Impacts of research from Scottish universities: Analysis of the REF 2021 Impact Case Studies

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The Research Excellence Framework (REF) is a process of expert review to assess the excellence of academic research conducted at universities in the United Kingdom (UK), undertaken by the four UK higher education funding bodies. The Scottish Funding Council commissioned RAND Europe, together with Electric Data Solutions and Different Angles, to conduct a study to review the breadth and depth of Scottish higher education’s research impact beyond academia as represented in the REF 2021 Impact Case Studies. The study aimed to address the following research questions:

• What are Scotland’s particular research impact strengths?
• How does research collaboration affect Scottish universities’ research impacts?
• How are Scottish universities contributing to Scotland’s National Performance Framework (NPF) outcomes?
• What contributions have SFC innovation investments made?

The study provides an in-depth examination of Scottish university Impact Case Studies using a mixed-methods research approach that involved a range of quantitative and qualitative analyses such as topic modelling, geotagging, text searches, bibliometric analysis, infographics and deep dives. This report is intended for a range of stakeholder including those interested in higher education research, the REF and research assessment, and more generally to anyone interested in the impact of universities on society.

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RAND Europe is a not-for-profit research organisation that aims to improve policy and decision making in the public interest, through research and analysis. RAND Europe’s clients include European governments, institutions, non-governmental organisations and firms with a need for rigorous, independent, multidisciplinary analysis. Electric Data Solutions provides bespoke analysis to universities, funders and publishers to help them understand their unique contribution to the global research system. Different Angles Ltd is a consultancy that focuses on the social impact of universities and research.

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Executive Summary

**Background and context**

The Research Excellence Framework (REF) is a system for assessing the range and quality of academic research conducted at universities in the United Kingdom (UK). It is undertaken by the four UK higher education funding bodies: Research England, the Scottish Funding Council (SFC), the Higher Education Funding Council for Wales (HEFCW), and the Department for the Economy, Northern Ireland (DfE). The REF aims to (i) provide accountability for investment in research by demonstrating evidence-based benefit, (ii) provide benchmarking information for the HE sector, and (iii) inform the selective allocation of research funding. The REF is conducted by expert review for each of the 34 subject-based Units of Assessment (UoAs), guided by four Main Panels of senior UK and international academics and research users. The REF assesses three elements for each institutional submission: output quality, research impact beyond academia, and the research-support environment.

1. Research Excellence Framework (2023a).
3. Panel A = Clinical and Life Sciences; Panel B = Engineering and Physical Sciences; Panel C = Social Sciences; and Panel D = Arts and Humanities.
4. The REF defines impact as ‘the effect on, change or benefit to the economy, society, culture, public policy or services, health, the environment or quality of life, beyond academia’ (Research Excellence Framework 2022).
5. Stevenson et al. (2023).
6. Whilst the REF ICSs provide a detailed and diverse illustration of universities’ research impacts, this sample was selected with the REF eligibility and assessment criteria in mind.

This report focuses on the impact of Scotland’s research beyond academia as represented in Scottish universities’ submissions to REF 2021.

For a comprehensive examination of the broader impact of UK university research, we recommend reading this report in conjunction with the separate report documenting our analysis of the UK-wide impact-case-study dataset.

**Study objectives**

The REF 2021 Impact Case Studies (ICSs) provide a resource for analysing the impacts of Scottish university research, reflecting the Scottish higher education research’s diversity and reach. Each ICS is a five-page narrative document universities submit detailing the societal impact of their institution’s research within a given timeframe. The ICS corpus provides a rich data source that can be analysed and text-mined to provide a broad overview of Scottish university research’s societal impact. The SFC commissioned...
this study to review the breadth and depth of Scottish higher education’s research impact beyond academia as represented in the REF 2021 ICS, specifically addressing the following research questions:

- What are Scotland’s particular research impact strengths?
- How does research collaboration affect Scottish universities’ research impacts?
- How are Scottish universities contributing to Scotland’s National Performance Framework (NPF) outcomes?
- What contributions have SFC innovation investments made?

We used a bespoke, mixed-methods research approach. We enhanced the publicly available REF ICS data with additional information. We then conducted various quantitative and qualitative analyses on these data, combining diverse analytical tools such as topic modelling, geotagging, text searches, bibliometric analysis, infographics and deep dives. We used this analysis to extract common themes, findings and messages describing the broad societal impacts of Scottish university research.

Key research findings

Scottish university research has made a significant societal contribution

This report analyses Scottish universities’ broader societal impact for the first time. Scottish universities submitted 746 ICSs, representing almost 12% of the 6,361 ICSs submitted by universities across the UK and publicly available in the REF case study database. During the REF 2021 assessment, more than 87% of Scottish university ICS submissions exhibited considerable (3*) or outstanding (4*) impact regarding their reach and significance.

Scottish university research has had wide-ranging societal impacts, including in drug discovery and clinical trials, the marine environment, museums and cultural heritage

Our analysis shows the diverse and widespread societal impacts of research undertaken at Scottish universities, identifying Scottish ICSs across all 79 unique impact topics or high-level impact clusters. These areas range from drug discovery and the marine environment to museums and cultural heritage and include impacts on local to global geographical scales and priority areas such as achieving net zero.

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7. Scottish Government (2023a).
8. E.g. such as that which could be linked to the impact case study via the publications references in the ‘References to the research’ section of the ICS template.
10. The identified impact topics can be found in the UK-wide analysis (RAND Europe et al. 2023).
Scottish universities’ research impact pathways are unique and emphasise the complexity and multidisciplinarity of research impacts

Linking the underpinning research in the ICSs with the corresponding impact topics and UoAs enables us to visualise different routes from research to impact, as illustrated in Figure 1’s detailed ‘alluvial diagram’ of Scottish university ICSs. The impact pathways demonstrate no single prominent pathway to impact; instead, they are numerous, diverse, complex, and often unique, highlighting the multidisciplinary nature of Scottish university research’s impact. The research fields contributing to each UoA’s case studies show considerable diversity, and each UoA contributes to a diverse range of impact topics.

Research collaboration plays a significant role in Scottish universities delivering research impact

Our analysis demonstrates collaboration’s critical role in Scottish universities generating research impact. We examined the extent to which collaborating institutions from the UK and internationally were involved in the research underpinning ICSs. Our findings showed that case studies submitted within Panel A (Clinical and Life Sciences) had the highest levels of collaboration, with 78.7% of case studies linked to UK collaborators and 79.3% to international collaborators. We also explored the types of collaborating institutions involved in the underpinning research, finding that collaboration with health-sector organisations was highest in Panel A (Clinical and Life Sciences), with 55% of the ICSs including underpinning research with health-sector collaborators. Collaboration with corporate organisations was highest in Panel B (Engineering and Physical Sciences), featuring in 35% of the case studies. We also investigated how collaboration amounts and types differed across impact types, finding that the ‘Clinical Medicine’, ‘Food, Environment and Ecology’ and ‘Public Health and Health Services’ impact clusters tended to have higher numbers of collaborating institutions than others.
Figure 1. Alluvial diagram illustrating pathways from Scottish university ICSs’ underpinning research to resulting impact

Note: The underpinning research is shown on the extreme left of the figure, while the resulting impacts are on the extreme right, organised by the 34 UoAs and four main REF Panels (middle of the diagram) for the 746 Scottish university ICS. The colour coding represents the four main REF Panels: pink = Panel A (Clinical and Life Sciences); blue = Panel B (Engineering and Physical Sciences); purple = Panel C (Social Sciences); and green = Panel D (Arts and Humanities). Readers can zoom into specific sections of this figure to read the text. A high-resolution file of this image can also be downloaded alongside the report.
Figure 2. UK map showing the number of Scottish ICSs reporting impact across each Nomenclature of Territorial Units for Statistics (NUTS) 1 region in the UK

Note: This figure shows the UK NUTS1 regions where impact has occurred. The shading represents the number of ICSs impacting each region, with darker shading representing higher ICS numbers and lighter shading representing lower ICS numbers. The number represents the number of ICSs that have reported impact within that region.
Scottish universities’ research contributes to Scotland’s NPF outcomes, including local impacts around health, education, culture, international and environmental impacts, and links to multiple UN Sustainable Development Goals (SDGs)

Scottish universities have achieved diverse and significant impacts across their local areas.

Analysis of the geographical regions mentioned in the ICSs shows that Scottish university research has had diverse impacts across local areas within Scotland, supporting the translation of research into societal benefits for the community. Overall, 29% of Scottish university ICSs reported ‘hyperlocal’ impacts (i.e. within 25km of the institution) in a broad range of sectors and policy areas, including healthcare, environment, education, arts and culture and local policy. As Figure 2 illustrates, Scottish research impacts are evident across all areas of the UK, with the highest proportion in Scotland (294 of 746 case studies) followed by London (96 of 746 case studies). These impacts occurred across various sectors and policy areas linked to Scotland’s NPF outcomes, including healthcare (e.g. improving patient care and access), education, public engagement, and heritage and culture (e.g. highlighting the significance of historical Scottish cultural work). Collaboration between universities and public-sector organisations like the NHS is a key mechanism facilitating this impact.

Scottish universities have contributed to global impacts and multiple UN SDGs.

Scotland’s research also has a significant international reach with worldwide impacts. Figure 3 shows that Scottish university ICSs reference a total of 172 countries and global territories, illustrating contributions to over 88% of countries across Europe, North America, Asia, Oceania, Africa and South America. These impacts were generated across diverse sectors, including healthcare (through new diagnostic tools and testing methods), arts and culture (through activities such as applied theatre), education to facilitate intercultural communication, civil liberties and human rights, including supporting public understanding of global issues.

Scottish universities have contributed to environmental impacts, including advancing net-zero goals locally and internationally.

Scottish universities’ research has directly benefited the environment by developing and implementing new technologies (e.g. carbon capture and storage), developing monitoring tools (e.g. to measure greenhouse gas emissions accurately), informing the development of climate policy across the UK and internationally including net-zero target setting, climate mitigation strategies and regulations; informing change across different sectors including agriculture, construction and energy, and working closely with industrial partners to translate their research into commercially viable solutions, generating economic value and benefiting the environment.

Scottish Government innovation investments impact key areas such as aquaculture, healthcare and construction.

Innovation investments like the Innovation Centres have supported impact across critical areas, helping enhance Scottish and international aquaculture’s welfare and sustainability via tools helping minimise sea-bed damage and algorithms supporting supply chains in reducing waste and increasing sustainability. Technological innovations have facilitated improved methods within the healthcare sector, including diagnostics and digital-care delivery, and informed Scottish Government strategy and NHS Scotland. Innovation investments within the construction sector have helped generate sustainable solutions related to reduced energy and material consumption and improved air quality, such as research supporting an increased understanding of indoor air quality and building performance.
Figure 3. The global impact of Scottish universities’ research

Note: This figure shows the countries and territories where impacts have occurred. The shading represents the number of ICSs within each region, with darker shading representing higher ICS numbers and lighter shading representing lower ICS numbers. The number represents the number of ICSs that have reported impact within each region.