National Heritage Science Forum

UKRI Progress Report on Research and Innovation Infrastructure Roadmap – Summary, April 2019

Introduction

In March 2019 UK Research and Innovation (UKRI) published its **Infrastructure Roadmap Progress Report**. The research and innovation infrastructure roadmap programme is designed to contribute to the Government's Industrial Strategy aim of raising total R&D investment to 2.4% of GDP by 2027 (and 3% longer term). The roadmap will increase UKRI's understanding of the UK's current capability and guide future planning.

The UKRI website provides a useful overview of the Infrastructure Roadmap Programme here.

The progress report summarises work to date from surveys of existing infrastructures and consultation with stakeholders and advisory networks.

Following a summary of the programme's purpose and its strategic context (Ch.1-2), the report presents research findings from 6 distinct sectors:

- Biological sciences, health and food sector
- Physical sciences and engineering sector
  Social sciences, arts and humanities sector
- Environmental sciences sector
- Energy sector
- Computational and e-infrastructure sector

Sectors of particular relevance to NHSF:

Physical sciences and engineering sector (Ch. 5, pp.41-54)

Themes that emerged in the physical sciences and engineering sector reflect the need for continuing technical advancements across complex infrastructure, extremely large data sets and the need for scientists and engineers to work together to deliver complete systems. Improvements, such as automation within sample preparation areas, could significantly improve the efficiency of processing samples. The ability to increase the scale of research into new materials is also considered an important next step, as well as being able to study materials and matter in their dynamic state.

Social sciences, arts and humanities sector (Ch. 6, pp.55-68)

The report recognises the increasing importance of SSAH disciplines in the Industrial Strategy missions and in UK government departments' 'Areas of Research Interest'.

The work has been led by ESRC and AHRC. UKRI is the major source of funding for large parts of the sector through capital investment, grant support, or universities formula funding. However, the initial analysis also demonstrates how the sector, in particular the arts and humanities, finds significant funding through non-UKRI government funding, philanthropic sources, charities or private sector support. The SSAH sector includes a number of Independent Research Organisations (IROs) with in-house capacity to carry out and lead research independently in their chosen field or discipline.

Within the work for the progress report, the following areas were considered:
• Major data infrastructure investments in the social sciences, for ingest, curation, archiving, linkage and secure access provision for research data including nationally representative surveys and internationally renowned longitudinal population studies
• Organisations performing research into methodologies, such as the National Centre for Research Methods

Infrastructures in the arts and humanities fall broadly into the following categories:
• Physical collections (including artefacts and larger physical structures such as archaeological sites) and their storage facilities
• Archives (including both physical objects and digital artefacts)
• Digital infrastructure (including digital record creation, digital data storage and tool sets)
• Libraries
• Laboratory facilities for heritage science and archaeology

Key messages and emerging themes (p.59):
Research and innovation infrastructure requirements for this sector fall into three main categories:
• Data collection – collecting new data for research purposes, for example, collecting specific data in relation to a representative sample of the population over time
• Data services – to provide secure access to research ready data from a variety of sources, activities include ingest, curation, archiving, linkage, data analytics, user guidance and secure access
• Physical and digital libraries, collections and archives
• Facilities for archaeological and heritage science research

Historical, cultural and heritage:
Having emerged as a key theme, facilities for archaeological and heritage science research are identified among the **critical future drivers for SSAH infrastructure**:

• Methodological innovations and data science skills, including innovation within the private sector or other disciplines.

• Advances in the field of heritage science and archaeology require investment in laboratory space and equipment to support physical and biological science research. Facilitating sharing of such significant investments across IROs and with smaller museums to provide a national service will be essential. (p. 61)

Understanding and maintaining cultural heritage (Theme 6, pp.66-7)

The UK's national museums, galleries, libraries, archives and historic places constitute a major part of the infrastructure for arts and humanities research. The heritage tourism

industry draws significant economic benefits to the UK. In 2016 in England alone it generated £16.4 billion in visitor spending, directly employing over 275,000 people and contributing £11.9 billion GVA to the economy. It is estimated that Britain's tourism industry will be worth over £257 billion by 2025, just under 10% of UK GDP and supporting almost 3.8 million jobs.

The heritage sector, in collaboration with HEIs, produces excellent cross-disciplinary research. The impact of this work could be transformed through greater collaboration across institutions, realising the potential of a joined up 'national collection' as highlighted in the Mendoza report, DCMS's Strategic Review of National Museums and in the 2017 'Culture is Digital' report. These reports highlight the tendency for heritage assets to be siloed in individual organisations, isolating related collections and preventing synergies of sharing. Knowing who holds what resources, where they are held and making connections between collections is labour-intensive and an inefficient use of time that would be better spent developing the research potential of collections. However, digital technology, AI and machine learning presents the opportunity to connect individual collections together, search across them and make them more accessible to both researchers and the public, enhancing their international reach and influence.

The chapter identifies seven emerging themes from the work to date (Economics and productivity, Next generation public services, Changing world, Addressing environmental challenges. Creative economy, Understand and maintaining cultural heritage, International development). For each theme information is presented on the specific and generic challenges associated with it, and the infrastructure capabilities which may address those challenges.

Heritage science has a contribution to make to each theme but the most significant contribution is to theme 6 (see copied table below for challenges and capabilities).

Theme 6: Understanding and maintaining cultural heritage	
Science, research and innovation challenge	**Potential capability required**
Understanding and maintaining cultural heritage • Physical preservation and conservation of fragile objects • Ensuring access while also minimising risk to collection (e.g. for physical sites) • Incomplete or non-existent digitalisation • Absence of common standards or language used in metadata of digital catalogues • Physical storage space for an ever-increasing body of artefacts • Ensuring that cultural heritage that is recorded and preserved in infrastructure reflects diversity of modern society • Broadening access to a wide range of users	Comprehensive data collection within the cultural heritage sector. Interoperable data services to provide secure research access to the data listed above, including: • Ingest • Curation • Storage and archiving • Cataloguing • User guidance • Linkage • Safe settings • Secure access to data (de-identified where appropriate) • Data analytics

Next Steps

UKRI is already working to develop the themes and issues set out in this report, identify the major themes not yet captured and seek opportunities for further connections across the landscape through continued engagement with the research and innovation community. The First Edition report will set out options for how the potential capabilities described in this report might be achieved, with the aim of publishing the final roadmap in Summer 2019.

UKRI will be engaging with stakeholders via a range of routes over the final months of the roadmap programme and aims to consider any valuable comments provided by end of April in the First Edition roadmap report.

Key take-outs from this report for the Heritage Science sector include requirements for shared investment in archaeological and heritage science research facilities and improved access to and sharing of research data.

Read the full report on the UKRI website here.

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