk