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| **Interim Evaluation of the UK Research Partnership Investment Fund** | |
| **Report to Research England by Belmana and the Centre for Enterprise and Economic Development Research, Middlesex University**  **July 2018** | |
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Table of Contents

[Foreword 5](#_Toc514831630)

[Abbreviations 6](#_Toc514831631)

[Executive Summary 8](#_Toc514831632)

[Purpose 8](#_Toc514831633)

[Headline findings 8](#_Toc514831634)

[Enhancing research facilities 9](#_Toc514831635)

[Encouraging strategic partnerships and stimulating additional investment 9](#_Toc514831636)

[Strengthening the contribution of the research base to economic growth 10](#_Toc514831637)

[1. Introduction 11](#_Toc514831638)

[Context of UKRPIF 11](#_Toc514831639)

[Aim of UKRPIF interim evaluation 14](#_Toc514831640)

[2. Approach to evaluation 15](#_Toc514831641)

[Assessing additionality of research investments 15](#_Toc514831642)

[Our approach for the evaluation 17](#_Toc514831643)

[1) Analysis of management information 17](#_Toc514831644)

[2) Case studies 19](#_Toc514831645)

[3. Overview of the UKRPIF projects 22](#_Toc514831646)

[UKRPIF funding by discipline 22](#_Toc514831647)

[UKRPIF funding by capital expenditure category 24](#_Toc514831648)

[UKRPIF projects by region 25](#_Toc514831649)

[Co-investment matching the UKRPIF funding 29](#_Toc514831650)

[4. Evaluating research infrastructure investment 31](#_Toc514831651)

[Creating a logic model for the UKRPIF 31](#_Toc514831652)

[Evaluating social science projects 35](#_Toc514831653)

[5. Emerging UKRPIF outputs 37](#_Toc514831654)

[Changes to operating models 38](#_Toc514831655)

[Co-locating the King’s College London (KCL) Research and Innovation Hub in Cancer (RIHC) with NHS delivery 38](file:///\\hefce-trimstore\offlinefs\snaithe\My%20Documents\UKRPIF\Interim%20evaluation\Published%20%20versions%20for%20website\Final%20report\20180216-UKRPIF%20Interim%20evaluation_Annexes%20removed%20(May%202018).docx#_Toc514831656)

[Impact on market readiness 39](#_Toc514831657)

[From research to market ready products at the High Temperature Research Centre (HTRC), University of Birmingham 40](file:///\\hefce-trimstore\offlinefs\snaithe\My%20Documents\UKRPIF\Interim%20evaluation\Published%20%20versions%20for%20website\Final%20report\20180216-UKRPIF%20Interim%20evaluation_Annexes%20removed%20(May%202018).docx#_Toc514831658)

[Impact on research outputs 41](#_Toc514831659)

[1) Publications and intellectual property 41](#_Toc514831660)

[2) Standard-setting and thought leadership 43](#_Toc514831661)

[Standard Setting at the 5G Innovation Centre (5GIC), University of Surrey 43](file:///\\hefce-trimstore\offlinefs\snaithe\My%20Documents\UKRPIF\Interim%20evaluation\Published%20%20versions%20for%20website\Final%20report\20180216-UKRPIF%20Interim%20evaluation_Annexes%20removed%20(May%202018).docx#_Toc514831662)

[Impact on collaboration with HEIs 43](#_Toc514831663)

[Impact on collaboration with industry 44](#_Toc514831664)

[Industry engagement at the Maxwell Centre, University of Cambridge 45](file:///\\hefce-trimstore\offlinefs\snaithe\My%20Documents\UKRPIF\Interim%20evaluation\Published%20%20versions%20for%20website\Final%20report\20180216-UKRPIF%20Interim%20evaluation_Annexes%20removed%20(May%202018).docx#_Toc514831665)

[Impact on start-up/spin-out and SMEs 46](#_Toc514831666)

[Impact on student numbers 47](#_Toc514831667)

[6. Conclusion 49](#_Toc514831668)

[Emerging outputs 49](#_Toc514831669)

[Evaluation going forward 50](#_Toc514831670)

[Quantitative 50](#_Toc514831671)

[Qualitative 50](#_Toc514831672)

[Lessons and reflections 51](#_Toc514831673)

[An approach to future evaluations of UKRPIF 51](#_Toc514831674)

[1) Applying methods from past evaluations 51](#_Toc514831675)

[2) Developing evaluation approaches 52](#_Toc514831676)

[References: 54](#_Toc514831677)

Foreword

Now in its sixth round of operation, the UK Research Partnership Investment Fund (UKRPIF) is the largest competitive grant funding scheme managed by Research England. Established in 2012, the UKRPIF has provided over £680 million of capital funding to 43 research projects across the UK in its first five rounds. Supporting research excellence and encouraging collaboration between universities and non-public organisations is key in meeting national priorities and global challenges. UKRPIF is central to this, enhancing the research facilities of universities undertaking world-leading research and fostering long-term strategic partnerships between universities and other organisations active in research.

Research England, working with the three funding bodies, has funded a diverse portfolio of research projects. Projects are often multi and inter-disciplinary in nature, forging collaborations across departments, universities, and external organisations. With projects across a breadth of research areas, including high value manufacturing, neuroscience, cancer research, aerospace, agriculture and the social sciences, the UKRPIF exemplifies the diversity and the scope of the research base in the UK.

The unique nature of the UKRPIF scheme means that for every £1 awarded, universities must attract double match funding from non-public sources. To date, over £1.7 billion of investment has been committed from co-investment partners, with almost £1 billion of this from industry and almost £330 million from charitable organisations.

With many of our projects specialising in big data initiatives, healthcare, and transport, there is a clear alignment with the UK’s industrial strategy. Enabling and enhancing new and existing partnerships, the UKRPIF is a prime example of how research institutions can work with other organisations to accelerate and translate research and innovation.

This interim evaluation report captures a snapshot of just some of the emerging research outcomes of the scheme; with most projects still in their infancy, many of their benefits will be realised in the years to come. Capital funding of this nature remains crucial to establishing the UK as a place where world-leading research can take place in world-leading facilities.

David Sweeney

Executive Chair, Research England

Abbreviations

|  |  |
| --- | --- |
| **BEIS** | Department for Business, Energy and Industrial Strategy |
| **BIVF** | Boehringer Ingleheim Venture Fund |
| **CDT** | Centre for Doctoral Training |
| **CERN** | The European Organization for Nuclear Research |
| **CURE** | The Creative Fund for Research Exploitation |
| **DCMS** | Department for Culture, Media and Sport |
| **DfE** | Department for the Economy, Northern Ireland |
| **ESPRC** | Engineering and Physical Sciences Research Council |
| **FLEXIS** | Flexible Integrated Energy Systems |
| **FTE** | Full Time Equivalent |
| **HEFCE** | Higher Education Funding Council for England |
| **HEFCW** | Higher Education Funding Council for Wales |
| **HEI** | Higher Education Institution |
| **HESA** | Higher Education Statistics Agency |
| **HMT** | HM Treasury |
| **HVM** | High Value Manufacturing |
| **IoT** | Internet of Things |
| **IP** | Intellectual Property |
| **ISG** | Industry Specification Group |
| **KCL** | King’s College London |
| **KPI** | Key Performance Indicator |
| **LEP** | Local Enterprise Partnership |
| **LSE** | London School of Economics |
| **KPI** | Key Performance Indicator |
| **MMV** | Medicines for Malaria Venture |
| **MRC** | Medical Research Council |
| **NAO** | National Audit Office |
| **NPL** | National Physical Laboratory |
| **OECD** | Organisation for Economic Co-operation and Development |
| **PBB** | Purpose Built Building |
| **PhD** | Doctor of Philosophy |
| **R&D** | Research and Development |
| **REF** | Research Excellence Framework |
| **SFC** | Scottish Funding Council |
| **SME** | Small and Medium Sized Enterprises |
| **STEM** | Science, Technology, Engineering and Maths |
| **STFC** | Science and Technology Facilities Council |
| **TRL** | Technology Readiness Level |
| **UKRI** | UK Research and Innovation |
| **UKRPIF** | United Kingdom Research Partnership Investment Fund |

Executive Summary

Purpose

1. This report presents an independent, interim evaluation of the UK Research Partnership Investment Fund (UKRPIF) programme commissioned by the former Higher Education Funding Council for England (HEFCE). The report summarises the activities funded through UKRPIF grants and reviews the early outputs. The evaluation is based on evidence and data provided by HEFCE, and on a series of case studies which involved a document review, interviews with key stakeholders and site visits. Research England, a new council within UK Research and Innovation (UKRI) operating from April 2018, will continue to manage the UKRPIF.
2. Progress has been assessed in accordance with the core objectives of the UKRPIF. These objectives are to:
3. Enhance the research facilities of Higher Education Institutions (HEIs) undertaking world-leading research;
4. Encourage strategic partnerships between HEIs and other organisations active in research;
5. Stimulate additional investment in higher education research and;
6. Strengthen the contribution of the research base to economic growth.

Headline findings

1. The UKRPIF supported 43 projects across the first five rounds of funding. In total, £681m was provided in UKRPIF grants against an initial committed co-investment of £1.67bn from private sector sources. As projects have matured, investment profiles have been revised and additional co-investment committed, with total committed funds reported to HEFCE amounting to £1.73bn by August 2017.
2. The committed co-investment includes almost £1bn of co-investment from industry partners, almost £330m from charitable organisations and over £400m from philanthropic donors.
3. There is an almost equal split between capital co-investment contributions (52%) and recurrent co-investment (48%). Round 1 of the UKRPIF saw significantly higher contributions of capital co-investment with later rounds reporting higher levels of recurrent co-investment for research projects.
4. The construction of a Purpose-Built Building (PBB) formed part of 39 of the 43 projects. UKRPIF contributed £452m to projects where this was the primary purpose. The projects involving the provision of such new facilities also reported the highest share of private sector co-investment.
5. Since the establishment of UKRPIF in 2012 until 2015-16, capital expenditure by HEIs on non-residential buildings and equipment has amounted to a total of £6.2 billion. UKRPIF grants and matched co-investment from private partners account for approximately a quarter of that total expenditure on capital during this period.
6. Although the scheme is open to projects from all disciplines, the projects supported were mainly STEM-focused and in disciplines ranging across high-value manufacturing, engineering, clinical medicine, bio-medical research and fundamental research. Two projects in the latest round were identified as social science focused.
7. Of the 15 projects that had submitted completion reports at the time of the evaluation, nine reported that more collaborations with other industries or HEIs had been one of the impacts of the project. More broadly, these projects reported on progress against the following themes:

* Impact on market readiness (4 reported impact);
* Research outputs (9 reported impact);
* Student numbers (5 reported impact);
* Impact on collaboration with HEIs (5 reported impact);
* Impact on collaboration with industry (7 reported impact); and
* Impact on start-ups, spin-outs, or small & medium sized enterprises (SMEs).

Enhancing research facilities

1. The interim evaluation found that the UKRPIF is meeting its objectives to enhance research facilities and corroborated the earlier findings of the National Audit Office (NAO, 2016) that the funded projects are on their way to providing positive economic impacts in addition to encouraging early research outputs.
2. The evaluation also found key changes in the operating models that have evolved alongside novel approaches to collaborations. These changes were enabled through the scope of investment and would not have been possible without the UKRPIF grant or the matched funding that was generated because the UKRPIF required co-investment.

Encouraging strategic partnerships and stimulating additional investment

1. Case studies and stakeholder consultations provided evidence that the UKRPIF is encouraging strategic partnerships between HEIs and other organisations, notably in industry. Additional findings indicate that the model has helped overcome barriers to collaboration also within industry, and that new intra-industry partnerships have been enabled because of the new networks and infrastructure.
2. Analysis of leveraged co-investment showed that the initial match-funding requirement has been exceeded for twelve UKRPIF projects. In many cases industry partners have been providing revenue funding for continued research that would otherwise have been difficult to sustain, and the networks and strategic partnerships established appear to have resulted in a pooling of funds that would otherwise have been unlikely.
3. Further, analysis of HESA data of capital investment by UK HEIs showed that UKRPIF and co-investment earmarked for capital spend makes up about 25% of total capital expenditure. Stakeholders consulted consistently emphasised the difficulty in finding the funds to build, refurbish and equip facilities that are essential for modern research.

Strengthening the contribution of the research base to economic growth

1. The interim findings indicate positive impacts on the research community’s ability to contribute to wider innovation and business growth. Longer term, it is not unreasonable to assume that job creation can be linked to these developments and that this will have wider impacts on indirect job-creation and local supply chains. A framework for a full evaluation of UKRPIF will be developed by Research England in 2018.

1. Introduction
2. The United Kingdom Research Partnership Investment Fund (UKRPIF) programme was established in 2012 to support large-scale capital investment in higher education research facilities. It is managed by Research England (formerly the Higher Education Funding Council for England) in collaboration with the other three UK higher education funding bodies. These are the Department for the Economy, Northern Ireland (DfE), the Higher Education Funding Council for Wales (HEFCW) and the Scottish Funding Council (SFC).
3. Under the UKRPIF scheme higher education institutions (HEIs) can bid for funding between £10m and £50m[[1]](#footnote-1) to support capital projects on the basis that they leverage double the amount in match funding from private sources. The fund is available to all HEIs eligible for research funding in the UK, subject to institutions demonstrating value for money and building on existing research excellence. The proposals are assessed by an independent assessment panel in terms of the objectives of the UKRPIF to:

* enhance the research facilities of HEIs undertaking world-leading research;
* encourage strategic partnerships between HEIs and other organisations active in research;
* stimulate additional investment in higher education research;
* strengthen the contribution of the research base to economic growth.

1. By the time of this evaluation, 43 projects had received over £680m through UKRPIF, with initial matched funds of £1.67bn from industry, charitable bodies and philanthropic organisations. Additional co-investment has since been committed, with committed funds reported to the HEFCE amounting to £1.73bn by August 2017.
2. During the first four rounds of operation, £450m of UKRPIF funding was allocated to 32 projects, attracting over £1.2bn of investment from business and charities. In 2017, a further £229m of funding was awarded to eleven projects as part of Round 5 of the scheme, leveraging in an additional £467m from private investment. Round 6 of the scheme was launched in September 2017, with a further £220m funding available to institutions across 2020-21.

Context of UKRPIF

1. The UKRPIF can be viewed as part of a range of investment funding for UK research both in HEIs and in large-scale and medium-scale research facilities.
2. In the period from the establishment of UKRPIF in 2012 until 2015-16, capital expenditure by HEIs on non-residential buildings and equipment was £6.2 billion. Figure 1 disaggregates this total capital spend between 2012-13 and 2015-16 on non-residential buildings and equipment. Total expenditure on buildings in this period came to approximately £4.5bn while £1.75bn was spent on equipment. To provide a sense of the scale of the UKRPIF, the government grants and matched co-investment from private partners amount to approximately a quarter of that total capital expenditure between 2012-13 and 2015-16.

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| Figure : Total Non-Residential capital expenditure on buildings and equipment 2012 to 2015 (£bn) |
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Belmana’s own calculations using HESA Capital Expenditure Data.

1. While UKRPIF funds could only be invested in capital, co-investments could be made towards either capital or recurrent costs, as long as the required double match-funding was achieved. Analysis of individual projects’ management information allowed a split between capital and recurrent (revenue) spending, though some judgements had to be made as recording was not always complete. From the co-investment of £1.67bn, over £800m went towards investment in buildings and equipment, with the remaining £900m on revenue expenditure.

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| Figure 2: Split between capital and revenue expenditure in committed co-investment across Rounds 1-5 |
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Belmana’s own calculations using HEFCE Management Information.

1. The split between capital and revenue spending varied between rounds, with the earlier rounds having a higher proportion towards capital expenditure. Round 1 was most prominent both in terms of absolute numbers and proportion, with an approximate £396m going towards capital investment. This constituted 75% of the co-investment committed from private sources in that round. In Round 2 46% of the co-investment went to investment in capital. Through Rounds 3-5, between 25% and 35% of the co-investment went towards such investment, indicating that co-investment was increasingly funding research projects.

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| Figure 3: Co-investment committed by round broken down by investment type (£m) |
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Belmana’s own calculations using Research England Management Information.

1. Around £900m of the committed co-investment was assessed as revenue expenditure relating to research in different forms.
2. The UKRPIF has also been analysed in relation to capital investment into sciences more generally. Alongside facility investment by HEIs, there is investment through the Science and Technology Facilities Council (STFC) into large-scale facilities such as the Diamond Light Source, the UK’s national synchrotron science facility located at Harwell.
3. In 2016, the National Audit Office (NAO) carried out a review of capital investment by the Department for Business, Energy & Industrial Strategy (BEIS) in science projects. Eight UKRPIF projects with bids approved between 2012 and 2014 were reviewed as part of this work. The review of the UKRPIF scheme was positive, concluding that HEFCE had gained assurance that all projects were sustainable and would deliver both scientific and economic impacts. However, the NAO found that BEIS and the research councils did not have a common systematic framework for assessing whether operational projects are delivering expected benefits (NAO, 2016). In response to the report’s recommendations, BEIS (2017) provides guidance for the appraisal and evaluation of science capital projects.
4. In 2016, the HEFCE commissioned an independent audit of the UKRPIF projects. Its focus was on the allocation and monitoring of funds, and assuring receipt of co-investment from the private sector (KMPG, 2016). It also assessed the financial effectiveness of the projects, identifying areas of good practice and putting forward recommendations (to HEIs and HEFCE) to improve future processes. The study noted that project leaders were keen to have a review of the outputs from the academic research, and not solely the financial outcomes.

Aim of UKRPIF interim evaluation

1. This interim evaluation of the UKRPIF is partly a response to the NAO report and to the feedback received in the KPMG audit report. As part of Research England's role on UKRPIF, it is responsible for monitoring progress and evaluating the success of the individual projects and the overall programme. An assessment of emerging project outputs and outcomes is required to support this role and to provide evidence to make the case for further investment in the scheme. Findings from this interim evaluation will be used to inform the development of a framework for a full evaluation of the scheme which is currently being developed by Research England.
2. The interim evaluation combines a review of project documents across the entire programme with five in-depth case studies of UKRPIF projects. Each strand of the report seeks evidence on how completed projects are meeting the objectives of the UKPRIF scheme and how the specific aims of each of these projects are being achieved. The interim evaluation also reviews approaches to evaluating investments into research facilities, suggesting a set of Key Performance Indicators (KPIs) that can inform future work in this area.

1. Approach to evaluation
2. The UKRPIF provides capital funding to develop research centres of mid-sized scale, focusing on partnership with industry or charitable bodies and on the translation of research outputs to commercial or social application. Successive parliamentary reports and government policy documents have highlighted the UK’s excellent research base, but also that the UK fails to maximise this potential to translate research into wealth and health (HC, 2009; HC, 2010; HC 2011; HC 2013).
3. Literature on evaluating investment in research infrastructure has generally focused on establishing the value for money and economic impact of large-scale facilities. Empirical work on investment in mid-size infrastructure of national and regional significance is less common, with reviews often focusing on more qualitative aspects (e.g. Blumel et al, 2015, on institutes focusing on health science translation). There have also been several studies on the related areas of knowledge exchange and the commercialisation of research outputs. While such work focuses less on the infrastructural aspects, exploring how universities facilitate commercialisation through dedicated offices or academic leadership, the studies cite the importance of equipment and facilities in the translation process (Ulrichsen et al, 2012).
4. One issue is the extent to which the impacts observed are additional, over and above what would have happened anyway (“deadweight”). There is often also a concern that government investment relocates investment (“displacement”). In evaluation, UK government policy has taken significant steps to improve the evidence about whether an assessment can attribute impacts to policy. Since the publication of the HM Treasury Green and Magenta Books, government departments have invested in data, methods and tools to improve policy evaluation in this area (HMT, 2011a & b).

Assessing additionality of research investments

1. The approach taken in this study builds on key contributions on the evaluation (and the limits/difficulties of evaluation) of capital projects. Roschow et al. (2011) developed a framework for evaluating publicly funded research infrastructure of pan-European significance. It contributes to the understanding of the impact on learning and capacity of operators of the facilities, their suppliers and users, providing an exhaustive list of indicators to evaluate the success of publicly supported research infrastructure projects.
2. Griniece et al (2015) divided the impact logic of an investment in research facilities into two main periods following Roschow et al. (2011): the design and construction phase; and the operational phase. They then detailed the pathways from inputs to outputs, and outputs to outcomes, which are mapped to indicators of impacts. They considered how specific design or technical requirements for scientific buildings or equipment can have an impact on learning and skills development amongst supplier firms, notably local (national) firms, during the construction phase. This expands on simple multiplier modelling by seeking to understand a wider impact specific to research infrastructure construction.
3. In the operational phase, the logic of impact is more complex. Broadly, the research moves beyond traditional economic impact measures (funding, jobs, and utilisation) by looking at indicators of human resource capability, innovation and scientific activity. Measures may be the number of successful PhD, masters and other qualifications, and the employment prospects of the qualification holders. For innovation, the collaborative research projects progressed and the extent to which intellectual property has been developed are considered (patents, etc). The scientific impact is measured by the publications stemming from the research investment. Publications are often regarded as a measure of the creation of new scientific and technical knowledge which may have an impact on the scientific community. However, the link between research publications and economic impact is more tenuous.
4. OECD (2014b) measured the impact of the CERN large-scale laboratory on the economy and society, analysing the impacts qualitatively. Impacts were categorised into themes ranging from purely scientific impacts to direct or indirect economic impacts from building and operating the facility. The authors then performed an exercise to choose which impacts should and should not be analysed further, with that further analysis being undertaken through case studies. The authors chose to qualitatively study the subjects they judged the most likely to stimulate additional wider benefits to society and the economy from innovative activity occurring within CERN.
5. Frontier (2015) attempted to understand additional impacts from capital expenditure on the teaching, research and knowledge exchange activities at HEIs in the context of formula capital spending. Additionality is assessed by identifying a counterfactual outcome i.e. what would have happened anyway had an HEI invested a different amount of capital expenditure. Their approach was to perform a cross-sectional regression analysis to estimate the change in each outcome measure of interest (student numbers, research student numbers, etc.) as a function of capital investment (averaging over five and three years depending on the outcome evaluated), and other HEI characteristics. An issue with the analysis is that the relationship between the outcomes of interest and baseline capital investment is likely to be endogenous; i.e. they cannot rule out reverse causality. Further, there may be problems due to omitted variable bias, such as not controlling for different higher education policies which may have affected the sector differentially.
6. Frontier (2015) found that an increase in capital spending of £5m over five years is associated with an increase of approximately 100 additional full-time equivalent (FTE) students. There is also evidence that this varies by institution type with a larger than average effect in institutions with a medical school and high research income and a smaller than average effect in specialist institutions. In addition, it was found that a rise in capital expenditure of £5m over five years is associated with an increase of around £500k in additional income from consultancy and contract research. Further, an increase in capital spending of £3m over three years is associated with an increase of approximately 13 additional research students in research-intensive institutions.
7. Helmers and Overman (2017) analysed the impact of the establishment of a £380m basic scientific research facility in the UK on the geographical distribution of related research. They investigated whether the siting of the Diamond Light Source (a third-generation synchrotron light source) in Oxfordshire induced a clustering of related research in its geographic proximity. The novelty in the work is in identifying a comparable area, the `runner-up' site near Manchester. In terms of impact metrics, the research uses both academic publications and patent data to trace the geographical distribution of innovation, finding that the siting of the synchrotron in Oxfordshire created a highly localised cluster of related scientific research.
8. The role of a university in technical change has matured as views of technology diffusion have changed. Hudson and Khazragu (2013) reviewed the interaction between HEI, industry and government and a more system-centred approach to innovation policy. They review the evidence from the HEFCE Research Excellence Assessments, seeking to understand what evidence of commercial success can be found there. Khazragu and Hudson (2014) developed the framework as a cost-benefit analysis, highlighting measures that can support benefits valuation such as the licensing revenue from patents, the value of companies spun out by HEIs as they commercialise activities and the leveraging of collaborations with industrial partners.

Our approach for the evaluation

1. This interim evaluation combines a review of project documents across the entire programme with five in-depth case studies of UKRPIF projects. This follows OECD (2014b) but, as it is an early evaluation, the approach can inform the focus of a future, full evaluation.
2. The evaluation synthesises across different strands of information: a quantitative and desk-based review of management information provided by Research England, and qualitative research through case studies of five completed projects.
3. An initial literature review informed the development of a logic model structuring the intervention logic and expected outputs and impacts. This in turn informed the management information (MI) analysis which looked at resource inputs of the programme and took cuts of the data looking at different breakdowns across the funded projects. The breakdown gave an overview of the types, sizes and locations of projects as well as their funding model, and served as the basis for the selection of case studies. The inputs analysis was followed by an assessment of emerging outputs reported, focusing on projects with completion reports.
4. Analysis of management information
5. A review of project documents has formed a key part of this interim evaluation. There are four distinct types of documents collected by Research England and the three funding bodies, as follows:

* *Original bids* outline the business cases for each capital investment project. They indicate the projects’ intended outputs and outcomes. The documents provide proof of co-investment commitments from private partners, estates information and equipment information. They also inform the categorisation of the project in terms of capital investment type, discipline of the research, and type of co-investment partner.
* *Monitoring returns (quarterly and annual)* provide summaries of the progress in delivering the investment funded by UKRPIF, payments received from co-investors and procurement information for the projects.
* *Project completion reports* are submitted to Research England twelve months after the official completion date of the capital output. They include evidence of emerging project outputs and outcomes, capital outputs, governance, residual risks and lessons learned from the projects.
* *Project audit reports*, produced independently by Sockmonkey Consulting (a pilot exercise) and KPMG, provide a summary of project progress and assess the financial effectiveness of each project, including the extent to which the double-match co-investment has been achieved.

1. The interim evaluation considered the 43 projects awarded funding through rounds 1-5. It used the project business cases (as submitted as part of the original bids), as well as monitoring and completion reports to measure project performance. It explored what can be learnt from these reports about performance and attempted to identify themes from which to develop KPIs for the programme. Revised co-investment profiles have been provided by Research England during the evaluation, and this information has been used for analysis of committed co-investment.
2. To understand the importance of UKRPIF in funding research infrastructure, the MI was analysed to explore how much of the co-investment was invested into facilities and other capital items, as opposed to funding research expenditure. The MI detailed overall co-investment and sometimes indicated where this was spent. However, in many cases, the researchers had to consider the initial bid documentation, which provided more detail. An element of judgement had to be included as sometimes determining what the co-investment funded was difficult.
3. The UKRPIF’s focus on research facilities and capital spending was then analysed in relation to overall investment by HEIs in non-residential buildings and equipment. HEIs report their overall capital investment to HESA, providing an annual picture of investment in research facilities.
4. As of June 2017, 21 projects have reported practical completion, meaning that the UKRPIF funding has been spent and that infrastructural elements have been completed, with research activity underway. Fifteen of these projects have returned completion reports to HEFCE. A further six completion reports are to be received in the year to June 2018, after the conclusion of this study.
5. There are challenges in analysing the programme solely relying on MI. Firstly, it is difficult to summarise and systematically compare the outputs reported in the completion reports as the standard format for the returns was not always followed. Representatives of UKRPIF-funded projects may also elect to describe only positive outputs excluding those that have not been achieved but which may be useful for evaluating the scheme. Further, responses from institutions are often varied in length and detail. For this reason, the evaluation complemented the MI review with in-depth case studies and confronted the evidence from the two strands.
6. Annex A gives a full list of the projects. Annex B presents a full overview of the project completion reports consulted as these contain self-reported outputs.
7. Case studies
8. The evaluation involved case studies of five UKRPIF projects, to complement the analysis of management information across the UKRPIF projects. The research approach was tailored for each project, informed by the management information review. Each case study employed a mix of site visits, semi-structured interviews and group discussions, in conjunction with in-depth reviews of quantitative and management information where possible. Analysis was cross-cutting with a focus on identified key themes, primarily collaborative research, commercialisation and capability building in each project.
9. The selection of projects for the case studies was based on analysis of management information across the UKRPIF projects. The 15 projects with completion reports – categorised by discipline and funding structure – generated a sampling frame from which a shortlist was selected. Purposive sampling was used to ensure a representative sample in terms of geography as well as sufficient coverage of UKRPIF expenditure. Care was taken to provide a sample with a reasonable spread of disciplines and research focus, and the choices were informed by the opportunity to establish best practices. As a result, only relatively mature projects, where emerging findings were likely to be observed, were considered.
10. Each study focused on one of five disciplines. The disciplines identified were:

* Biomedical;
* Engineering;
* Fundamental Research;
* High Value Manufacturing; and
* Clinical Medicine.

1. Then, a matrix was created that identified projects in terms of the co-funding type, level of funding, capital expenditure type (i.e. purpose-built new or refurbished) and region. The geographical spread achieved was representative of UKRPIF funding dispersed. This was corroborated by analysis of MI. The selection process used this matrix to select one “anchor” project with the next four selections based on review of the remaining disciplines, eliminating the institutions operating in regions already selected in order to maintain good regional coverage. The process also provided a mix of other characteristics, such as the type of organisation that co-invested in the project. This process generated five potential samples, and discussion between researchers, HEFCE and the research Steering Board finalised a selection.
2. The final sample covers a cross-section of disciplines, ranging from high-value manufacturing to bio-medical sciences, that have benefited from UKRPIF funding of up to £20m. A list of case study samples can be found at Table 1. The findings at this stage focus on early outputs, emerging and expected impacts, and future trajectory of the projects. Findings and review of indicators to measure outputs and impacts are integrated into the section on lessons learnt and recommendations for future evaluations.
3. Longer versions of each study (Annex C) also include considerations on the delivery of the projects, which were highly complex infrastructure developments that involved the building of purpose-built state-of-the-art research facilities that in many cases needed to be equipped with expensive and advanced equipment.

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| Table : Case study samples | | | |
| **Institution** | **Project** | **HEFCE Funding** | **Discipline** |
| University of Birmingham | High Temperature Research Centre (HTRC) | £20.0m | High Value Manufacturing |
| University of Cambridge | The Maxwell Centre | £21.0m | Fundamental – Materials |
| University of Dundee | Centre for Translational and Interdisciplinary Research (CTIR) | £12.0m | Bio-Medical |
| Kings College London (KCL) | Research and Innovation Hub in Cancer (RIHC) | £15.0m | Clinical Medicine |
| University of Surrey | 5G Innovation Centre (5GIC) | £11.6m | Engineering – Telecom |

1. Individuals were selected for interviews in terms of the functions they lead in a project, in an activity of the project or in the fund more generally. A typology was applied which distinguished between academic leadership, academic end users, commercial and external end users, and stakeholders operating in the wider context (such as co-funders, membership organisations and local bodies).
2. The fieldwork entailed semi-structured interviews in person while conducting site visits. In some cases, additional follow-up interviews were conducted over the phone. Topic guides were designed with a set of questions for each of the key themes (background about the individual, project objectives, project inputs and delivery, outcomes, whether outcomes could be attributed to the funding and lessons learnt). The interviews were tailored to the respondent and case study type, recognising the different perspectives of different stakeholders in terms of their involvement in designing, delivering and monitoring the projects. In terms of outcomes, the interviews focused on R&D, skills and spillovers expected or, in later phases, demonstrated, by the projects. Some questions also covered the delivery and construction aspects of the project which often involved innovative operational models and the procurement of new, complex equipment.
3. Results from the interviews were analysed using a structured approach. The interviews were recorded and notes from each were entered into a spreadsheet that allowed key points to be first coded and then analysed. The studies synthesise across interviews and, during this process, material was anonymised (though a referencing system to establish a clear audit trail has been maintained in the dataset).
4. A key part of this analysis was to triangulate across interviews, monitoring information and the document review. As the case studies developed, key themes around the novel operating model and collaborative nature of work around commercialisation started to emerge, and this was incorporated into the synthesis. For each case study a detailed report was written up which was converted into a four-page overview per study. The overviews were discussed and verified with HEFCE and project personnel, and a final synthesis was made across the five projects to pull out overarching themes.
5. Due to the nature of projects funded through the first four UKRPIF rounds the case studies were all focused on science, technology, engineering and mathematics (STEM) research. To inform the development of a framework and evaluation guidance that can be applied also to social sciences, an additional consultation was undertaken with the Alliance Manchester Business School (AMBS) which has recently benefited from UKRPIF funding. The Head of School and the Deputy Vice Chancellor were both consulted on project goals and objectives, as well as the methods applied to gauge emerging outputs and impacts, wider benefits and additionality. The types of collaborations and co-investment were also discussed and compared to those of STEM-focused projects.
6. Overview of the UKRPIF projects
7. This chapter uses the funding and business case evidence to characterise the investments in terms of discipline, type of capital and size of co-investment. It should be noted that an assessment of deadweight is not provided, i.e. how much of the overall project investment would have been carried out in the absence of the UKRPIF funding.
8. Table 2 presents the allocations of UKRPIF grants by each of the five rounds of funding. The analysis is based on committed co-investment and considers revisions to the co-investment. Revisions in co-investment profiles have resulted in an increase in the amount of co-investment from the £1.67bn committed in the initial bids to £1.73bn. This constitutes an aggregate positive variance of £53m across all projects funded[[2]](#footnote-2). In aggregate, committed co-investment reported to HEFCE made up 72% of the total project funds.
9. Round 5 has allocated the most funding with a total of £230m going towards 11 projects. Round 1, on the other hand, has received (or is due to receive) the most private co-investment for 13 projects (£549m).

UKRPIF funding by discipline

1. All 43 projects supported by the UKRPIF during Rounds 1 to 5 have been categorised according to six different disciplines: Bio-medical, Engineering, High-value Manufacturing (HVM), Clinical Medicine, Fundamental Research, and Social Science. These six headings were selected to reflect the diversity of projects across the portfolio. One feature of the UKRPIF is that because the programme fosters collaborative partnerships, projects do not necessarily fit within academic disciplines. Many operate across academic departments to work with industry and/or charities and/or philanthropists.
2. The definitions of the six disciplines are as follows:

* *High-Value Manufacturing* covers projects where investment supports the application of leading-edge technical knowledge and expertise to the creation of products, production processes and associated services.
* *Engineering* projects are outside those focused on manufacturing but involving science and technology concerned with engines, machines and structures.
* *Clinical Medicine* projects are closely allied with front-line healthcare, supporting hospitals or other providers as they diagnose, treat or prevent disease.
* *Bio-medical*projects foster translational activity (often with pharmaceutical companies) bridging the gap between research and clinical outputs.
* *Fundamental Research* facilities support experimental or theoretical work to acquire new knowledge. Fundamental breakthroughs in science can ultimately impact industry and society. This type of research also tends to operate in a longer time frame and so complements the more short-term commercial R&D outside of academia.
* *Social Science* projects study society in the broadest sense and the interpersonal relationships of individuals as members of society. The research can be interdisciplinary in nature taking insights from other disciplines.

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| Table 2: Funding by UKRPIF round | | | | | |
| **Round** | **UKRPIF Funding (£m)** | **Co-investment (£m)** | **Total** | **UKRPIF Funding**  **(%)** | **Co-investment (%)** |
| 1 | 186 | 549 | 735 | 25% | 75% |
| 2 | 115 | 339 | 455 | 25% | 75% |
| 3 | 65 | 164 | 228 | 28% | 72% |
| 4 | 86 | 209 | 294 | 29% | 71% |
| 5 | 230 | 466 | 695 | 33% | 67% |
| Total | 681 | 1,726 | 2,407 | 28% | 72% |
|  | **Count of Projects** | **Count Share** | **UKRPIF Mean Value (£m)** | **Co-investment Mean Value (£m)** | **Co-investment to UKRPIF Ratio Mean** |
| 1 | 13 | 30.2% | 14.3 | 42.2 | 3.0 |
| 2 | 9 | 20.9% | 12.8 | 37.7 | 3.0 |
| 3 | 4 | 9.3% | 16.1 | 40.9 | 2.5 |
| 4 | 6 | 14.0% | 14.3 | 34.8 | 2.5 |
| 5 | 11 | 25.6% | 20.9 | 42.4 | 2.0 |
| Total | 43 | 100.0% |  |  |  |

Source: UKRPIF Co-Investment Profiles Rounds 1-5

1. A detailed breakdown of funding by the six disciplines is presented in Table 3. Annex C provides the full list of projects and how they were categorised into disciplines. There has been an increase in the number of disciplines covered by UKRPIF, with more recent rounds funding capital investment in social sciences, such as the London School of Economics (LSE) International Inequalities Institute and the University of Manchester’s Alliance Business School.

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| Table 3: Funding by discipline | | | | | |
| **Discipline** | **UKRPIF (£m)** | **Co-investment (£m)** | **Total (£m)** | **UKRPIF Funding (%)** | **Co-investment (%)** |
| Bio-medical | 135 | 324 | 459 | 29.4% | 70.6% |
| Clinical Medicine | 165 | 418 | 584 | 28.3% | 71.7% |
| Fundamental | 61 | 134 | 195 | 31.4% | 68.6% |
| HVM | 169 | 497 | 666 | 25.3% | 74.7% |
| Engineering | 109 | 268 | 378 | 28.9% | 71.1% |
| Social Science | 42 | 84 | 126 | 33.3% | 66.7% |
| Total | 681 | 1,726 | 2,407 |  |  |
|  | **Count of Projects** | **Count Share** | **UKRPIF Mean Value (£m)** | **Co-investment Mean Value (£m)** | **Co-investment to UKRPIF Ratio Mean** |
| Bio-medical | 7 | 16.3% | 19.3 | 46.3 | 2.5 |
| Clinical Medicine | 12 | 27.9% | 13.8 | 34.9 | 2.7 |
| Fundamental | 4 | 9.3% | 15.3 | 33.5 | 2.2 |
| HVM | 11 | 25.6% | 15.3 | 45.2 | 3.2 |
| Engineering | 7 | 16.3% | 15.6 | 38.3 | 2.4 |
| Social Science | 2 | 4.7% | 20.9 | 41.8 | 2.0 |
| Total | 43 | 100.0% |  |  |  |

Source: UKRPIF Co-Investment Profiles Rounds 1-5

UKRPIF funding by capital expenditure category

1. The funds provided to HEIs under UKRPIF can be used for any of the following purposes:

* The refurbishment of buildings used for research;
* The construction of new research premises;
* The replacement, renewal or upgrading of equipment used for research;
* A combination of the above.

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| Table 4: Funding by Capital Expenditure Category | | | | | |
| **Category** | **UKRPIF (£m)** | **Co-investment (£m)** | **Total** | **UKRPIF Share of Total** | **Co-investment Share** | |
| PBB | 452 | 1,219 | 1,672 | 27.1% | 72.9% | |
| Equipment | 11 | 23 | 34 | 33.2% | 66.8% | |
| Refurb | 33 | 82 | 115 | 28.8% | 71.2% | |
| PBB/Equipment | 130 | 283 | 413 | 31.5% | 68.5% | |
| PBB/Refurb | 12 | 32 | 44 | 27.3% | 72.3% | |
| PBB/Refurb/Equipment | 32 | 67 | 100 | 33.3% | 67.4% | |
| Equipment/Refurb | 10 | 20 | 31 | 33.3% | 66.7% | |
| Total | 681 | 1,726 | 2,407 |  |  | |
|  | **Count of Projects** | **Count Share** | **UKRPIF Average (£m)** | **Co-investment Ave (£m)** | **Leverage Ratio** | |
| PBB | 28 | 65.1% | 16.2 | 43.6 | 2.9 | |
| Equipment | 1 | 2.3% | 11.4 | 22.9 | 2.0 | |
| Refurb | 2 | 4.7% | 16.5 | 40.8 | 2.5 | |
| PBB/Equipment | 8 | 18.6% | 16.2 | 35.4 | 2.2 | |
| PBB/Refurb | 1 | 2.3% | 11.9 | 31.7 | 2.7 | |
| PBB/Refurb/Equipment | 2 | 4.7% | 16.2 | 33.5 | 2.1 | |
| Equipment/Refurb | 1 | 2.3% | 10.2 | 20.4 | 2.0 | |
| Total | 43 | 100.0% |  |  |  | |

Source: UKRPIF Co-Investment Profiles Rounds 1-5

1. The breakdown of UKRPIF funding by capital investment category is shown in Table 4. Most funded projects are purpose-built buildings (PBBs), accounting for just under two thirds of projects. Additionally, the total capital spend on PBBs was significantly greater than the other categories, accounting for 66% of the total UKRPIF spend, compared with 5% for refurbishment only.

UKRPIF projects by region

1. Figure 4 disaggregates UKRPIF by region (with the number of projects within each region given in brackets). The spread of the UKRPIF is wide with many regions having an HEI benefitting from UKRPIF in the five rounds. One region (North East England) has not received funding in the five rounds. There is a notably higher level of co-investment in London.
2. Figure 5 aggregates the English regions to show allocations by country (with the number of projects within each country given in brackets).
3. Figure 6 shows a map of UKRPIF-supported HEIs and the number in brackets denotes the count of projects per HEI. The map demonstrates that the selected case studies have good regional spread and one is from a devolved administration.

Figure 4: UKRPIF allocation by region

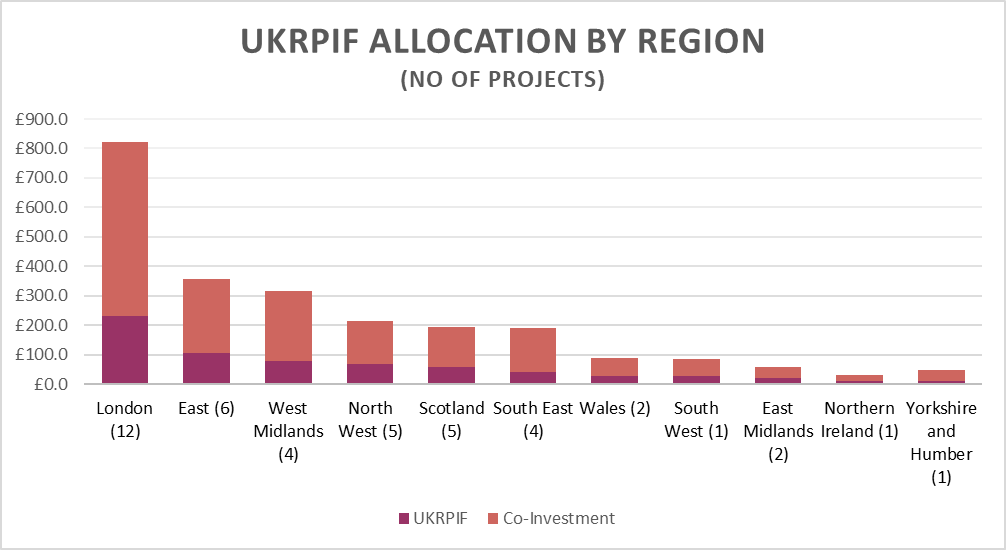
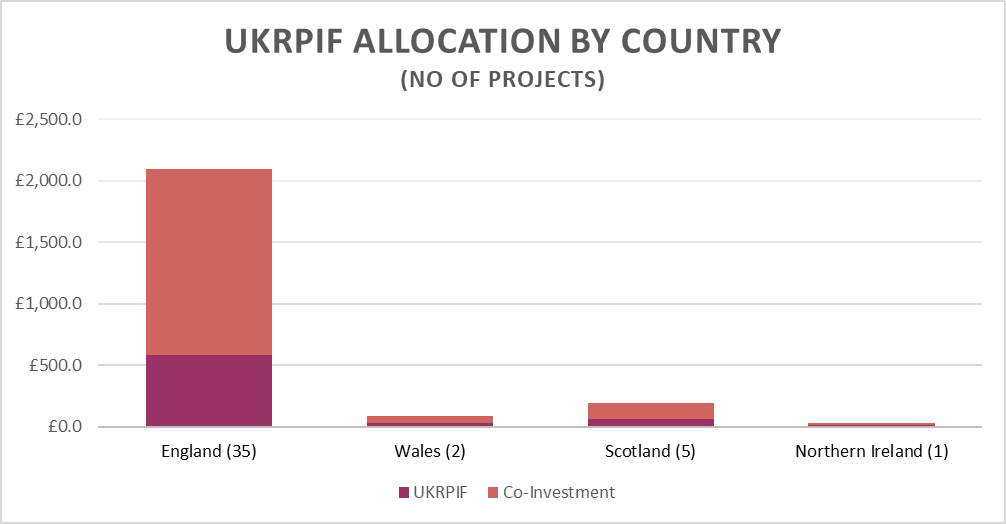


Figure 5: UKRPIF allocation by country



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| Figure 6: Map of HEIs receiving UKRPIF and case study selection | | |
|  | **Centre for Translational and Interdisciplinary Research:** The University of Dundee has a reputation for research in the Life Sciences, interdisciplinary working and the translation of discoveries into healthcare solutions. The new centre combines multiple scientific disciplines to tackle system-level problems in biology, drug-discovery, medical informatics and healthcare. **UKRPIF:** £11.6m, **Match Funding:** £26m |
| **High Temperature Research Centre:** The HTRC is a unique world-class casting, design, simulation and manufacturing research facility established by the University of Birmingham in partnership with Rolls-Royce. The centre aims to deliver world-class fundamental and applied research programmes focussed around underpinning materials research, radical process improvements and predictive processing modelling. **UKRPIF:** £20.0m, **Match Funding:** £40.3m |
| **Maxwell Centre:** The Maxwell Centre aims to be a focal point for collaboration between industry and the university’s research in the physical sciences. The building, located on the West Cambridge Science and Technology campus, aims to facilitate innovative research and allow research scientists from industry and the university to work alongside each other. **UKRPIF:** £21.0m, **Match Funding:** £42.1m |
| **King’s College Cancer Centre:** The project forms part of the King’s Health Partners’ strategic plan, which identified the need for funding to establish the centre and hub by 2016. The centre is expected to benefit from other investments already made in the TSB Cell Therapy Catapult. **UKRPIF:** £15.0m, **Match Funding:** £32.6m |
| **5G Innovation Centre:** The University of Surrey, working with industrial partners, has built an international centre for future generational mobile broadband, internet and communications research. **UKRPIF:** £11.6m, **Match Funding: £**23.3m |

Co-investment matching the UKRPIF funding

1. The monitoring data allows some analysis by type of co-investment. A key measure is the ratio of co-investment to UKRPIF funding. This shows that for every £1 of UKRPIF funding, a further £2.45 is leveraged from co-investment partners. This does not include additional co-investment leveraged during the post-award period.
2. Table 5 summarises co-investment by main source of funding. Projects where the main funding was derived from industrial partners had the largest amount of co-investment with £982m committed from private industry sources.
3. Charitable funding is a broad category, and it is useful to be able to identify mission-led co-investment from philanthropic support for research. Therefore, Table 5 splits charitable funding between “Charity” and funding models where co-investment came from a philanthropist, usually with a strong, longer-term mission associated with the individual “Philanthropy”. Philanthropy also includes endowments.

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| Table 5: Funding by Co-Investor Type | | | | | |
| **Co-investor Type** | **UKRPIF (£m)** | **Co-investment (£m)** | **Total** | **UKRPIF Funding (%)** | **Co-investment Funding (%)** |
| Philanthropy | 176.3 | 415.8 | £592.1 | 30% | 70% |
| Industry | 372.5 | 981.8 | £1,354.3 | 28% | 72% |
| Charity | 132.4 | 328.6 | £461.0 | 29% | 71% |
| Total | 681 | 1,726.2 | 2,407.4 |  |  |
|  | **Count of Projects** | **Count Share** | **UKRPIF Mean Value (£m)** | **Co-investment Mean Value (£m)** | **Co-investment to UKRPIF Ratio Mean** |
| Philanthropy | 11 | 26% | 16.0 | 37.5 | 2.41 |
| Industry | 24 | 56% | 15.5 | 40.9 | 2.73 |
| Charity | 8 | 19% | 16.5 | 41.1 | 2.78 |
| Total | 43 | 100.0% |  |  |  |

Source: UKRPIF Co-Investment Profiles Rounds 1-5

1. Analysis of the co-investment so far has referred to funding committed to the projects as per the original bid documentation (and any subsequent revisions communicated to HEFCE). However due to the collaborative nature of UKRPIF projects, additional co-investment from third party sources is often received during the life-cycle of the project. Improvements to research facilities also lead to additional R&D awards and income from other public funding streams. So far twelve projects (out of the 43) have already met their double-match funding requirement of the UKRPIF programme, with all twelve projects leveraging additional co-investment from a) co-investors who had already previously committed funding to the project or b) new sources of investment.
2. Evaluating research infrastructure investment
3. The activities supported by UKRPIF can be categorised into two phases following OECD work (Griniece, 2015). The first is the “Construction Phase”, including the building, equipping, and/or refurbishment of research facilities. Then, there will be the “Operational Phase” when research is underway. This phased structure supports methods to evaluate investment impacts.
4. The direct and indirect benefits are categorised separately for these two phases. The direct impacts from the construction phase are, firstly, considered to be the technical and scientific knowledge applied during design and construction to finalising the new research facility. The construction may involve local companies, which leads to employment opportunities temporarily. Upskilling of administrative personnel managing the grants and project delivery can also occur.
5. The activities during the construction phase may lead to further indirect economic impacts as there can be a significant multiplier effect on the local economy. Direct suppliers of the newly created research facilities will stimulate more economic activity further down the supply chain by intra-industry purchases. These, in turn, may create jobs in other industries as their workers spend money in different areas of the economy. In cases such as the Surrey 5G Innovation Centre the infrastructure provided offered opportunities for smaller companies to benefit from integrated supply chains and a demand for the services and technologies they could offer.
6. Finally, to construct new research facilities, novel and innovative design, building and equipment solutions are required as part of the criteria for funding. Local companies can benefit from accumulated know-how and complementary skills that expand their competitive advantage in other markets (e.g. enable winning international procurements of similar research facilities).

Creating a logic model for the UKRPIF

1. Figure 7 presents a logic model for the UKRPIF. A logic model indicates how overall outcomes – at the right of the figure – follow a causal chain from inputs to outputs. The usefulness of the logic model is that it can then be used to understand potential metrics at different stages in a project. Some metrics are tabulated in Table 6.
2. The evaluation built on the research of Griniece et al (2015) to draw up an initial model that split the lifecycle impacts expected into construction and operational phases, noting that the benefits of the operational phase are more numerous and complex than those of the construction phase. Impacts associated with the operational phase may start to appear during the construction phase and there is not always a clear split that aligns with delivery of the project. But conceptually, the benefits from the second phase can be categorised into the following:

* *Direct economic impacts:* Benefits from the capital investment operation derive from the performance of the infrastructure, the services provided and how optimally the equipment is used. The maintenance and operation of a research facility has longer-term effects on employment in HEIs and companies, such as additional jobs for scientists, technicians, and administrative and support personnel. The increase in staff and student recruitment is a major benefit of a capital investment for a research facility. Modern and/or innovative research facilities can attract and retain the best talent. This includes both local and international researchers, technicians and students.
* *Indirect economic impacts:* These activities have a multiplier effect on the local economy and relevant supply chains. However, the multiplier effect may reflect displacement spending i.e. increased spending in one HEI research facility due to one-part UKRPIF funding in research facilities will simply displace spending (or reduce it) in another HEI which does not receive any support.
* *Research impacts:* The new research infrastructure facilitates research, building on the co-investment from industry and non-industry partners. The partners would seek to use the research in delivering new products/services or improving products and services. There may be additional co-investment or research involving those beyond immediate partners, with research shaping industry approaches or standards. Beyond impacts on industry and production, the research would also be expected to enable wider community benefit by informing government policy and areas of practice such as health.
* *Innovation impacts:* Investment into science infrastructure may create spin-out companies, start-ups, new patents and R&D leading to increased levels of technical absorption from industry. However, if the local academic and industrial environment does not lead to sufficient levels of absorption capacity from the newly developed skills, then there is no increase in human capital from the programme.
* *Impact on research excellence and social capital:*Accumulation of new knowledge, publications in internationally renowned journals, and the UK being recognised as a centre of research excellence are potential impacts from the capital and recurrent funding. An important aspect is the development of research collaborations and collaborations with users of research to support innovation and growth. As a result, formal and informal social networks are nurtured thereby increasing knowledge sharing. In sum, the newly formed human capital requires social capital to be effective and build on existing research excellence.
* *Other non-market impacts:*The non-market impacts of investment in research infrastructure are externalities which affect wider society without this being reflected in the value of the capital investment. The newly funded infrastructure can impact the health and well-being of third parties living close to the development or further afield, for example, from increased congestion, noise, air pollution, or from the development of medicines and vaccines. Additionally, the new facilities can impact the availability of natural resources, energy and water use and waste generation, habitats, biodiversity and ecosystems.

1. When assessing the emerging outputs, the indicators can be both quantitative and qualitative. By the time of this study, 21 of the 43 UKRPIF-funded projects had reported completion. Therefore, while operational phase outputs were still emerging, some of the construction phase ones could be discerned. To some extent, the focus of OECD work on very large international scientific facilities means evaluations emphasise the construction phase. UKRPIF investments are innovative, but their smaller scale means the departures from best practice in construction are more modest. Most projects reported that, rather than the buildings and equipment they procured being innovative in themselves, it was the setting up and optimising of the different parts that was highly innovative.
2. This motivates a key feature of the logic model for UKRPIF, departing from Griniece et al (2015): the potential outcomes due to changes in how research facilities operate, as the significant investments allow redesign. UKRPIF projects have often viewed the investments as an opportunity to enable collaboration across disciplines and with industry, or to optimise their buildings and equipment to conduct research at scale. Investments have enabled research to replicate facilities seen in industry, or to locate research nearer to delivery, or to create environments that ease the translation of research excellence into commercial or societal outcomes.

Figure 7: Logic of the UKRPIF

Table 6: Suggested KPIs and metrics for evaluation

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| **Evaluation Area** | **Key Performance Indicators** | **Collection and Measurement** |
| **Research Outputs** | Standard measurements of research outputs and excellence, e.g. publication volumes, quality, citations. | Relevant data generally collected as part of standard reporting and submissions for Research Excellence Framework (REF)  **Source:** Institutional monitoring systems |
| **Operating Model** | Co-location of researchers with inter-disciplinary focus  Translating research outputs into industry/delivery due to co-funding | Core factor, and can be project specific. Since it is a ‘softer’ and often qualitative measurement it will need to be covered by interviews and consultations.  **Source:** Qualitative insights from departments |
| **Collaborative Space** | Networking events: Footfall  Networking events: Industry partners  Hot-desking and use of space by partners | Relevant data generally collected as part of standard reporting. It is noted that there may be no counterfactual, as the events started with the investments.  **Source:** Institutional monitoring systems |
| **Equipment & Facilities** | Uptake of equipment & facilities by internal researchers, external researchers and/or by industry | Facilities management systems could provide facilities usage data. This then needs some analysis of quality, and benchmarking relative to comparable international centres may be used. Quality may be determined by evidence of innovation in the equipment set-up, which could create intellectual property (IP). Social science projects are less likely to be using such a model since they may be more focused on ‘co-creation’.  **Source:** Institutional monitoring systems |
| **Commercialisation and Spin-Outs** | Marketable products rolled out  Patent applications  Time-scale to market  Revenues from IP | Engineering-focused projects use technological readiness levels (TRLs) and similar manufacturing measures; clinical researchers report on progress in terms of progress to trials. Marketable products and patenting are less likely to be relevant for social science projects.  **Source:** Institutional monitoring systems |
| **Capacity Building and Staffing** | PhD students recruited, other staffing  Staff seconded from academic/public partners, from industry partners | Relevant data generally collected as part of standard reporting, but it is unlikely that purely data-driven analysis would be able to prove additionality.  **Source:** Institutional monitoring systems |

Evaluating social science projects

1. The early UKRPIF projects focused on STEM disciplines. This meant the case studies, which were selected from completed projects, did not include the more recent social science investments. The Alliance Manchester Business School (AMBS), a recent UKRPIF investment at the University of Manchester, was consulted to sense-check approaches for the full impact evaluation. It was expected that this would highlight potential differences in partnerships and research outputs between social science-focused research and infrastructure investments, and STEM-focused ones.
2. AMBS is a business school that takes a cross-departmental approach to research. The UKRPIF funded investments are the Data Lab, the Behavioural Change laboratory and state of the art facilities that can host collaborative research events. The funding has – unlike most of the STEM focused projects – been matched through a number of donations from philanthropists than a single co-investor.
3. The route to additional impact is similar to STEM-focused projects. The investments enhanced facilities, with the large, single capital spend meaning the development of innovative facilities that otherwise would not have been developed as a single, coherent project. The leveraged co-investment was more likely to focus on research use of the facilities, and it was noted that social science research generally consists of more incremental small- or medium-sized projects rather than funding for multi-year, large groups.

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| **Identifying and Measuring Outcomes** | |
| **Changes to the Operating Model** | The changes are similar to STEM-focused projects, and facilities alter and enhance the way academics and industry interact by way of co-location. In the future it will be of interest to attempt mapping of the networks and human capital generated. |
| **Uptake of Equipment and Facilities** | A revenue-generating model where premises and equipment are rented out to commercial partners is likely to be less appropriate for social science-focused infrastructure investments as most businesses use the facilities in a co-creation context. Measuring uptake of facilities through income derived from rental of facilities/equipment is therefore unlikely to be helpful. |
| **Innovative Nature of Facilities and Equipment** | Contrasting with STEM focused investments in materials and advanced manufacturing, innovation in social science projects such as those run by AMBS lies in the use of the equipment and facilities rather than in the equipment itself. The equipment employed is largely “off the shelf”, and the scope for innovations is in the algorithms and modes of deployment. |
| **Commercialisation and Spin-Outs** | A hard metric for marketable products rolled out is not likely to be a suitable measurement of success as a lot of operations and research evolve around softer areas of work, talking to companies about improvement of processes and services to boost their productivity. However, there is scope for spin-outs growing out of the interdisciplinary nature of business schools. |

1. As with STEM-focused projects, the deadweight is difficult to assess, and measurement and attribution of impacts is complex due to the timescales and nature of work (which is often consultative). However, metrics such as tracked business engagement and benchmarking against similar projects in other departments provide useful points of comparison. AMBS reports on outcomes in line with the STEM-focused investments. Key outputs include publications, partnerships and recruitment. Further, in line with overall findings of UKRPIF projects, the accessibility and attractiveness of the premises to industry along with co-location of staff were central to project design.
2. A departure noted by ABMS from STEM projects was that outcomes would often involve policy influence, partnering with local, national and international government and policy-making stakeholders. The links with industry, especially SMEs, then may also be shaped around the policy levers that the social sciences seek to influence.
3. Emerging UKRPIF outputs
4. The emerging outputs have been analysed for the 15 projects that have returned a project completion report to HEFCE and the five projects selected as case studies. Each output was categorised into the following different themes: changes in operating models, impact on market readiness, research outputs (such as papers, patents and licences), student numbers, impact on collaboration with universities, impact on collaboration with industry, and impact on start-up companies/spin offs.
5. The quantitative evidence is not yet mature enough to assess the long-term impacts and the additionality of impacts. However, the case studies highlighted many early outputs and expected impacts and supported the analysis of management information and investment data to explore the way impacts are developing that might be measured in a full, future evaluation.
6. The research uses a mix of case studies and review of the early outputs reported by projects to HEFCE in monitoring. Firstly, the case study findings corroborate the analysis of MI, that the UKRPIF is meeting the objectives to enhance research facilities. Secondly, the case studies provide evidence of operational change, innovative research practices and partnership structures. The analysis of management information and private sector investment leveraged highlight the role of the UKRPIF in encouraging strategic partnerships between HEIs and other organisations, and the consultation with stakeholders from institutions and industry partners complemented these findings, highlighting new opportunities for collaboration and co-location.
7. Additionality has been explored at various levels to assess the extent to which projects and investments might have gone ahead without UKRPIF support: would the HEIs have used other funding available to them and would private sector actors have been willing to provide enough finance for the investment, without the grant. An interesting area highlighted is that the structure of the UKRPIF, and the requirement for co-investment, means that larger investments can be made joining up streams of finance, coordinating activities around strategic considerations and drawing in collaborators. Case study interviews picked up that the coordination involved and the size of funding delivered meant that a scale of investment was possible which otherwise would have been difficult. This was considered crucial by stakeholders and end-users, and funding that could have been obtained through alternative sources would otherwise have been for piece-meal investment and isolated research projects.

Changes to operating models

Co-locating the King’s College London (KCL) Research and Innovation Hub in Cancer (RIHC) with NHS delivery

The RIHC, also called the ‘Innovation Hub’, has used the UKRPIF grant and leveraged co-investment to embed research into patient pathways.

The hub co-locates research facilities, such as an expanded biobank of cancer samples, with clinical activity. It occupies a floor of the newly built Guy’s and St Thomas’ Hospital Trust Cancer Centre, which is also the main co-investor. The hub is an open-plan design equipped with state-of-the art equipment, extensive biobanking facilities and hot-desking areas to encourage interaction between teams. The premises have been developed to foster collaboration and harness innovative ideas.

This has reduced equipment duplication, freeing up capital resources to purchase additional equipment. The centralisation of equipment has also provided efficiencies for the teams conducting clinical trials. Trials team members also have hot-desks in the hub facilitating their interaction with the biobank and researchers, and perceive efficiencies both in finding clinical principal investigators and engaging in ongoing dialogue with biobankers regarding techniques and feasibility in trials.

The location of the hub itself within the Cancer Centre has also created opportunities through routine interaction with the activities on the other floors, and the lease of the top floor to HCA healthcare UK has connected academic activity and private healthcare resulting in training and partnering opportunities currently being explored.

1. A feature of the UKRPIF is its funding of capital investment on a scale to create facilities. The projects involve changes to operating models and the way research is undertaken. These changes have taken place across three broad dimensions. Firstly, there has been the replacement of dispersed research equipment, spread across research groups, by single, open labs. Secondly, there has been an enhancement of equipment, optimising it to meet research needs and often integrating automation. A final impact has been the design of facilities to improve collaboration to translate research findings into prototypes and marketable products.
2. Across the case studies the investment had enabled funding of premises that brought research teams together from different parts of the research institutions. This often coincided with co-location with industry representatives and partner employees. The co-location of staff and partners had important implications for the way research equipment could be sourced and procured, and in cases such as the Maxwell Centre and KCL’s Cancer Innovation Hub the sharing of machines across teams became an integral part of the new operating models. Further, the integration of teams from across departments and across academic/industry partners breaks down boundaries of knowledge. Researchers and users of facilities noted the informal mode of working and opportunities to discuss ideas and concepts in a non-pressurized environment.
3. These new modes of working harness best practices in innovation, as staff with higher degrees of discretion to solve complex problems have been demonstrated to have a positive impact on organisations’ capacity to innovate (Greenan and Lorenz, 2009). In many ways, the structures developed are those of ‘learning organisations’, where new patterns of work and thought are nourished. A driver has been optimising equipment and joining individual pieces together in new ways, often underpinned by automation and large-scale data processing facilities. In the Centre of Translational and Interdisciplinary Research (CTIR), facilities for drug discovery and the analysis of proteins require automation so that research can be at scale, such as repeatedly testing potential candidate molecules for future pharmaceutical products. The UKRPIF has also funded the large-scale computing equipment and software, with the data processing systems themselves being innovative and becoming an output, sold to both university-based and private researchers that produce vast quantities of data.
4. The case studies considered how, following the investments, the facilities compared with other similar centres in the UK and abroad. The investments were regarded as significantly raising the sophistication of work that could be undertaken, with all centres citing only a handful of comparable institutions globally in their research area. In the Dundee study, drug discovery capabilities are benchmarked across research, verifying the centre as high in drug discovery facilities.

Impact on market readiness

1. Four projects recorded an impact on the readiness of research for use by consumers and society from the capital investment. Their outputs are summarised in Table 7, technological advancements are characterised in terms of TRLs and clinical trial phases, as used in pharmaceutical product development. TRL is a technology management tool that provides a measurement to assess the maturity of evolving technology. It is measured on a scale of 1 to 9 where a high number indicates a technology is ready for market, while low numbers are associated with more conceptual work. In medical treatments, there are five phases to trials, zero to four. As a project progresses to the next phase, a treatment is closer to being suitable for use and the testing is occurring in frontline delivery.

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| Table 7: Impacts on market readiness | | | |
| **HEI** | **Project** | **Output**  *The direct results of project activities.* | **TRL/Phase** |
| University of Surrey | 5G Innovation Centre | Technical breakthrough: 1TB per second data rates on future 5G networks | TRL 4 |
| University of Birmingham | High Temperature Research Centre | One of the primary goals is to shorten the time from design to make of development components: first programme achieved 13 months to deliver test hardware, a process that would have typically taken 24 months before. | TRL 4 |
| Brunel University | National Structural Integrity Research Centre | Four early-stage technologies validated to proof of concept and under consideration for follow on development with industrial partners | TRL 3 |
| University of Oxford | Target Discovery Institute | HIF prolyl hydroxylase inhibitors now in phase 3 clinical trials for anaemia | Phase 3 |

Source: Project Completion Reports

From research to market ready products at the High Temperature Research Centre (HTRC), University of Birmingham

The University of Birmingham and Rolls-Royce have jointly established the HTRC to create a unique world-class casting, design, simulation and manufacturing research facility. The scale and quality of the development are already yielding results, and the centre can demonstrate new manufacturing capabilities that significantly reduce the time to design and manufacture components for engine development programmes. The key to raising the technology readiness level at which research works has been equipping the centre to the level of a Rolls-Royce plant, with considerable input from Rolls-Royce. Research can quickly be tested in manufacturing processes, without disrupting the highly automated production processes of an operational plant.



The centre has sped up the process to develop components for demonstrator machines and the first HTRC programme achieved 13 months from start of design to delivery of test hardware. It has also allowed new training opportunities, with apprentices, Rolls-Royce staff and researchers co-located and working together within a facility that can operate at significant scale.

1. For example, the Target Discovery Institute at the University of Oxford is well underway in developing a drug as it is entering a phase 3 clinical trial. This development pre-dates the construction of the new facilities, but the newly built research facility should be instrumental in conducting the trial. Other technologies are at lower readiness levels such as at the National Structural Integrity Research Centre (Brunel University) which has validated several technologies to proof of concept (TRL 3) and awaits further development from industrial partners.

At this early stage of the evaluation, qualitative evidence gathered through the case studies was important to inform an understanding of the impacts to date and likely development going forward. Crucially, the terminology and conceptualization around translational research and project life-cycles vary between disciplines, and because of the variety of research areas and sectors represented in the projects, stakeholders consulted framed their work in different ways. For instance, professionals and academics engaged in High-Value Manufacturing and Engineering (Telecommunications) readily thought of their research output in terms of TRLs, whereas academics engaged in fundamental and bio-medical research tended to use a vocabulary of translational research instead. Academics operating in clinical medicine unsurprisingly thought of their work in terms of stages of trials.

1. The consensus was that the infrastructure – both physical and intellectual – had contributed to speeding up the process whereby initial research proposals were transformed into tangible outputs that could be tested and taken up for practical use.

Impact on research outputs

1. Nine of the projects reported a discernible positive impact on research outputs and these are presented in Table 8. The type of research outputs ranges from academic and policy white papers to licences and patents. Several academic publications have been produced from three of the new projects, although judging their quality is not possible from analysing the management information alone. In the case study evidence, research leads reported their publications plans were on track. As the facilities were new and advanced, it was expected that research outputs would be published in high impact journals.

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| Drug discovery at the Centre for Translational and Interdisciplinary Research (CITR), Dundee  The CTIR established in the University of Dundee’s School of Life Sciences translates research discoveries into healthcare solutions. The UKRPIF investment has doubled the centre’s drug discovery capability and has allowed the Drug Discovery Unit (DDU) to expand its activities, with candidate drugs for preventing and treating malaria reaching clinical trials in 2017.  The centre fills an important role in de-risking the path from research to drugs, and has a specific strand to develop the evidence about molecules emerging from academic research to a more mature level.  Work is often for researchers outside of Dundee, recognising that the level of capability in the centre is not common outside the pharmaceutical companies.  The number of drug discovery projects in the DDU has doubled since the award, as capacity has been increased and bottlenecks removed from processes to test candidate drugs. |
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1. Publications and intellectual property
2. Intellectual property (IP) rights in the form of patents or licences show the potential for innovations to be commercialised either by the facility itself or by potential industrial licensees and/or private partners. Only one registered patent has been reported in the MI[[3]](#footnote-3), but two other projects reported that they expect to register some soon.
3. Case study interviews also reveal that projects have produced registered IP (e.g. Surrey). The partnership between Rolls-Royce and the University of Birmingham at the HTRC is on track to register several patents, especially in innovations in tooling associated with the advanced facilities that have been established in the centre.

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| Table 8: Impact on research outputs | | |
| **HEI** | **Project** | **Output** |
| University of Surrey | 5G Innovation Centre | Publish White Papers to provide thought leadership for policy |
| Swansea University | Energy Safety Research Institute | 20 papers published since facilities operational |
| University of Birmingham | High Temperature Research Centre | 20 research projects completed or underway |
| University of Glasgow | Clinical Research Facilities for Stratified Medicine | IP related KPIs and outputs linked to academic and industry spinouts |
| University of Manchester | Paterson Institute for Cancer Research | IP and patenting expected to be affected positively: double invention disclosures, licensing, patents and commercial partnering for new diagnostic |
| Queen’s University Belfast | Institute of Health Sciences | Three patent or licensing applications under consideration aiming to develop new vaccines, a new treatment for preeclampsia and a new biomarker for diabetic complications |
| University of Southampton | Experimentation Facilities in Engineering Science | Publication of conference and journal papers using facility |
| University of Strathclyde | Continuous Manufacturing and Crystallisation Research for Pharmaceutical Products | High quality peer‐reviewed scientific publications and conference reports disseminating the research outcomes. Target exceeded: 1 patent and licence |
| Brunel University | National Structural Integrity Research Centre | 37 academic publications generated by NSIRC students to date |

Source: Project Completion Reports

1. Standard-setting and thought leadership
2. An important aspect in the development of an innovative research base has been the aim to establish the UK as a leader in setting of international technology standards. Alongside patents and registered intellectual property, industrial and academic partnerships are involved in global endeavours to harmonise underlying technologies or processes through standard setting bodies.

Standard Setting at the 5G Innovation Centre (5GIC), University of Surrey

The 5GIC hosted by the University of Surrey is at the forefront of standard setting and innovation in 5G and the Internet of Things (IoT).

[](https://www.surrey.ac.uk/5gic/members)

Nationally, the Centre provides input into UK 5G policy via the Future Communications Challenge Group, and internationally it has contributed to the setting of common international standards. Its staff has set up two standards group with the European Technologies Standards Institute (the 5GIC Strategic Advisory Board sub-group, and the Standards Strategy Group), and the Centre recently established new Industry Specifications Groups (ISGs) on Next Generation Protocol and Broadcasting/Mobile.

The UKRPIF grant was vital in enabling the Centre to position itself as a leader. The funding signalled government commitment and acted as a catalyst for national and international industry partners to make strategic investments in 5G technology, making Guildford the *“place to be”* in Europe, influencing the international agenda on research and standards.

1. Such outputs can play an important part in research leadership and the commercialisation of research. Firstly, the research for setting standards is high quality, often reviewing across technologies with a high complexity. Secondly, by UK research institutions being involved in standard setting, the researchers and companies working in the institution become early adopters and benefit from access to the future direction that a technology may take. The impact will be hard to measure, being long-term and often delivered through influence and engagement, rather than formal research outputs.

Impact on collaboration with HEIs

1. Table 9 tabulates the impact on collaborations with other HEIs. The projects all report positive impacts on such partnerships, although the data available from monitoring and completion reports often lacks qualitative information on the nature of these collaborations. The case study on the Centre for Translational and Interdisciplinary Research (CTIR) provided insights about how its facilities, the equipment-related expertise in the centre and research excellence have underpinned new collaborations.

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| Table 9: Impact on collaborations with HEIs | | | |
| **HEI** | **Project** | **Output** |
| University of Manchester | Multidisciplinary Characterisation Facility (MCF) | Researchers are free to move between three universities (Cambridge, Imperial, Illinois Urbana-Champagne) and use MCF |
| University of Swansea | Energy Safety Research Institute (ESRI) | ESRI has initiated a new research collaboration with University of South Wales and Cardiff University (FLEXIS) |
| University of Dundee | Centre for Translational and Interdisciplinary Research | Four new strategic partnerships with HEIs (University of Aberdeen, University of St Andrews, University of Glasgow and University of Edinburgh)  Three new strategic partnerships with overseas HEIs (Boehringer Ingleheim Venture Fund (BIVF), Ascenion and the University of Tübingen) |
| Brunel University | National Structural Integrity Research Centre | Network of 23 HEIs including international collaborations with:  • Tianjin University, China,  • Universiti Teknologi Malaysia,  • Universiti Kuala Lumpur, Malaysia  • Kaunas University of Technology, Lithuania  • Pusan National University, Korea |
| University of Strathclyde | Continuous Manufacturing and Crystallisation Research for Pharmaceutical Products. | Eleven new academic collaborations. Five international collaborations |

Source: Project Completion Reports

Impact on collaboration with industry

1. The altered operating models and provision of facilities that encourage and facilitate collaboration has fostered networks and brought in industrial engagement in various forms. This resonates with current trends that are increasingly seeing innovation as being driven by knowledge and resources outside the firm, rather than being generated from within (NCUB, 2012).
2. Larger companies, such as Rolls-Royce, carry out research in-house, but are increasingly relocating these activities into universities. Strategies employed to overcome barriers between corporate researchers and academic collaborators include employment of research students as interns and secondees, as well as other technology transfer strategies. This brings innovation out of the laboratory and to the attention of commercial interests.
3. The case studies also highlight how integrating research into production processes in a timely manner needs the research to be tested in operational settings. HTRC has been able to replicate almost all the equipment of a working plant in the centre, allowing both academic and industry researchers to test ideas as if in a factory. This means researchers can develop their innovations to higher levels of manufacturing readiness without going to a plant, where disrupting operations may be expensive.

Industry engagement at the Maxwell Centre, University of Cambridge

Since it opened April 2016, the Maxwell Centre has hosted a series of events introducing local and national industry stakeholders to the materials research undertaken by the teams making use of the space and equipment on site. The centre has posited itself as a ‘facilitator’, providing a platform for collaboration and presenting the University’s work to external actors.

The Centre is plugged in with the Cambridge Network of businesses, and works with the network to organise industrial seminars where researchers present their work, offer workshops for academics and industry representatives, and organise the flagship Annual Research Showcase. The events attract significant interest, and the data services day attracted 80 individuals from 44 different companies.

The premises host a comprehensive infrastructure and suite of devices that can convert early research to products that can be manufactured, and function as a first port of call for external actors. Current collaborations include Jaguar Land Rover, BAE Systems, and ARM as well as smaller tech SMEs.

The Centre operates a hot-desking system in conjunction with a scheme that leases out equipment provided through the Royce Institute, co-locating researchers and industry representatives. By 2017 the number of full- and part-time residents of the office space amounted to 27 individuals representing 11 companies.

[](https://www.maxwell.cam.ac.uk/our-vision)

1. This need for research to be able to test innovations in an operating environment is common across the case studies. For drug discovery, high-value manufacturing and engineering/telecommunications, there is increased automation in the operational settings making it less convenient to test research outputs.

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| Table10: Impact on collaboration with industry | | | |
| **HEI** | **Project** | **Output** |
| University of Manchester | Multidisciplinary Characterisation Facility | Three partnerships with BP |
| University of Surrey | 5G Innovation Centre | Company membership of centre increased to 58 within two years. New partnerships with non-telecoms companies (McLaren, NPL, Ordinance Survey). Collaborate with Digital Catapult, which seconded full-time employee to 5GIC. Membership scheme operates on different tiers: £145 for SMEs, up to £60,000 p.a. for "platinum" members, free for academics by invitation |
| University of Birmingham | High Temperature Research Centre | Secured Rolls-Royce investment of initially c.£15M over 5 years into UK R&D in investment casting and development to be undertaken in the new institute. Already extended by £6M and 2 years |
| University of Cambridge | Maxwell Centre | Attracted interest from industry, ranging from start-ups and SMEs to multinationals |
| Imperial College London | Imperial West Technology Campus | Co-location of three multinational businesses |
| University of Dundee | Centre for Translational and Interdisciplinary Research | Nine new collaborations with pharmaceutical companies |
| University of Strathclyde | Continuous Manufacturing and Crystallisation Research for Pharmaceutical Products | Ten recruits into industry |

Source: Project Completion Reports

1. Table 10 presents impacts on collaboration with industry by project using more quantitative data. A limitation with the reported data is that it is not possible to make a qualitative judgement whether the development of more industry collaborations is fostering knowledge sharing and leading to more innovation and growth. The easy-to-measure aspects of collaborations, such as number of partnerships, number of projects and extent of staff exchange provide a good insight into the level of collaboration, but probably insufficient to measure all the complexity of the impacts.

Impact on start-up/spin-out and SMEs

1. Four projects noted positive developments, summarised in Table 11. One start-up company is in the process of establishing itself alongside an industry partner to commercialise a technology developed within the UKRPIF-funded facility. Other impacts involve increased knowledge transfers, technology adoption and engagement with private companies.

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| Table 11: Impact on start-up/spin-out and SMEs | | | |
| **HEI** | **Project** | **Output** |
| University of Swansea | Energy Safety Research Institute (ESRI) | ESRI is in process of creating a start-up company with an industry partner to commercialise technology developed within ESRI |
| Queen’s University of Belfast | Institute of Health Science | Increased knowledge exchange activity with two SMEs |
| University of Dundee | Centre for Translational and Interdisciplinary Research | Engagement with sixSMEs |
| University of Strathclyde | Continuous Manufacturing and Crystallisation for Pharmaceutical Products | Technological adoption by companies; sixexamples to date |

Source: Project Completion Reports

1. Case study findings likewise indicated that funded institutions are beginning to generate spin-outs, as individuals and teams are accessing state-of-the-art equipment and facilities. In all studies, some provision had been made to allow SMEs to be incubated, with the SMEs having strong research links to the academic centres. However, the project completion and procurement is still in a too early stage to get a reliable sense of magnitude.

Impact on student numbers

1. Evidence of the quantity, and indicating quality, of the students recruited because of the UKRPIF projects can be seen by the prevalence of industry sponsorship in two of the projects shown in Table 12 – the National Research Centre for Structural Integrity, and Experimentation Facilities in Engineering Science.

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| Table 12: Impact on student numbers | | |
| **University** | **Project** | **Output** |
| University of Swansea | Energy Safety Research Institute | Six post-doctoral research associates employed. Seven postgraduate research assistants recruited and all in line to complete |
| University of Birmingham | High Temperature Research Centre | Offers PhD studentships, and these are already under way. Also offers apprenticeships. University has invested an additional £2M in academic research and related staff |
| Queen’s University Belfast | Institute of Health Sciences | Recruitment of internationally recognised clinician scientists: five new staff.  Increased by 10 since 2012 and quantity of postgraduate students is currently 126.  Increased number of international postgraduate students by 9  Early indication that facilities attract better quality students by their prior academic qualifications. Too early to measure their quality from their research output yet |
| University of Brunel | National Research Centre for Structural Integrity | To date 41 students have completed or are currently completing the MSc course, over 80% of whom were sponsored by industry for their major project. 83 NSIRC PhD students currently enrolled; 26 studentships being advertised |
| University of Southampton | Experimentation Facilities in Engineering Science | New doctoral training cohorts with industry sponsorship over next five years with focus on impact on UK GDP |

Source: Project Completion Reports

1. Conclusion

Emerging outputs

1. This report represents an early-stage evaluation of the UKRPIF and, as such, it should be recognised that many of the outputs are still emerging. Nevertheless, the report shows a promising early picture for the UKRPIF in terms of outcomes.
2. The first two UKRPIF objectives of enhancing research facilities in HEIs undertaking world-leading research and encouraging strategic partnerships between HEIs and other organisations active in research are being met in many ways:

* Fifteen funded projects have been complete for at least a year with innovative research already underway.
* Of those 15, nine state an impact in terms of more collaborations with other HEIs and/or industry. These include arrangements to allow the free movement of researchers between HEIs, co-location of multinational businesses or the use of the newly completed facilities by private companies.
* The third objective of stimulating investment in higher education research is also demonstrated by the additional co-investment leveraged to the projects from private and public funding sources.

1. The monitoring processes that are in place confirm that the co-investment is on track and that projects are not at risk of failing to meet the double match-funding criteria to date. Another promising development is that twelve of the projects have leveraged co-investment beyond what was stipulated in their original bids either from their original co-investors or new sources. The important matter of the “additionality” of this investment, as opposed to diverting resources from other research activity, cannot, however, be analysed through recourse to monitoring data alone.
2. Surveys and interviews shed light on the issue of additionality although they have limitations, and project leaders may be able to provide convincing cases as to why their UKRPIF sponsored projects are additional. The interviews undertaken for the case studies highlighted the importance of the structure of UKRPIF, a fund focusing on capital investment and expecting significant co-investment. This has meant HEIs have focused their thinking around how to enhance collaboration, whether to restructure the way research us undertaken and ways to optimise equipment within the new medium-scale facilities.
3. It is perhaps too early to confirm if UKRPIF-supported projects are meeting the fourth objective, that of strengthening the research base that contributes to economic growth. What can be said is that the UKRPIF has maintained a good regional spread (although North East England is one notable omission) and academic spread which could lead to balanced growth in the medium- to long-term as well meeting national strategic priorities. Further, there are promising and measurable signs from the technological advancements underway which can be seen in additional human capital formation as indicated by the rise in student numbers, increased number of collaborations between universities and industry which may stimulate new commercial ideas, start-ups in the process of establishing themselves and SME engagement and technological absorption from several firms.
4. Any future economic evaluation of UKRPIF should seek to confirm that this early promise is converted into a lasting economic impact. Some recommendations are made below about where an evaluation approach can build on existing approaches to evaluating investments into research facilities.

Evaluation going forward

1. At the stage of this interim evaluation, which was completed in November 2017, it was not possible to gather hard metrics to address additionality and deadweight. Review of existing reporting, the Research Excellence Framework (REF), milestones and deliverables presented in bids and completion reports, and face-to-face consultations with experts gave rise to some key recommendations to be applied when evaluating the programme in the future.

Quantitative

1. This research has a quantitative strand and the future data collection and evaluation options would include:

* A deadweight assessment of the UKRPIF and its associated activities;
* An assessment of displacement generated by the investment;
* An estimate of the number of jobs created and/or safeguarded in the HEIs when the UKRPIF is complete. This can be incorporated into project reporting, and would provide a baseline;
* Linking companies benefiting directly from the research infrastructure to administrative data such as the Business Structure Database to assess growth;
* Conducting a multiplier analysis to estimate the impact on the local and national economy.

Qualitative

* Surveying end-users on their use of the facilities and the added value of this access to their research;
* Continuing the case study approach, following up on the case studies sampled as part of the interim evaluation and sampling an additional selection that have completed development. This phased longitudinal approach will allow researchers to follow up on early findings, trouble-shoot monitoring practices, and re-visit areas of impact measurement that were deemed complex or too early in 2017;
* Use the survey vehicle to map networks and clusters around the developments. This should take into consideration intra-university, inter-university, industry-university and industry-industry collaboration.

Lessons and reflections

1. It is at this stage too early to reliably measure additional outputs and wider impacts due to the limited number of completed projects and the early stage of ones that have been completed. However, the evaluation did highlight some lessons to be considered going forward:

* The standard format for returns was not always followed by projects. This made it challenging to analyse monitoring data and get an overview of the projects. In the future, it would be helpful to enforce the standard template;
* The nature and extent of the co-investment from private and charitable partners is a useful initial benefit measure, but understanding whether such funding would have been received without UKRPIF remains important to determine additionality. Keeping consistent measurement of committed co-investment, and comparing the amount to the initial bid, may help to indicate additionality;
* An important aspect of the interventions is the strategic networks enabled through the application process and collaborative models generated. To fully capture this added value is not possible solely using MI, and qualitative data collection either through in-house monitoring activities or case studies in any later full evaluation is recommended.

An approach to future evaluations of UKRPIF

1. A full evaluation of the UKRPIF will be undertaken in the future. This interim evaluation gives some insights into what that evaluation may cover. The study has used the monitoring data collected by HEFCE with case studies grounded in qualitative data collected on five projects. A key constraint at this interim stage is that the full impacts of the UKRPIF investments are unlikely to have occurred yet, with many impacts still to be completed and in operation.
2. The approach taken to this interim evaluation is informed by previous research. It provides a good starting point for any future, full evaluation of the UKRPIF and the next section considers some the lessons from past evaluations. The sections after this then consider where any evaluation may need to adapt past approaches. One aspect is the inclusion in UKRPIF of social sciences and the third section looks at the adaptations needed to evaluate such investments.
3. Applying methods from past evaluations
4. Past research facility evaluations have developed a useful and well-understood set of measures to understand outputs, outcomes and impacts. Table 6 presents key performance indicators that might be used to evaluate the performance of UKRPIF projects. It indicates how many outputs can be explored using the MI, permitting an assessment of the emerging outputs of the UKRPIF in terms of staffing, facilities usage, and partnerships and collaborations.
5. For UKRPIF, the monitoring data collection process is well-structured, and the projects are routinely reporting their progress. The reporting one year after the completion of the project is particularly detailed and a second collection, three years after completion, should be considered. There is some scope for collecting additional information on outputs stemming from the programme and to help the undertaking of an economic evaluation of the programme.
6. It should be stressed that it is important to integrate a set of KPIs based on the findings from this report. This will allow a more comprehensive and systematic comparison of outputs across the scheme than presented in this report. Therefore, the following additional recommendations for enhancing the monitoring collection are as follows:

* The monitoring data often lacks information on usage of the research infrastructure. This may be because few projects are fully opened. However, as facilities move into the operational phase, it would be useful to request project leaders to identify and report the users of the services offered. This list should distinguish between proprietary and non-proprietary users;
* On collaborations and partnerships, a full evaluation may benefit from mapping the networks in which the new research facilities are located. It would be useful to identify where the UKRPIF-sponsored projects are in terms of the existing knowledge or research base in the United Kingdom and globally. Gathering robust baseline data would be useful to meaningfully measure change;
* The monitoring reports could be adjusted to allow HEIs to list the SMEs and start-ups benefiting from the UKRPIF-sponsored research infrastructure and categorise the nature of links;
* Project leaders could report on the expected revenues from the commercial activities stemming from the research infrastructure. This is important because it measures the sustainability of the facilities, as more retained profits could be recycled to support further activities and, in turn, future benefits. It would also be useful for analysing the multiplier effects of the scheme.

1. Developing evaluation approaches
2. Based on the observations and insights from case study interviews, a framework to measure the success of the investments has been structured as part of this interim evaluation. The framework categorises areas of future evaluations to which KPIs can be mapped and data collected to assess progress as well as impact. The key areas that should be covered by a comprehensive evaluation are (1) standard research/academic outputs; (2) the development of innovative operating models; (3) the building and use of collaborative space; (4) the quality, as well as use, of equipment and facilities; and (5) commercialisation of research and generation of spin-outs.
3. Several aspects of these areas are covered in the existing reporting systems or can be developed easily from the data already collected. Where this is not the case, an assessment will need to be made on whether any new collection is proportionate.
4. Given that the Research Excellence Framework includes the assessment of impact case studies, linking evaluation evidence to the REF would be sensible. It could also lower the evaluation burden, in that the facilities would already be preparing materials for REF. The case studies highlight new research outputs specific to a research facility’s role, such as standard setting related research. This may be designed into an evaluation.
5. The second and third areas are the development of innovative operating models and of collaborative spaces in research centres. Each focuses on the way research is undertaken, including how collaboration is encouraged. For this interim evaluation, the case study approach has provided evidence about collaboration changing and the future evaluation will need to bring in the views of users and ways in which changing the way research operates has deepened the links between research, its facilities and knowledge exchange.
6. The fourth aspect a future evaluation will need to consider is the quality of the facilities the UK has developed, in relation to other countries as well as in comparison to other UK facilities. In some disciplines, benchmarking of research facilities is used. This explores the scale of the facility, in terms of its throughput, and the complexity of the research that can be undertaken. The case studies indicated that facilities certainly operate recognising this, but measurement will need to be customised and comparisons across UKRPIF may then be difficult.
7. Any future evaluation will need to look at commercialisation. It was apparent in the business cases for projects, the monitoring data and the case studies that UKRPIF was an opportunity to translate research into delivery and products that could be commercialised. Table 6 indicates that a relatively mature range of measures is available (IP revenues, products developed, maturity of research in terms of market readiness). However, assessing the additional impact will be difficult. Issues include considering where the “commercialisation” is in a public good, such as incorporating new treatments into NHS delivery.

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1. The maximum funding HEIs could apply for was raised from £35m after Round 4. [↑](#footnote-ref-1)
2. Note that 1.67bn and 1.73bn are rounded figures. [↑](#footnote-ref-2)
3. By the University of Strathclyde, in relation to the UKRPIF project “Continuous Manufacturing and Crystallisation Research for Pharmaceutical Products” [↑](#footnote-ref-3)