

Final Evaluation of the Connecting Capability Fund (CCF) Programme

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Wellspring

Knowledge In Sight™



**Research
England**

About Wellspring

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Wellspring is a leading provider of end-to-end technology transfer software and services. Working in technology transfer for over 20 years (previously as IP Pragmatics), we are a trusted, independent partner to universities, research institutes and public sector organisations in over 20 countries. Our team of experienced ex-industry, university TT and IP specialists has active global industry networks and contacts and use this collective expertise alongside extensive market, IP and scientific information resources, to provide analytical rigour and practical insights. We have led several public sector funded reviews across different aspects of the knowledge exchange landscape, examining topics such as spinout equity stakes, proof-of-concept funding, tools to smooth industry-academic collaboration, and evaluation and benchmarking of university knowledge exchange activity. As IP practitioners ourselves who have licensed multiple technologies and set-up several spinout companies, we have first-hand experience of the issues and challenges in commercialising IP, and bring a practical and pragmatic perspective to these assessments.

1 Executive Summary

Research England's (RE) Connecting Capability Fund (CCF) Programme invested £111 million to encourage collaboration between Higher Education Providers (HEPs) to share good practices and capacity in their knowledge exchange (KE) and research commercialisation activities. The programme has funded 18 innovative projects, 11 of which successfully applied for one or two year extensions to continue to evolve their activities, completing in December 2023. This funding was allocated to complement and build on established Higher Education Innovation Funding (HEIF) mechanisms.

Building on previous reviews of the programme activities and outputs, RE has commissioned Wellspring (previously known as IP Pragmatics) to evaluate the CCF programme against its objectives, which are:

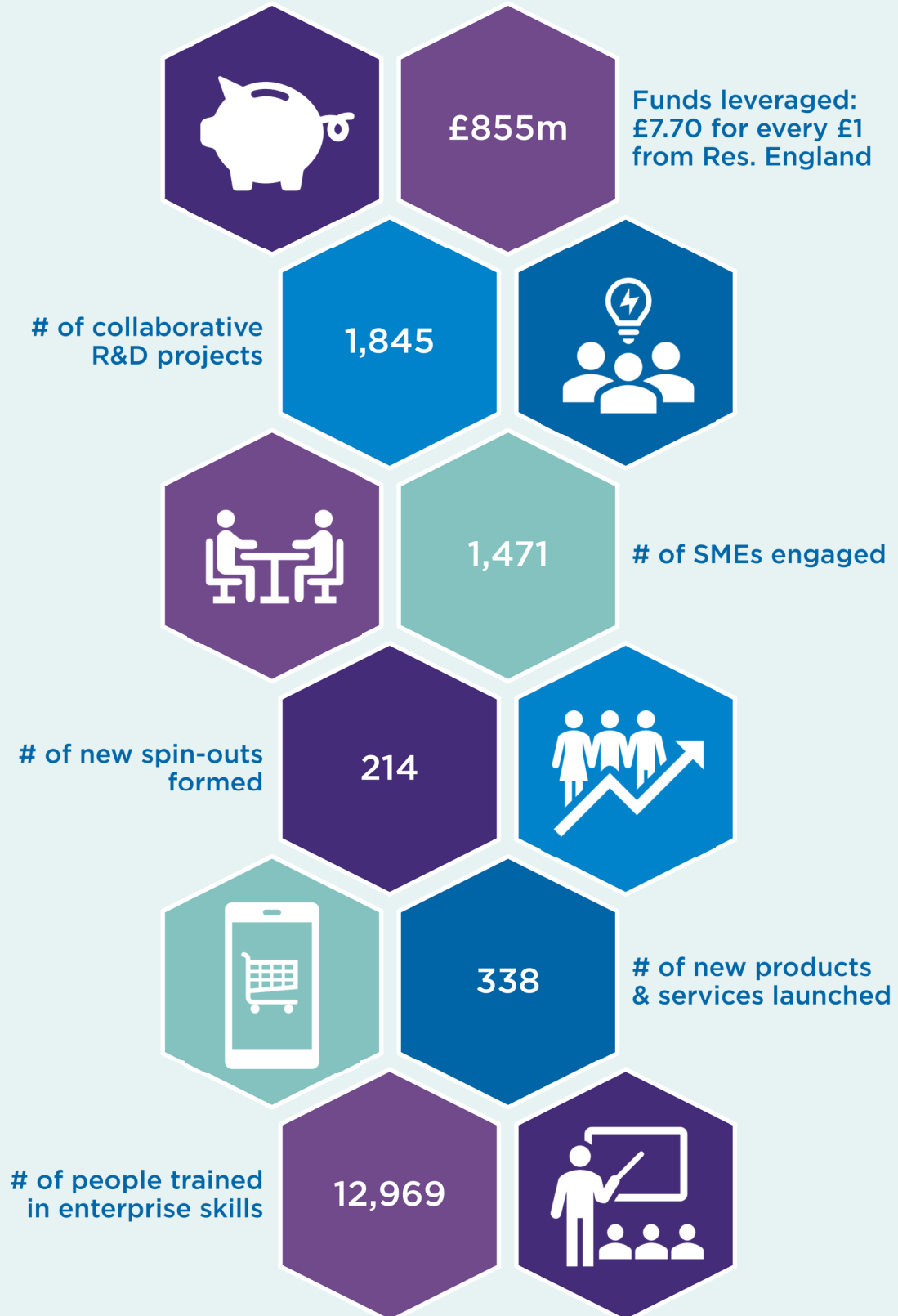
To strengthen the contribution of English HEPs to productivity and economic growth and to delivery of the objectives of the Government's priorities, *by:* enhancing effectiveness in use of the university knowledge base to deliver commercial and business applications and wider applications for the economy and society, *through:* stimulating strategic collaboration between HEPs across England which:

- **delivers pooling of KE expertise and capabilities so that businesses and other users can access a range of KE offers or critical mass of knowledge**
- **builds capacity to provide cross-university responses to technological or industrial sectoral or inter-disciplinary challenges, or to regional alignments and challenges**
- **incentivises sharing of expertise in KE and commercialisation and dissemination of good practice across the HE sector.**

This evaluation is a desk-based study, drawing on the evidence collated and published in four previous reviews of the programme, and combining it with other public information and internal RE monitoring reports, to compile an overall review of the outputs, outcomes, and impacts achieved by the programme as a whole. Evidence collection throughout these studies has been anecdotal, not systematic and exhaustive.

The report describes many examples which illustrate how the individual projects within the CCF programme have now matured from the previously reported activities, outputs and short-term outcomes, to begin to deliver concrete longer-term outcomes and impact. These are evidenced in the delivery of leveraged funding for the projects; development of skills across KE professionals, academics, students and industry partners; increased R&D activity; adoption of new innovations by small and medium sized enterprises (SMEs); creation of spin-outs; investment raised for individual projects and spin-outs, as well as for ongoing Access to Finance funds; and through alignment with successive Government priorities. Whilst these impacts have begun to be delivered during the CCF programme timespan, it is expected that significant future impacts will continue to arise following the completion of the individual projects, due to the lengthy timescales required for successful commercialisation.

CCF PROGRAMME IN NUMBERS



* All figures will under-estimate the true outcomes

Throughout our earlier reviews of the CCF programme, the overall experience of the HEPs in the programme and their individual projects was universally reported as extremely positive. There was a high level of enthusiasm for the programme, even as the projects reached and passed the end of their funding periods. The onset of the Covid-19 pandemic part-way through the initial funding phases had varied effects on the projects, which had to overcome many challenges to continue project delivery in the new circumstances. The structure of the funding and the availability of no-cost extensions meant that most of the projects were able to adapt well, though achievement of some outputs, outcomes and impacts were probably delayed.

EQ1: To what extent did the CCF support the creation, enhancement or development of collaborations between HEPs and industry partners to drive commercialisation success?

Forming collaborative relationships between partners was at the heart of the CCF programme, and all the CCF projects were very successful in this aim. Every project included at least three HEPs, and the largest (ASPECT) reached nearly 50 HEP partners as members or associate members during the project. Altogether 61 HEPs were formal members of at least one project. These collaborations were viewed as very productive, bringing mutual benefit to organisations that might not otherwise interact.

The projects clearly increased the number of collaborations between HEPs and industry partners, with at least 3,176 new relationships with businesses reported by the projects (particularly with SMEs), leading to at least 1,845 collaborative R&D projects. Many more companies participated in ancillary networks and meetings. The geographical spread of the projects across the country has produced a widespread effect on businesses in the regions. This report contains multiple instances of the types of commercialisation success that arose from these collaborations.

EQ2: To what extent, and how did CCF funding complement HEIF in approach and delivery, in particular the impact of direct funding for collaborations, and have HEPs sustained these collaborations through HEIF or other means?

From the interviews carried out in the previous reviews, the participants clearly believed they received many positive effects from the CCF programme that would not have been funded by other funding streams. HEIF funding is used for all types of KE and therefore initiating collaborative activities may not be first choice. The CCF programme was complementary to (and not a substitute for) HEIF. HEIF funding is an essential mechanism to provide the fundamental services and facilities that enabled the HEPs to benefit from the additional activities and collaborations that CCF has funded. The CCF funding allowed the organisations to experiment with higher risk commercialisation activities, which would not otherwise be prioritised. The EIRA project also included some partner universities that did not receive any HEIF funding at all, and so provided a route to introduce more sustained KE support and activities.

SPRINT and other projects provided HEP-agnostic innovation and BD support, with specialised innovation advisors shared across the network. This model worked very well to supplement their HEIF-funded KE resources, by providing access to specialists who may not otherwise be justified at an individual HEP level.

Sustainability has been a challenge for some of the projects which have had to prioritise which activities can be maintained. Keeping the team together was one of the most common aims, and one for which HEIF funding has most often been used to maintain relationships and some activities beyond the end of the project. Examples include networking events and some training. Some CCF projects which have built a network or community have managed to continue this through low levels of administrative support, or at larger scale through the use of membership fees or by charging for events.

The most difficult aspect of CCF funding to replace has been the PoC projects. This is seen as being essential to move opportunities from the university sphere to a state where they become more commercially valuable. Sources of such funding are always likely to be from grant, government, or subsidised sources due to the high risk nature of this stage of development.

Most of the projects reported that they have taken a “mosaic” or “tapestry” approach to sustainability, stitching together disparate funds from multiple sources. For example ASPECT has moved to a membership-fee based model to fund its core operations, with this membership fee usually obtained from the HEP partner’s HEIF allocation. This has been supplemented with additional grant funding received from ESRC and AHRC to support the continuation of the Aspect Research Commercialisation (ARC) Accelerator.

Of the 18 CCF projects, at least ten are still actively collaborating and working together, and five more have retained legacy websites describing their activities and achievements, and providing learning materials for the wider sector. In addition to this formal activity, the individual connections made between organisations are expected to continue to encourage sharing of experiences and expertise between individual partners, and to form the basis of future collaborative bids and activities.

EQ3: To what extent, and how, did CCF support, strengthen and enhance the contribution of English HEPs to productivity and economic growth and delivery of the objectives of Government priorities?

The CCF projects have delivered activities which align with overarching government policies to boost productivity by harnessing the world-leading research in the partner HEPs and investing to bring these closer to market. The ultimate benefit to the UK includes new products and services, as well as more high growth companies, employing staff and returning value to the country through taxes and economic growth. At least 1,417 SMEs were helped by the CCF programme, over 200 new spin-outs were founded, and more than 338 products and services were launched.

Government plans for growth and prosperity have highlighted the importance of selected key industries where the UK has strengths and potential to grow. Different CCF projects focused on the innovation needs of some priority industry sectors, including Advanced manufacturing; Aerospace, space, aviation; AI and data, quantum computing; Ageing society; Clean energy; Clean growth / Net Zero; Construction; Creative industries; Food & agriculture; Health & wellbeing / healthcare; Smart cities; and Transport.

Skills development has also been a recurring theme across many of the CCF projects, building capacity in talent and leadership and promoting a research and innovation culture within HEPs, and upskilling their partner companies.

The wide geographical spread of projects has inevitably supported government aims to increase innovation and economic development across the country, catalysing opportunities and supporting regional growth.

EQ4: To what extent, and how, did the collaborative aspect of CCF increase and/or enhance the effectiveness of the use of the university knowledge base to deliver commercial and business applications and wider applications for the economy and society?

The collaborative aspect of the CCF programme is its central premise, and the individual CCF projects reported that this element both worked really well in practice, and delivered benefits in multiple ways. As one participant put it: *“It’s a fantastic programme - there are real synergies from working together”*.

At a basic level, combining the resources of the HEPs provides the critical mass or scale to attract investment (for Northern Gritstone), make it easier for businesses to access multiple HEPs (for Scale-Up, EIRA, MICRA), or to bring together the best expertise from different HEPs to solve a particular problem (Bloomsbury SET, UK SPINE). It also allowed THYME and others to increase their influence with regional partners, such as local authorities or regional networks, by speaking with a coherent voice across multiple HEPs.

Some CCF projects used their collaborations to bring together disparate researchers with a shared specialism or industry focus. For UK SPINE, SPRINT, SWCTN, this gave businesses a single point of access to the most appropriate collaborators tailored to their particular industry. SPRINT and MTSC were also able to employ specialist KE professionals with deep industry knowledge to find partnerships and broker deals.

Another key benefit from the CCF programme was the sharing of good practice and learnings from the scheme, whether within the individual projects, between CCF programme members, or to the wider KE community. RE helped to foster some of these cross-project learnings through holding events, the Programme Enhancement Team (PET) and networking. These activities between the projects were welcomed, and maybe even more could have been done to foster these communities of practice, extend the learnings further in the sector, and ensure the preservation of the learning materials generated by the CCF projects.

EQ5: To what extent, and how, did CCF deliver economic and societal impacts?

The economic and societal impacts of the CCF programme will arise from the outputs of the collaborative research, business partnerships, and spin-outs that have been generated by the projects. These are already beginning to bear fruit and at least 338 new products and services were launched through the programme. However, it is expected that additional impacts will continue to be generated for many years to come, particularly for high-tech spin-outs which can take 10-15 years to mature and bring products to the market.

Each of the CCF projects has multiple case studies of economic and societal impacts, whether that be helping companies to reach NetZero, opening up eye healthcare to all, improving mushroom harvesting or apple yields, increasing public understanding of the bioeconomy, building a drug development pipeline for age-related disorders, developing high-tech solutions for aerospace or improving museum exhibits.

Similarly, the range of applications addressed by spin-out companies that have been founded with the help of the CCF projects, and to be further developed with the help of the Access to Finance funding is very broad, with the potential to deliver a myriad of societal impacts, through health technology, clean energy, AI & computing, advanced materials, healthy ageing, the care economy, lifelong learning, climate tech, future work, future homes, future cities, and many more.

EQ6: Based on the overall impact of CCF, and considering which of those impacts can be given market and non-market values, did CCF represent value for money?

Research England invested a total of £111.4 million into these CCF projects: £86.4 million towards the first round of competitive funding and £25 million towards follow on funding. In this narrative study, based on case studies and non-exhaustive evidence collection, it is not possible to carry out a formal Value for Money calculation for the programme. Nevertheless, there are some proxy indicators of the value that can be attributed to the impacts of the programme. The projects brought in combined supplementary funds of £391 million, as well as additional support of £149 million for individual spin-outs and projects, plus £315 million for investment funds. By all of these measures, the value delivered by the CCF programme far exceeds the amount of funding committed by RE to the projects themselves, bringing at least an additional £7.70 for every £1 invested by RE.

Independent evaluations of the gross value added (GVA) of individual projects were also very positive, each reporting a significant cost benefit ratio of additional value delivered for each £1 of public investment.

Project	Gross Value Added reported	Cost:Benefit Ratio reported
Advanced Therapies	£4.5m + £10.1m from investment in R&D	1 to 5.92
Scale-Up Programme	£57m from members of the programme £153m future GVA predicted by 2030	1 to 7.5
Northern Accelerator	£76.3m future GVA predicted by 2028	1 to 7.4
IBbD	£37.5m of additional net sales	1 to 3.5
EIRA	£8.3m net present value of GVA	1 to 3.65

The real value of the CCF programme, however, can be seen in the economic and social outcomes described above, and the impacts that these will have for the nation and beyond. The programme has also strengthened lasting relationships between the HEP participants, and delivered a legacy of learning about successful approaches to commercialisation that benefit both HEPs and industry. The enthusiasm of the participants, and their keen desire to maintain access to the networks they have built, to disseminate the materials they have generated, and to

continue providing the KE approaches they have developed is testament to the value that they have derived from the scheme.

Evaluation conclusions

Overall, these indicators show that the CCF Programme has provided excellent value for money, in measurable economic returns, in the strength and breadth of the impacts generated so far, in contributions to the UK economy, and most importantly in the more subjective viewpoints of all the participants in the projects themselves. This is demonstrated in the continued sustainability of the activities and/or learnings of at least 15 of the 18 projects funded.

In carrying out these CCF projects, the participants have achieved the objectives of the programme and supported government priorities for increased R&D spend, improved skills, and enhancing UK productivity and economic growth. They have also led to the generation of over 200 new HEP spin-outs, as well as stimulating the growth of over 1,500 SMEs and other companies.

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2 Introduction

The Connecting Capability Fund (CCF) programme managed by Research England (RE) was established to incentivise Higher Education Providers (HEPs) to share good practice and capacity across the sector, forging external technological, industrial and regional partnerships, and delivering the government's priorities.

The objectives of the CCF fund are:

To strengthen the contribution of English HEPs to productivity and economic growth and to deliver the objectives of the Government's priorities, by:

- enhancing effectiveness in use of the university knowledge base to deliver commercial and business applications and wider applications for the economy and society, through:
- stimulating strategic collaboration between HEPs across England which:
 - delivers pooling of knowledge exchange (KE) expertise and capabilities so that businesses and other users can access a range of commercialisation offers or a critical mass of knowledge
 - builds capacity to provide cross-university responses to technological or industrial sectoral or inter-disciplinary challenges, or to regional alignments and challenges
 - incentivises sharing of expertise in commercialisation and dissemination of good practice across the HE sector.

A pilot round of 18 CCF projects was funded from 2017-18 to 2020-21, and 11 of these successfully applied for one or two year extensions to continue to evolve their activities. The last of these project extensions completed in December 2023

The collaborations supported by the CCF involve multiple HEPs (with a requirement to have at least three English HEPs in each project), as well as businesses, investors and other partners. The main focus for the programme was commercialisation of university research, and collaborative research conducted with industry, and we use the term “commercialisation” throughout the report to cover all the activities that were within scope. Direct support for businesses was not eligible, and student enterprise could only form a minor component of the activity of a CCF project. Common objectives and activities within the many CCF projects include:

- development of spin-out companies and start-ups
- creation of university venture funds
- enhanced licensing of university intellectual property (IP)
- strengthened partnerships with business – both large corporates and SMEs
- simplified access to university research and expertise for specific sectors
- development of technology clusters
- reinforcement of regional strengths
- building networks
- student enterprise (as a minor activity)

Since the completion of this initial group of projects and follow-ons, the continuation of the CCF programme has been embedded within the Research England Development (RED) fund. It is now managed through a series of project competitions, each targeted on a specific priority topic

in commercialisation, as advised by an expert group. Initial competitions have sought collaborative projects focused on university commercialisation ecosystems, and on shared Technology Transfer Office (TTO) functions. Subject to future funding availability, future priorities will include: development of distinctive tech/industry sector commercialisation practices; and industry/business R&D collaboration (including scaling up). Further information about possible future priorities for the CCF-RED programme have been published by RE¹. These later projects funded under CCF-RED are not included in this evaluation.

¹ <https://www.ukri.org/wp-content/uploads/2024/08/RE-080824-Funding-Opp-UniversityCommercialisationEcosystems-SupportingPaper.pdf>

3 Aims & Methodology

The CCF scheme was specifically designed to identify the additional value that may be possible through collaboration; within HEPs, between HEPs, and between HEPs and industry. It aimed to overcome traditional individual research rivalries between universities and explore what synergies can be achieved when HEPs work together and pool their resources.

As the CCF programme progressed, RE has commissioned a number of interim reviews of progress:

- **Interim Review of the Connecting Capability Fund Programme**, undertaken by Wellspring (then named IP Pragmatics Ltd) published in February 2020²
- An **Update to the Interim Review of the Connecting Capability Fund Programme** undertaken by Wellspring/IP Pragmatics published in October 2020³
- **Interim Report on best practice and learnings to inform national policy development** undertaken by the CCF Programme Enhancement Team (PET, consisting of PA Consulting and Wellspring/IP Pragmatics) published in February 2023⁴
- **Final report on best practice and learnings to inform programme management** (unpublished) undertaken by the CCF PET completed in April 2023

These reviews used a combination of semi-structured interviews with the members of the CCF projects and other stakeholders, as well as examination of background and published information on each of the projects.

Now that all of this original wave of CCF projects have been completed, RE has commissioned Wellspring to produce a final evaluation of the programme as a whole, drawing on the previous work and supporting information to compile an overall review of the outputs, outcomes, and impacts achieved by the programme as a whole.

This has been a desk-based study, using the evidence collated in these previous four reports, and combining it with other information drawn from

- Project bid documents
- Monitoring statements provided to RE
- Key performance indicators (KPIs)
- Public documents (websites, press releases, case studies, etc)
- End of project evaluation reports (where available)

It is important to note that throughout these studies, the evidence collection has been anecdotal, not systematic and exhaustive. The figures reported in this study relate to the state of play in the CCF projects as at their final monitoring statements and end of project evaluations, but also draw on information gathered during the previous interviews for the earlier reports. Due to the use of individual KPIs for the CCF projects, and choices made by the different projects in

² <https://www.ukri.org/publications/interim-review-of-the-connecting-capability-fund-programme/>

³ <https://www.ukri.org/publications/update-to-the-interim-review-of-the-connecting-capability-fund/>

⁴ <https://www.ukri.org/publications/connecting-capability-fund-ccf-interim-report/>

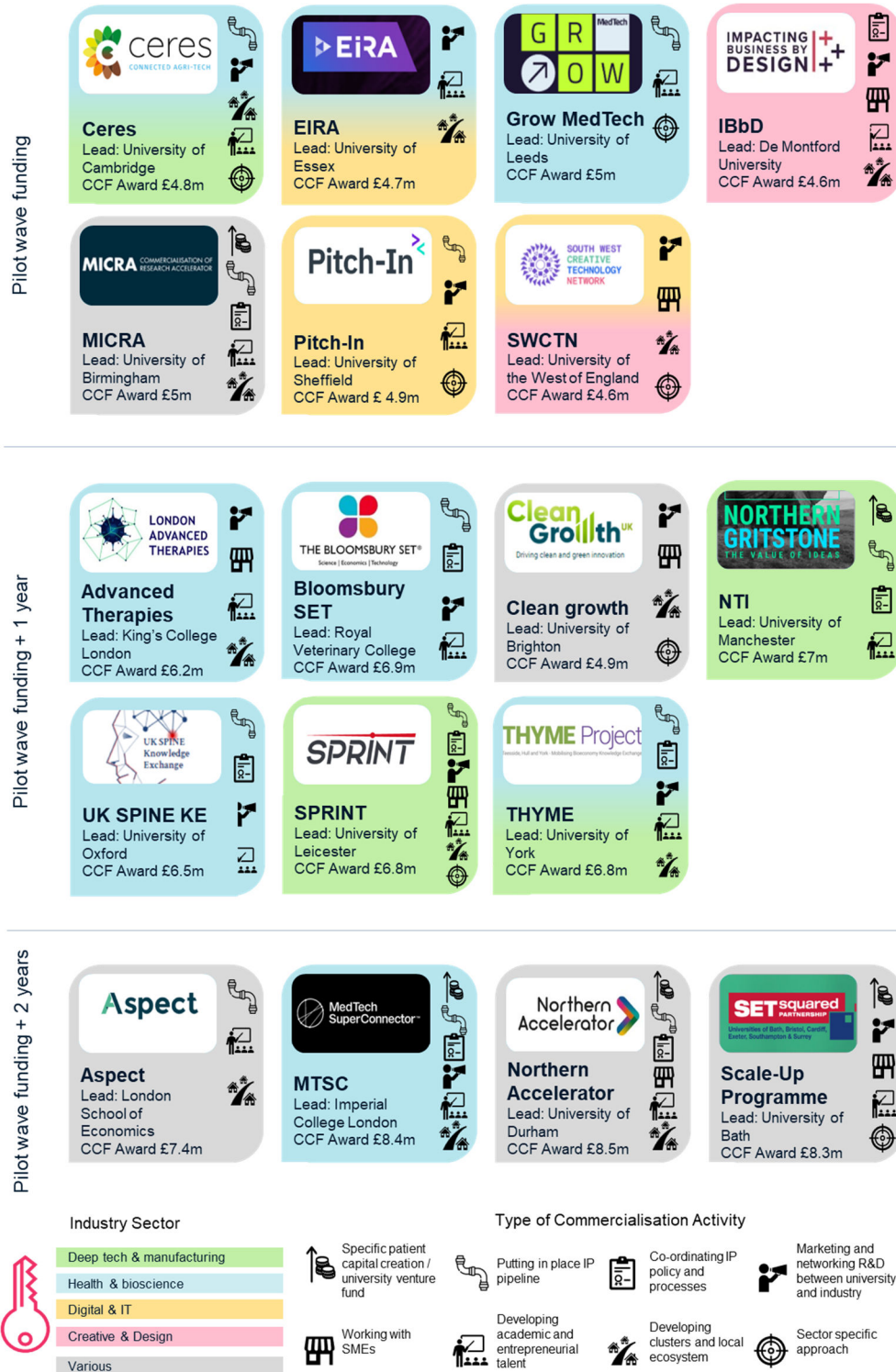
which aspects of their project they choose to celebrate, the totalled figures reported are expected to be an under-estimate of the actual outcomes from the CCF programme.

In collating the evidence presented in this report, we have focused on finding answers to the following evaluation questions posed by RE:

- To what extent did the CCF support the creation, enhancement or development of collaborations between HEPs and industry partners to drive commercialisation success
- To what extent, and how did CCF funding complement HEIF in approach and delivery, in particular the impact of direct funding for collaborations, and have HEPs sustained these collaborations through HEIF or other means?
- To what extent, and how, did CCF support, strengthen and enhance the contribution of English HEPs to productivity and economic growth and delivery of the objectives of the Government's Industrial Strategy and other Government priorities?
- To what extent, and how, did the collaborative aspect of CCF increase and/or enhance the effectiveness of the use of the university knowledge base to deliver commercial and business applications and wider applications for the economy and society?
- To what extent, and how, did CCF deliver economic and societal impacts?
- Based on the overall impact of CCF, and considering which of those impacts can be given market and non-market values, did CCF represent value for money?

4 Overview of CCF Projects

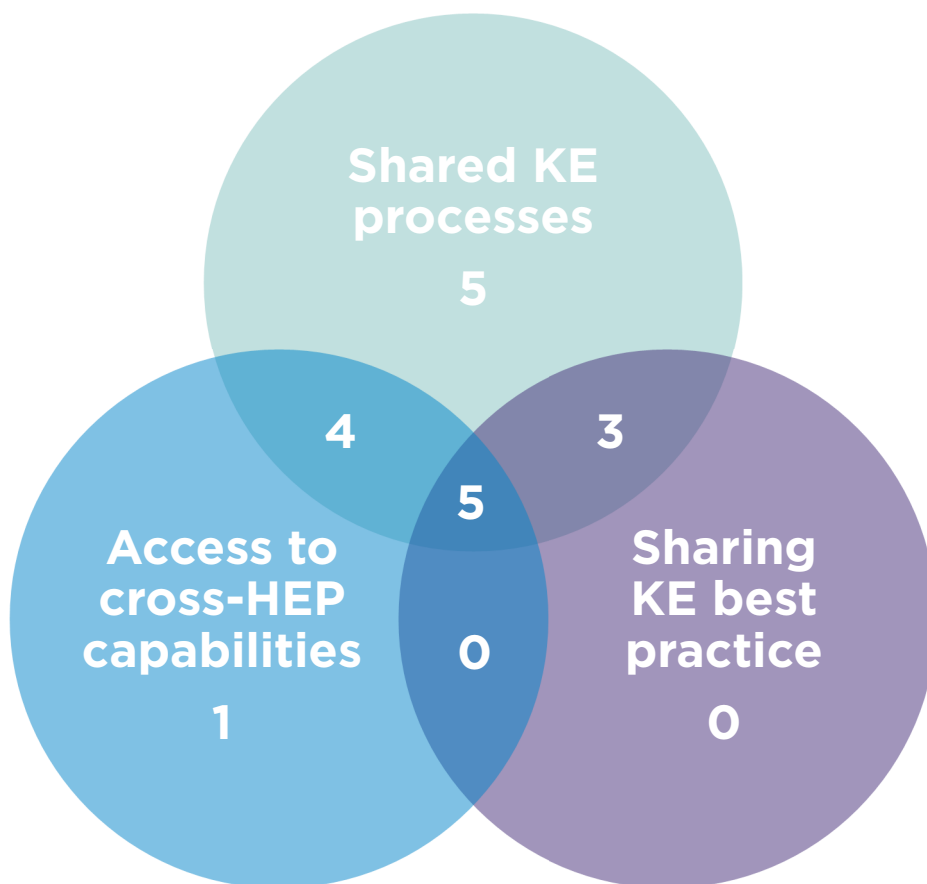
CCF projects covered a range of commercialisation activities and different industry sectors, which are summarised in the diagram below⁵:



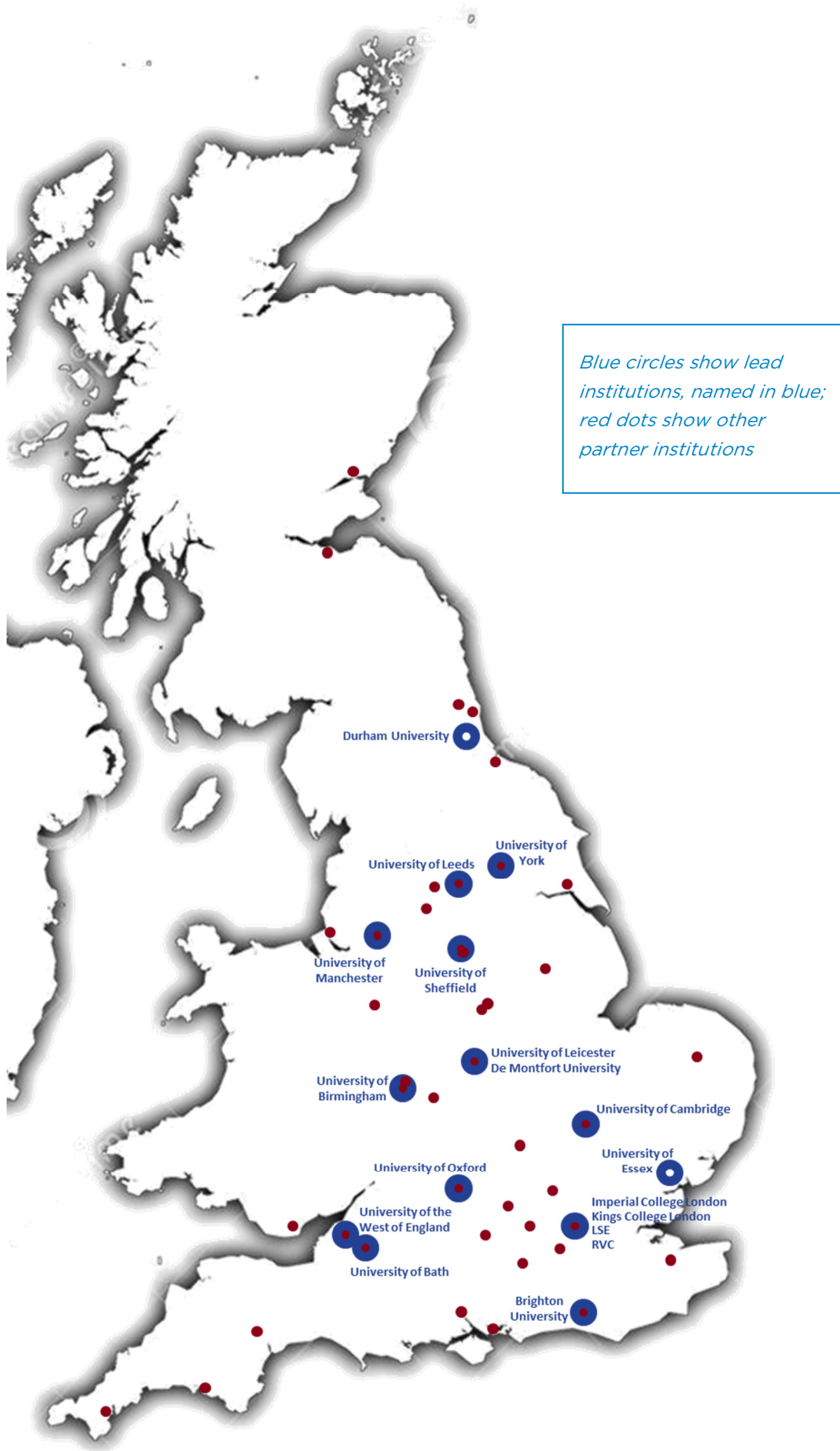
⁵ Connecting Capability Fund (CCF) interim report from the Programme Enhancement Team, PA Consulting & IP Pragmatics, March 2023, <https://www.ukri.org/publications/connecting-capability-fund-ccf-interim-report/>

The CCF programme aims to demonstrate the benefits that can be achieved by undertaking KE activities at scale and in collaboration. The projects selected for the CCF were focused on increasing commercialisation, but some also included other aspects of knowledge exchange. The most common types of activity that the CCF projects addressed were; developing academic and entrepreneurial talent to support commercialisation, developing cluster and local ecosystems, and marketing and networking R&D between university and industry/business. Some CCF's also focused on other activities such as network creation, good practice development, accelerator creation and outreach.

All of the projects addressed each of the three main objectives of the CCF programme to a lesser or greater degree. However, some projects had a more pronounced focus on certain of these objectives. The spread of the different key objectives amongst the projects is as follows:



Overall, the CCF projects and follow-on projects involved 60 HEP collaborators and more than 128 individual businesses and investor partners, as well as wider business investor networks. These were spread across all regions of England, with some HEP partners also within Wales and Scotland, although these were not eligible to receive direct funding from the programme.



CCF Final Evaluation

The main themes and aims of the 18 CCF projects are shown in the table below:

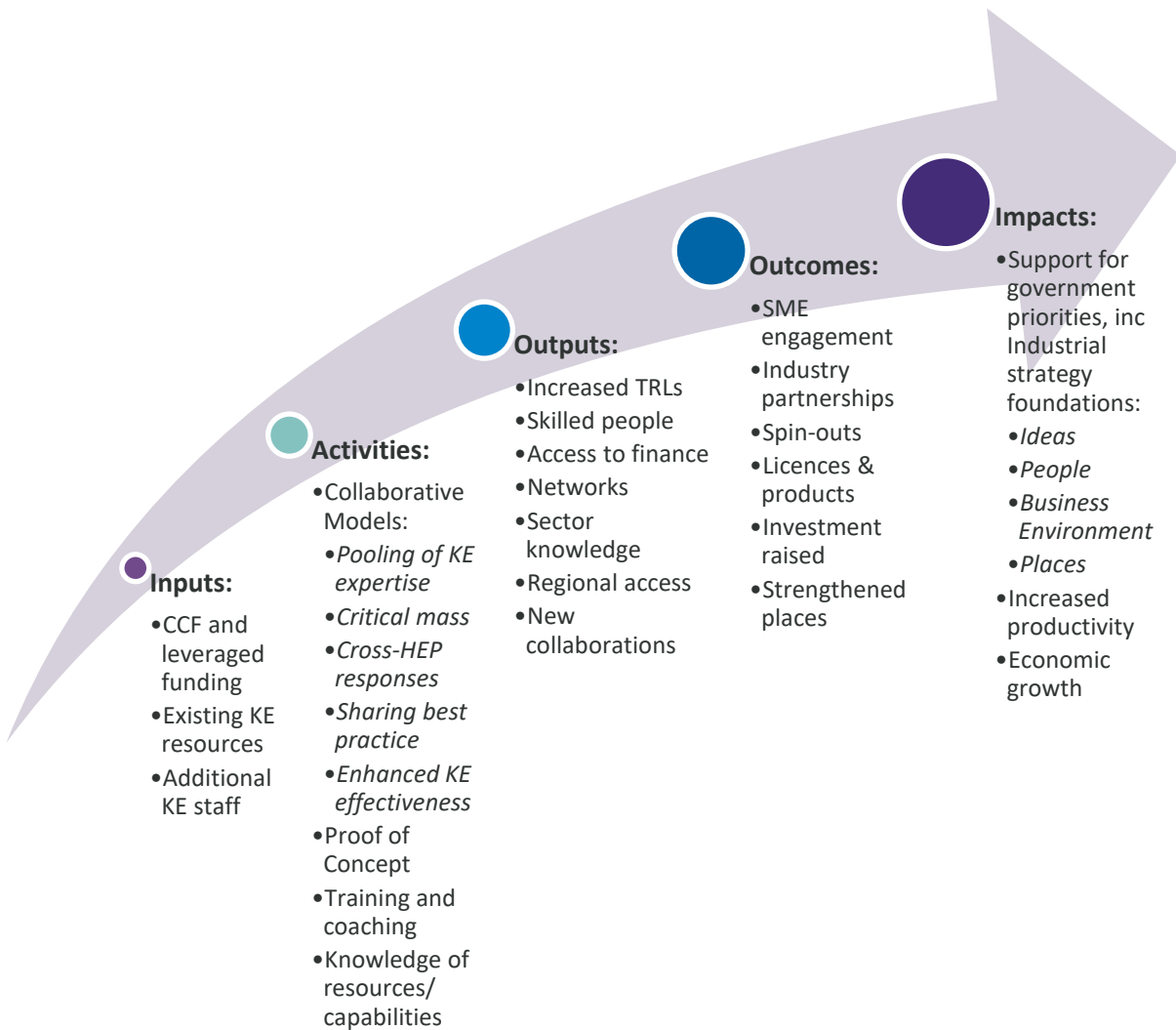
Project	Website	Region
Advanced Therapies	https://medcityhq.com/our-programmes/	London
Utilising complementary expertise and strengths to provide a comprehensive set of activities to catalyse knowledge exchange between the HEPs, SMEs and industry, building on the structure of a successful MedCity programme, to position London, and the UK, as a global leader in the sector of advanced therapies		
ASPECT	https://www.aspect.ac.uk/	National
To develop, implement and scale up a globally leading social sciences commercialisation ecosystem, based on an innovative new approach successfully piloted with Zinc, an LSE spin-out		
Bloomsbury SET	https://www.rvc.ac.uk/research/knowledge-exchange/the-bloomsbury-set	London
Pursuit of innovative scientific / technical solutions (tools, vaccines, mathematical models) to counter infectious diseases and increasing resistance to antimicrobials, and hence help safeguard human and animal health. Investigation of socio-economic barriers and enablers to the timely adoption of these technical solutions in the real world.		
Ceres	https://www.ceresagritech.org/	East
To create a new cluster supporting growth, productivity and innovation across the agri-food supply chain in the East of England		
Clean Growth UK	https://www.clean-growth.uk/	National
To create a National Clean business-innovation network linking thousands of members with a clean, green or low carbon focus to the knowledge and facilities of three applied research universities. It aims to drive innovation and market take up of technologies, products and services which provide solutions to the climate and environmental crisis. SMEs can tap into support to innovate, commercialise and secure investment whilst academics and students are provided with strong, enduring links to a wide pool of cleantech companies		
EIRA	https://www.eira.ac.uk/	East
To extend the established Eastern ARC Research Consortium to support businesses and key technology sectors of priority in the East of England, working with a network of regional higher education providers		
IBbD	https://www.ibbdesign.co.uk/	National
To address SMEs' needs for responsive and holistic support for design innovation to enable the successful development and commercialisation of new products		
Grow MedTech	https://growmed.tech/	North
Focusing on technology convergence and the de-risking of technologies in a patient-focussed and commercially-driven innovation system, it will enhance productivity and economic growth in the UK medical technology sector, while addressing the evolving health needs of the population		
MICRA	https://micragateway.org/	Midlands
To establish the UK's largest, formal technology transfer office collaboration, across the eight Midlands Innovation alliance universities, providing a shared knowledge exchange network and 'gateway' to the MI alliance's collective intellectual property (IP) resources		
MTSC	http://medtechsuperconnector.com/	London
Bringing together talented early career researchers (ECRs), academic discoveries and pooled know-how from 8 academic institutions with 3 bioscience incubators, industry expertise, NHS patients and enabling partners (investors, service providers, designers etc.) to determine the most effective methods for translation of Medtech discoveries into clinical practice and consumer use		

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Project	Website	Region
Northern Accelerator	https://www.northernaccelerator.org/	North East
To deliver a step change in commercialising research to deliver economic impact in support of the North East priority technology/industrial sectors. This integrated approach aims to provide the commercial pipeline to feed into, and de-risk, the establishment of a legacy NE Universities Investment Fund.		
NTI/Northern Gritstone	https://www.northern-gritstone.com/	North
To support the growth of a significantly enhanced, shared intellectual property pipeline; set up a unique regionally focussed finance vehicle, seeking to raise £350 million in private finance to support university commercialisation; and strengthen the entrepreneurial eco-system of the North of England		
Pitch-In		National
To extract and demonstrate benefit from IoT technologies via wide-scale collaboration between academic institutions and the public and private sectors. It will investigate barriers to collaborative IoT exploitation, trial solutions, capture KE good practice learning outcomes, and disseminate guidance regionally, nationally and globally		
Scale-Up Programme	https://www.setsquared.co.uk/programme/scale-up-programme/	South
Aiming to tackle the challenge of scaling up small to medium-sized enterprises to innovate and grow, focused on key technology sectors and enabling partnerships across the South of England		
UK SPINE	https://www.kespine.org.uk/	National
An open innovation approach drawing on partnerships across universities, NHS and business to advance clinical research and medical innovation focused on improving health in old age		
SPRINT		National
A space sector focused SME high growth programme, engaging businesses in support of the UK Space Sector Growth Strategy		
SWCTN	https://swctn.org.uk/	South West
To develop a new, networked model of KE for creative technologies innovation through a series of interdisciplinary R&D programmes that grow the capabilities and connections between the participating HEPs and industry partners		
THYME	https://thyme.biovale.org/	North East
To deliver projects focused upon 3 areas: transforming bio-based waste into new products; converting industrial sites by re-purposing them for bio-based manufacturing; growing the productivity of the region's bioeconomy as a whole by bringing together research and commercialisation capabilities in the Yorkshire, Humber and Tees Valley region.		

5 Potential Impacts of the CCF Programme

To understand the context of how the aims of the CCF programme could lead to the outcomes and impacts that it hoped to achieve, the interim report set out a simple logic model, shown in the figure below. This works backwards from the desired impacts (increased productivity and economic growth) to understand the outputs and outcomes that will deliver those impacts, the activities that will promote those outputs and outcomes, the skills and knowledge needed to support those activities, and the resources that must be applied to build those skills.



This model allows suitable metrics to be identified to monitor progress of the programme across its lifespan. Both qualitative and quantitative measures are discussed in the following sections.

The logic model, and the analysis in this report, both focus on the stated external economic benefits arising from the CCF programme, and to a lesser extent to how this may feed back into economic benefits within the participating HEPs. There are also other more intangible benefits that were identified; some of these are discussed in later sections on added value from the project and changes to KE practice and. Significant impacts on wider society, for example in improvements to research & knowledge, to environmental sustainability, to health and welfare, or to quality of life have also stemmed from the outputs of these projects, and some examples are referenced, but these have not been catalogued or examined in depth in this report.

6 Key Impacts Achieved

The previous interim and update reports have focused on the emerging outputs and outcomes for the projects, and how these were contributing to the impact of the CCF programme as a whole. Commercialisation activity is a long-term process, and it is still quite early to calculate the potential long-term value of the CCF programme. However, now that the projects are 6+ years from inception, it is possible to move on from the previous approach of looking at outputs and short-term outcomes, and instead to focus more onto longer-term outcomes and impact. For more information about the mechanisms that have been used successfully to drive the results during the CCF projects, and about the earlier activities and outputs of the projects, *please see the earlier review reports*.

The compiled evidence has been used to identify case studies and illustrative examples of these emerging outcomes and impacts. These are illustrative of the value delivered by the programme, but are not intended to be a comprehensive account of all that has been achieved and of possible future impacts to be delivered. The websites and social media accounts of the projects are full of similar examples of interesting case studies and examples of real-world impact from their activities. The outcomes have been grouped into different themes: leveraged funding; development of skills; R&D activity, SME innovations; spin-outs created; investment raised; and alignment with Government priorities. We have also considered the Key Performance Indicators (KPIs) which were reported by the projects. These were set individually for each project to relate to their specific project aims and ambitions, and so it is not always straightforward to compile and compare different categories of data across the projects. The figures presented below may therefore be open to alternative interpretations.

Where possible, for each of the themes below, we also consider the extent of the return on investment achieved, and the timescales that this took. For all the effects discussed, it can be difficult to determine the direct influence and return from the CCF scheme, because good projects will use multiple sources of support to develop their commercial prospects. The CCF projects are not acting in isolation, but also depend on the leverage that they have attracted, and the environment surrounding their partner HEPs.

6.1 Alignment with Government priorities

Over the course of the 5-year term of the CCF programme, detailed Government policies and priorities have evolved, but there are a number of themes which remain consistent, and which are also likely to be important under the new Labour Government. The aims and ambitions of the individual CCF projects have supported several of these themes, particularly focusing on increasing R&D spend, improving skills, and enhancing UK productivity and economic growth.

Economic growth

Development of economic strength through partnerships is central to the CCF programme as a whole, and all of the CCF projects demonstrated activities, outcomes and outputs which aligned with this theme. As further described in the sections below, harnessing the world-leading research in the partner HEPs and investing to bring these closer to market is central to all the projects. Some are focused on working with established industry players, but more have worked

to partner and collaborate with innovative SMEs, start-ups and spin-outs to develop technologies which can tackle priority issues and move the solutions into the real world. These activities have attracted significant levels of external investment into these projects, accelerating them towards the market. The ultimate benefit to the UK includes new products and services, as well as more high growth companies, employing staff and returning value to the country through taxes and economic growth.

CCF projects aimed at SME engagement, such as Scale-Up Programme, Clean Growth, IBbD, MTSC and Pitch-In, align with these government priorities to catalyse private sector R&D and boost the research activity of innovative SMEs with potential to scale and deliver UK economic growth. These projects unlocked HEP collaborative opportunities for SMEs who may not understand the benefits of working with researchers and who may not have accessed R&D grants previously.

Other CCF projects, including Northern Accelerator, NTI and MTSC were aimed at producing high growth spin-outs, which also fits with these aims of stimulating R&D activity and economic growth. These spin-outs tend to be embedded in a high research culture, delivering high value jobs. Several CCF members participated in the Government-commissioned Independent Review of Spinouts and the recommendations of the final report were generally well aligned with the activities in these CCF projects.

High-growth sectors

The UK has strengths in several industry sectors which have the potential to drive economic growth, as well as to address pressing issues, including climate change, an ageing population, the rise of AI and big data, and ensuring that key sectors such as energy, advanced manufacturing, healthcare and food remain at the forefront.

Some of the high growth industry sectors that have been identified as a priority for Government investment are shown in the table below. Many of the CCF projects were aligned with these sectors, addressing their needs and identifying key commercialisation challenges and opportunities.

Industry sector	CCF Projects
Advanced manufacturing	Pitch-In, NTI, MICRA Scale-Up Programme, IBbD
Aerospace, space, aviation	SPRINT, Scale-Up Programme
AI and data, quantum computing	Scale-Up Programme, EIRA, Pitch-In, SPRINT
Ageing society	UK SPINE, Scale-Up Programme, Pitch-In, ASPECT, Grow MedTech
Clean energy	Clean Growth, SPRINT
Clean growth/Net Zero	Clean Growth, Scale-Up Programme, Pitch-In
Construction	SPRINT
Creative industries	SWCTN, EIRA
Food & agriculture	Ceres, Pitch-In, SPRINT
Health & wellbeing / healthcare	UK SPINE, Scale-Up Programme, EIRA, THYME, Advanced Therapies, MTSC, Bloomsbury SET, Pitch-In, Grow MedTech
Smart cities	Pitch-In
Transport	Scale-Up Programme, SPRINT

Skills

Skills development has also been a recurring theme across Government policies, and are addressed in many ways in the different CCF projects, as described in sections 6.7 & 6.5. Many CCF projects contributed to building capacity in talent and leadership and promoting a research and innovation culture within HEPs. Others sought to extend this skills development into the companies that participated in the projects.

Regional impact

The wide geographical spread of projects has inevitably supported government aims to increase innovation and economic development across the country, catalysing opportunities and supporting regional growth.

For example, NTI has had a measurably positive impact on government priorities to increase investment outside London and the Golden Triangle, by creating a large new, privately financed, investment vehicle to support the creation and scale-up of IP rich business in the North of England. Northern Accelerator and MICRA also have ambitions to do the same elsewhere in the UK.

Specific policies

The THYME project and others have supported government sustainability policy, and also contributed to the UN Sustainability Goals.

Case Study: Net Zero 360



The UK government has a host of legislation and policies related to net zero and sustainability including: Climate Change Act, Environment Bill, Net Zero Strategy, British Energy Security Strategy, Heat and Buildings Strategy, Hydrogen Strategy, Transport Decarbonisation Plan, Industrial Decarbonisation Strategy etc. Clean Growth (and several other CCF projects) contributes to these initiatives, by helping companies to measure their carbon footprints and set net zero plans and by tapping into extensive academic expertise to help them develop and commercialise the next generation of sustainable / low carbon products, services, processes and business models. The Net Zero 360 service includes a workshop series, a rigorous carbon calculator, action planning support, access to university innovation expertise and facilities, as well as support to fund these net zero activities. <https://www.clean-growth.uk/net-zero-360/>

Falcon Coffees is a green coffee trading company with global supply chains that Clean Growth linked to the University of Brighton on a 2.5 year business innovation project to work with their farmers and supply chain partners to not only measure their collective emissions but to plan for how to move to Net Zero, investigating opportunities for carbon mitigation, sequestration and offsets.

Konrad Brits, founder and CEO of Falcon, said “*This partnership will allow us to work with our farmers and supply chain partners to not only measure our collective emissions but to educate ourselves on how to move to Net Zero, in line with the Paris Agreement*”.

Bloomsbury SET adopted a 'One-Health' integrated approach to address global problems surrounding infectious disease and AMR, helping deliver on the Government's commitment to meeting the UN Sustainable Development Goals and adding support to Infectious Diseases Strategy and the Government's five-year (2019-2024) strategy to tackle the global threat of AMR.

UK SPINE activities were closely aligned with government ambitions to increase healthy life expectancy. The project actively engaged with policy makers, including contributing to Sense about Science's 'Evidence Week' where researchers from the UK SPINE network attended Westminster to brief parliamentarians on ageing research. They have developed a public guide which has been shared with policy makers, to outline the opportunities in this area. UK SPINE also worked closely with the Multimorbidity taskforce and the UK Ageing Network.

Enhancing HEP impact

At their heart, the whole CCF programme is intended to support the overarching aim of UKRI to ensure that the impact from the research that they fund within the HEPs is maximised. The enterprise culture within the researcher communities has been enhanced by the programme, delivering a legacy of individuals ready to continue to deliver further impacts from their research.

6.2 Spin-outs in key technologies created

Six of the CCF projects were specifically aimed at progressing a pipeline of potential new high-growth companies as spin-outs for the participating HEPs. Several of the other projects were focused on increasing the commercial readiness of research opportunities, but where the ultimate route to commercialisation (including licensing or spin-out) had not yet been determined. Some technologies are better developed through a standalone company than through licensing to an existing company. This may be because the technology is radical or disruptive or a platform technology, which needs further innovation to understand where the best applications may be within the current market. Spin-outs tend to be more suited to higher risk, higher reward technologies, which may be ignored by the established industry players. In this case, the return to the HEPs could be through an eventual exit from their initial stake in the company and/or revenues from an accompanying licence agreement.

A total of 214 newly formed spin-outs have been reported by the CCF projects, which between them are addressing a wide range of societal challenges and market needs. Some examples of these spin-outs are described in more detail in Appendix 2, and summarised in the graphic below:

214

New spin-outs created

- **Imperagen:** Enzymes to accelerate large molecule drug discovery
- **PulmoBioMed:** medical diagnostic grade collector for exhaled breath samples
- **Charco Neurotech:** the CUE Device using pulsed cueing vibrotactile stimulation to alleviate symptoms in Parkinson’s Disease patients

Health & Wellbeing



- **Advanced Electric Machines:** Electric motors without the use of rare earth materials
- **Cellexcel:** aqueous method to waterproof biocomposites
- **Fruitcast:** AI and machine learning to predict strawberry harvests and reduce food waste

Environment



- **Solar2Water:** using solar energy to generate water from the atmosphere in disaster zones
- **SCALED:** custom-fit wearables for athletes to minimize joint injuries
- **William Oak Diagnostics:** lateral flow test to allow new and expectant mothers to test their micronutrient levels at home

Quality of Life



- **Opteran:** mimicking insect brains for autonomous machines
- **Aegiq:** photonic quantum computing
- **Slingshot Simulations:** digital twins and decision intelligence
- **Agaricus Robotics:** mushroom picking robot

High-growth Industry



Examples of the type of support that was provided by the CCF projects in order to develop these new spin-out projects are shown in the table below:

Project	Outcome / Impact
Northern Accelerator	A Pre-Incorporation Fund was provided to develop high quality research projects to the point where they were ready to spin-out. 38 spin-outs were formed, with each of the partners contributing at least one spin-out to the total. This number has increased since the formal end of the project. Together, this fund and the Executives into Business programme (see below) increased the rate of spin-out formation from the partner HEPs more than four-fold.

Project	Outcome / Impact
Northern Accelerator	By the end of the project, 173 entrepreneurs were registered with the Executives into Business programme, and able to take advisory and executive positions within new spin-outs to help them with their commercial development. This programme was also supported by ERDF funding. 43 executives were placed during the programme.
MTSC	The Venture Accelerator programmes provided 125 participants with funding, training, mentorship and access to industry partners to help fast-track the translation of their medical technology research. These went on to found 37 new ventures.
MTSC	The first ever spin-out from the Royal College of Music was supported by the project. MTSC was able to successfully facilitate the connection of a lung therapy research project from the Royal College of Music with the Advanced Hackspace at Imperial College London to develop the technology and build a prototype together.
Ceres	3 new spin-outs were launched, with 5 additional spin-outs under development by the end of the project. This included two that were the first ever spin-out opportunities from the University of Lincoln.
ASPECT	ASPECT (alongside its partner Zinc) generated at least 74 new SHAPE (social sciences, arts or humanities) spin-outs over the course of the project, alongside other ventures that will not be incorporated or have a formal structure. For example, some may operate (at least initially) through their host university, offering consultancy or CPD.
Scale-Up Programme	The CCF project focused on supporting the growth of SMEs, including several companies which had previously spun-out of the partner HEPs.
EIRA	Provided start-up grant support of up to £3K for 7 months for students and recent graduates across the EIRA network. 32 student and graduate start-ups were supported with £93k in microfinance grants EIRA also ran an Enterprise Accelerator to develop entrepreneurship skills for EIRA students.

A new spin-out will typically take several years (often 10-15+ years) before it reaches an exit point where value in the form of equity returns may be realised by the original HEP and CCF project. Within the timescale of the CCF programme, however, these spin-outs have been founded and are beginning to scale and grow, to introduce valuable products and services to the market, to offer employment and to contribute to the local economy. Several have also attracted additional investment from venture capital (VC) funds, angel investors and other sources, to leverage the input from the CCF projects; this is discussed further in section 6.6 below.

Case Study: Northern Accelerator



The Northern Accelerator CCF developed particularly well-integrated support programs for their spin-outs, and have subsequently worked with other CCF projects and HEPs to adopt their approaches in other regions. The project has led to a sustained increase in the number of spin-outs founded by their partner HEPs. Northern Accelerator's *Executives into Business* programme supported spin-outs to engage high-quality business leaders at an early stage through developing a model that de-risks the executives' participation by offering remuneration for the achievement of key deliverables in addition to the traditional offer of sweat equity. Their approach provided access to a strong candidate pool of executives with a diversity of highly relevant experience and knowledge which improved investment readiness for university spin-outs. They also provided free *Innovation Assessment* support to potential spin-out companies and other commercialisation prospects at partner universities. This support evolved over the course of the CCF project into a more flexible model which was more useful for the spin-outs.

Other support mechanisms at Northern Accelerator included *Pre-incorporation Funding* to develop research ideas towards commercial outcomes, and the *Future Founders* course as part of the Ideas Impact Hub, which gave academics the knowledge, understanding and commercial skills to establish successful spin-out enterprises or licensing opportunities. Taken together, these programs were designed to address the main areas of risk that are typically encountered by a new spin-out, giving them a greater chance of survival and success.

6.3 Leveraged funding

All of the original CCF projects were expected to supplement the funding from RE with leveraged funding from other sources. Sources for this funding included in-kind contribution of staff resources from the partner HEPs, as well as from private companies, and from other public sources. The reporting of the source of this leveraged funding was not always consistent, so it was not always possible to allocate these to public or private sources. In many cases it was not possible to identify the source, and much of the leverage has been categorised as “unspecified leverage”.

£855 million

Total funding leveraged
by the CCF projects

Funding can be categorised as R&D private sector leveraged where:

- 1) It is used for work dedicated to increasing the stock of knowledge and developing applications for the knowledge (R&D), as defined by the OECD Frascati manual.
- 2) Funding must originate from the private sector (including from overseas), therefore excluding funding from UK local government, other UK government departments or from other publicly funded organisations. Funding from HEPs or charities can count, if funding was not originally from the public sector and the funding is additional.
- 3) Funding must not have occurred if government funding had not originally happened.

- 4) Can be in the form of money or in the form of in-kind investments such as instruments, lab space, testing facilities or expert time allocated to the projects."

Some of the sources of additional funding which were used to leverage the CCF funds include:

- Funding to support translational activities from other grant sources, including research councils, InnovateUK, Wellcome Trust, etc
- European Regional Development Fund (ERDF), and other place-based funding such as UK Shared Prosperity Funds, LEPs
- Public/private sector projects for low carbon investment
- UK Space Agency and Space Park Leicester
- Partner and grant contributions to projects (which have not been split out in Section 6.6)
- Equity funding for new spin-outs (which have not been split out in Section 6.6)
- New project members

The follow on projects then continued this achievement and raised additional leveraged funding. This KPI was measured across all of the projects, and by summing the amounts reported in the final monitoring reports for the projects, we were able to identify that the total amount of funding that was directly leveraged by the £111 million invested into the CCF projects by Research England was at least £391 million, of which around £7 million was reported to come from public sources. For much of the remaining leverage, the source of funds could not definitively be determined.

Significant amounts of further leverage (£315m) were also achieved for Access to Finance funds, and £149m for individual projects and spin-outs, and are reported in Section 6.6. This latter funding is likely to fall largely within the definition of private leverage.

	Total
Direct leverage	£390,930,911
Access to Finance funds	£315,200,000
Funding for individual projects and spin-outs	£148,971,519
Total	£855,102,430

The range of different partners and sources that have contributed leveraged funding to the CCF programme demonstrate the value that others have placed on the scheme.

To attract a total of at least £7.70 in addition to every £1 invested by Research England is also impressive. This tangible leverage was mostly realised during the timescale of the initial projects (3 years) and the follow on projects (1 or 2 further years) and some of the partnerships forged are expected to continue. Many of the individual opportunities supported by the CCF projects will also continue to attract additional funding beyond the timescale of the CCF programme.

6.4 Increase in R&D activity

Ideas which arise from the HEP research base are often promising, but not yet proven or developed to the extent that would allow them to be directly deployed by industry, consumers

or society. All the CCF projects included activities which aimed to bridge this gap, to translate academic ideas and increase their commercial readiness.

One of the most popular uses of funding during the CCF projects was to establish a Proof of Concept (PoC) fund that could provide funding to individual academic- or business-led projects. These were aimed at reducing the uncertainty around the commercial value of the opportunity, and establishing its importance to society. Ultimately, the eventual objective was to produce successful products or services which are available in the marketplace, and/or to spin-out successful companies (see Section 6.2). These PoC projects not only stimulated increased research and development (R&D) activity directly, but also brought academics from different HEPs and/or industry together to form initial collaborations, which continue to offer opportunities for further commercially-orientated university R&D. For example, EIRA worked with PepsiCo, and MTSC worked with GSK Consumer Health to develop industry challenge-led innovation programmes for their researchers.

Meanwhile, Pitch-In actively worked with industry, utilities and local government to ensure that their IoT solutions were installed and tested in real world situations

Some of the ways in which increased industry-HEP R&D activity was stimulated and demonstrated by the CCF projects include:

- Joint collaborative research projects, leading to increased uptake of technology and ideas for commercial exploitation
- Expanding into new markets, gaining new customers, new product development
- Training to increase skills and knowledge within industry
- Networking, especially sector-specific interactions
- Employment of secondment of students and researchers
- Targeting SMEs with limited prior experience of working with academia (see Section 6.5)
- Removing barriers and speeding up engagement times
- Linking up the supply chain
- Directories, sharing contacts, joint industry days
- Enabling access to skills and identify cross-university expertise

Measures which demonstrate the outcomes and impact of this increased R&D activity include the number of new products and services which have been introduced. In the previous reviews, examples were given of individual technology projects that had successfully progressed further down the pathway to commercial readiness. For example, engineering projects which had reached a higher Technology Readiness Level (TRL), design projects that moved from a mock-up to a manufacturing prototype, or healthcare projects that moved to testing in man.

3,176

Number of businesses engaged

1,845

Number of collaborative R&D projects

338

New products and services

Case Study: Accessing funding for collaborative R&D



In the Scale-Up Programme, one of the specific activities offered to its business members was the provision of targeted support to identify university collaborators and then develop and win collaborative R&D bids. This included identification of relevant funding calls, and then deliberately targeting SMEs that would be interested in that call, to provide additional help. As well as identifying academic collaborators, this included project brief development, bid writing resources and critical review. The process was very successful, leading to a bid success rate of 35.7%.

One successful example is Ecomar, an SME creating innovative battery and hydrogen-electric powertrains, which cut carbon emissions and save millions of litres of fuel. Following an introduction the University of Exeter, the company secured £5.6m of collaborative R&D funding, which significantly accelerated their product development. The company also raised angel investment, and employment has risen fourfold with increased sales revenue, profitability and productivity. The company commented that the Scale-Up Programme had moved them on “*probably five years beyond where we dreamed we would be at this stage*”.

Some examples of the outcomes of increased R&D activity are shown in the table below:

Project	Outcome / Impact
SWCTN	Over the project, 24 prototypes were developed and tested in the real world, to develop new products and services with commercial potential addressing industrial, societal, cultural and environmental challenges on the themes of immersion, automation and data. In addition, several of the project's Fellows have gone on to secure funding for their businesses from outside of SWCTN to bring them closer to market.
Pitch-In	A total of 53 collaborative research and development projects were completed, aiming to demonstrate the benefits and practicalities of IoT in different industry contexts, helping to de-risk and promote the adoption of IoT. These mini-projects involved over 100 external collaborators. In addition a further 23 collaborative funding applications were submitted to other funding sources.
Grow MedTech	100 projects received Proof of Market funding, 13 received Proof of Feasibility funding, 96 received Proof of Concept, and 25 projects at TRL5+ and 10 other projects were also supported. These funds were used to de-risk medical technologies; around 56% included direct clinical engagement, and about 69% involved a co-development partner.
Advanced Therapies	75 HEP-HEP and HEP-industry collaborative projects received awards from the Advanced Therapies Confidence in Collaboration and Collaborate to Innovate funding schemes
THYME	PoC projects of £30-50k each were awarded to 40 projects that addressed one of THYME's Grand Challenges and involve at least two HEPs and one industrial partner

Project	Outcome / Impact
Bloomsbury SET	42 grants were made to projects at different scales involving at least two of the HEP partners and/or partnerships with large corporations, not-for-profit institutions and SMEs
Ceres	125 new opportunities were identified and developed, with 41 presented to the Investment Committee, of which 31 projects were supported.
NTI	Funding was provided at different levels: Pathfinder projects (<£10K), and Proof of Principle projects (<£250K). 46 exploratory projects were commissioned and completed, and 51 Proof of Principle projects commissioned.
EIRA	28 R&D grants provided companies with early stage collaborative R&D support between £20-£50K, part-funded by the company. These supported feasibility testing, product development and diversification, de-risking innovation and optimising organisational processes.
Northern Accelerator	98 PoC projects were supported, with 7 of the pre-incorporation R&D projects leading to licensing deals and the remainder developing towards spin-out or other impacts.
UK SPINE	PoC fund with two streams: <ul style="list-style-type: none"> • a Flagship Programme funds high impact strategic projects (>£300K) with higher translational potential. Four projects are currently underway. • A Bridge Programme for higher risk innovative projects (>£75K) conducting translation-focused scientific research for healthy aging. UK SPINE funded 42 projects. Eight of these projects delivered new collaborations; 6 resulted in new datasets, 5 led to new methods, over 10 targets have undergone in depth interrogation, 5 of these have progressed into compound identification, 4 projects produced new compounds, and 2 human trials are underway.
Clean Growth	Supported over 300 university-business R&D projects
Scale-Up Programme	311 R&D projects with partner HEPs were developed with support from the programme. These focused on SME engagement (see Section 6.5)
Grow MedTech	Of their 134 directly funded technology development projects, 69% had a co-development partner (clinical/industry/3rd sector), 56% had direct clinical engagement, and 49% are convergent technologies. These involved a broad range of individuals, including: 380 academics and 121 industrial/commercial organisations, plus clinicians/healthcare professionals, clinical and health care organisations, and industrial individuals.
ASPECT	Through the Zinc programme, ASPECT provided social science input into many of their ventures. A key priority for Zinc is activating and expanding its community of applied social scientists (working in businesses and other settings as well as in academia), developing collaboration and disseminating opportunities across the network.
EIRA	The Innovation Weekender event held in March 2020 involved 59 students from across the partner HEPs, who worked together to produce innovative and creative solutions to a real-life business challenge set by PepsiCo. Digihubs provided skills development for start-ups with short term projects up to 12 weeks. 153 academics have engaged with business-focused EIRA projects, working with over 185 students.

Project	Outcome / Impact
ASPECT	Partner Zinc won the tender to deliver the Healthy Aging Catalyst Programme for UKRI, expanding their university relationships and supporting 60 academics over three years. In addition, Rachel Carey (Chief Scientist at Zinc) secured a £1.2m Future Leaders Fellowship, co-hosted by Zinc and LSE, which enabled scale up of social science innovation at Zinc.
Advanced Therapies	Within hours of an approach from one of the many UK life sciences companies working in advanced therapies, they could be put in touch with relevant experts in the partner HEPs.
MTSC	One of their incubator programme cohorts explored relevant and industry-led themes set in consultations with GSK Consumer Healthcare.
UK SPINE	Engaged with industry partners through events and active brokerage activity. At least ten pharma partners, nine SMEs, three venture capital and four charity partners have contributed to the UK SPINEs mission through: AIMdays, PoC project delivery; knowledge sharing and providing vital resources.
SWCTN	Held industry showcase to share the prototypes invested in by SWCTN with the industry.
Pitch-In	Pitch-In's 'Low Cost Automation' IoT work impressed senior healthcare executives, prompting a follow-on mini-project investigating the use of IoT-based devices for non-critical support in hospitals.
NTI	Held a joint event with a large pharma company to introduce them to technologies in the pipeline at Manchester, Sheffield, Leeds and Liverpool.
EIRA	EIRA support resulted in the launch of 34 new products/services.
Bloomsbury SET	Funded projects led to the development of 10 data linkage/mathematical models/databases/laboratory tools, 2 vaccine candidates, 5 diagnostic products and 2 new antimicrobial/antimalarial drugs, 6 prototypes and 5 clinical trials. They have formal partnerships with large and small companies for these projects, including industry leaders MSD Animal Health, as well as prominent non-commercial partners including APHA and international research institutes.
Grow MedTech	By year 2, 38% projects had carried out Patient and Public Involvement (PPI) activities, 29% were planning to carryout PPI activities as part of the funded GMT project, 18% had developed a plan for PPI at the next stage of development and as a deliverable of the funded GMT project, and only 15% had not engaged with PPI.
Ceres	Generated 20 licences that were executed or in negotiation at the end of the project period.

Throughout the project, these individual R&D collaborations allowed a wide range of projects to progress from research, through development, to create successful case studies leading to tangible outcomes where new product or services have been introduced, leading to demonstrable impact from the CCF project interventions. Some examples are outlined in Appendix 2, and summarised in the graphic below:

- Portable eye diagnostic
- Use of IoT in social prescribing
- Reducing obesity in children
- Drug discovery for ageing therapeutics
- Physiotherapy games for rehab in children

Health & Wellbeing



- Electric cargo bike expansion
- Reducing spraying against strawberry mildew
- Generation of valuable products from sugar processing waste
- Prediction of apple orchard yields

Environment



- Immersive experiences for museums
- Work with Royal Shakespeare Company
- Pollution protection mask for commuters and cyclists
- Bed net design to stop spread of malaria by mosquitos

Quality of Life



- Non-destructive forensic evidence retrieval
- Anti-scale for oil wells
- Steer-by-wire system for cars
- Prediction to minimise battery degradation in electric cars

Industry



Although these are some examples that have arisen during the timescale of the CCF projects, we would anticipate that further R&D projects will continue to generate further new industry innovations. For example at Ceres, of the 20 licences that were executed or in negotiation at the end of the project period, all but 3 arose during the final year of the project, demonstrating the time required to generate this type of outcome. It may not always be straightforward to link new products back to the CCF project that may have stimulated the initial activity. Further in-house development is often needed within the company after collaboration/licence and transfer of the technology, which can be quick (for example in the case of new software development), or may take many years (for example for healthcare products which must undergo rigorous safety and efficacy testing). Ultimately, these licensed products will return a revenue stream in the form of milestones, development fees and royalty payments to the HEP, demonstrating the direct return on investment from these PoC funds. They will also bring benefits in terms of increased revenues and economic and societal impacts for the companies themselves and the wider economy.

6.5 Adoption of new technologies or innovations by SMEs

In the previous section, we have described CCF project outcomes relating to increased collaboration with industry more generally, and the development and adoption of specific products and services. Several of the CCF projects, including Clean Growth, IBbD, SWCTN, Scale-Up Programme and others, had a particular focus on making links specifically with small and medium enterprises (SMEs), which traditionally have found it harder to interact with the HEP sector. The predominant aim was to increase the uptake of technology and ideas generated within the universities, and make these available for commercial exploitation by SMEs. Some projects, including SPRINT and the Scale-Up Programme, also found that their interactions enabled their larger industry partners to link up with SMEs that were being supported by CCF projects to develop their technology up to the point where the larger company would be interested. This benefit all the participants – the HEP, SME and large company all gain from these relationships. The most successful interactions seemed to be with small and medium, rather than micro companies, as these tended to have more of the internal infrastructure required to engage and adopt new approaches. The total number of SMEs engaged was likely well over 1,500, as several projects did not break down their reported industry interactions between SMEs and other businesses.

Throughout the CCF programme, CCF projects have fostered engagement between industry and HEPs, through networking, exchanges, and joint collaborative research projects. These interactions enhance the adoption of new ideas and technologies from HEPs into industry. One important route was to provide training to upskill SMEs that may not be familiar with working with universities. These CCF projects included training and coaching opportunities which are aimed at the businesses themselves, to give them the skills they need to work effectively with HEPs and to develop their own businesses. Some examples are shown in the table below.

1,417

Number of SMEs
engaged

Project	Outcome / Impact
Clean Growth	Offered a Commercialisation and Investment Readiness programme to provide SME businesses and new innovators with tailored business support through 1-2-1 coaching, workshops and masterclasses and Profitnet a peer-to-peer growth programme Offered links to graduate internship and student placements to enhance the skills base of the SME businesses
SPRINT & Scale-Up Programme	Provided coaching for SMEs on how to access investment, their own funding schemes as well as funding from Innovate UK and others
IBbD	The SMEs engaged with the project increased their awareness of how to use new product design processes in their businesses, increasing their ability to use external design houses effectively. The CCF was also able to pass on their knowledge of State Aid rules to these companies.
Advanced Therapies	3 new collaborative training programmes were developed to train the next generation of workforce needed to develop and deliver gene and cell therapy products. They were designed in response to a scoping assessment to identify skills gaps, and are now freely available on the NHS website.

Project	Outcome / Impact
Pitch-In	The development and delivery of a training course for strategy development in IoT aimed at managers. This encouraged decision makers to proactively see the potential for IoT. Such skills-based entrees have also proven highly effective as a means of establishing contacts that lead to collaborations.
Pitch-In	The development of an intensive hands-on course focusing on monitoring and control of a jet-engine health monitoring application. This developed both traditional systems development and machine learning knowledge and skills. The intended audience here is more at the technical delivery end, but is nevertheless an opportunity to promote capability. The intensive course was face-to-face and so was suspended during lockdown.

Other CCF activities aimed to foster interactions and collaborative projects with SMEs which can have a direct effect on their innovation, growth, productivity and efficiency, and lead to new products and services. To make SME engagement with universities easier, CCF projects provided significant guidance and consultation up-front, so that only projects with a high chance of being funded were progressed to the application stage. Companies appreciated this support as they received valuable input and improved their chances of success. For the university partners, the involvement of companies looking for expertise means that collaborative projects are market-led, and more likely to be translated and taken up in a commercial setting. The CCF projects had to put significant efforts into finding and engaging the SMEs, through targeted funding calls, advertising, marketing campaigns, and building new networks. SPRINT, IBbD and others also found that a dynamic, quick-responding process was essential to attract and engage SMEs. Scale-Up Programme reported that growth of SME businesses can be accelerated with relatively small (albeit labour/resource intensive) interventions, such as improving networking, reviewing bids and bidding preparation masterclasses.

Case Study: Body Rocket and SPRINT

Through a SPRINT R&D project, start-up Body Rocket was able to benefit from the 'one stop shop' expertise and facilities of the University of Southampton to test and validate its new, real-time aerodynamic drag meter. This is a device which fits onto a bike in the form of sensors on the seat post, stem and pedals. Real-time aerodynamic drag force data is then beamed wirelessly to a Garmin cycle computer, giving precise, in-the-moment feedback throughout the course of a training session or race, or as the cyclist experiments with different positions, movements and kit. This SPRINT project helped to advance the prototype to Minimum Viable Product status, moving closer to a commercial product launch. Overall, this SPRINT project helped the start-up raise over £255k of new capital from 374 investors (April 2020) and £270k in follow-on private capital from existing investors (January 2021). Body Rocket founder explicitly recognised the key role of SPRINT in securing funding, explaining that *"the SPRINT project has shown us that this technology is possible and played a very big role in helping us to hit our top target"*.



Some examples of outcomes which have driven impacts relating to the adoption of new opportunities by SMEs are shown in the table below. These will also have contributed to the

total number of products and services introduced as a result of the CCF programme, and reported in Section 6.4.

Project	Outcome / Impact
Clean Growth	2,808 new network company members (most of which are SMEs) were recruited over the project lifetime, who could then access Clean Growth's innovation, commercialisation and funding support services
Clean Growth	313 translational R&D projects were undertaken between HEPs, SMEs and corporates, leading to the development of 221 new or enhanced products, services and processes.
SPRINT	Over the full project, SPRINT engaged with 571 new businesses, to assess and develop innovation plans. 143 new business interventions took place with 110 different business partners. An Innovation Voucher structure worth £50k, matched by £33.3k in cash or kind from the SME partner was used for the majority of these projects. SPRINT participants reported that the CCF project had led to new funding and investment, new partnerships, new product development, increased revenues, job creation, increased exports and access to new markets.
THYME	Cluster activities have resulted in 15 SMEs developing new manufacturing processes and/or products, 4 businesses generating greater economic value, and the creation of 6 new biobased start-ups.
Scale-Up Programme	Developed a collaborative R&D (CR&D) SME and academic engagement model, which is now embedded and in use in all the partner HEPs. They were very successful in bringing SMEs and academics together around targeted support, including bid development, to allow them to access grant funding to work together, bringing in a total of £14.9m in collaborative research funding.
Scale-Up Programme	Over the course of the project, the 461 SMEs that signed up for membership, interacted with HEPs at 127 events, and carried out 311 CR&D projects. Many of these SMEs were new to working with HEPs, and a client survey revealed that 79% of respondents said it helped them to grow faster and 41% to achieve higher turnover. 90% were considering a collaboration with a SETsquared university in the next year as a result of the programme.
Advanced Therapies	27 Collaborate to Innovate awards of up to £150k each were made to HEP-SME collaborations with the objective of promoting <u>new</u> interactions between SMEs that are innovating and bringing advanced therapy products closer to market with academics with complementary expertise.
IBbD	57 collaborative company projects were carried out, bringing new product development (NPD) capabilities to these SMEs and developing new commercial products. The businesses contributed around half the project costs with in-kind support, and were expected to repay their grant support once the product generated significant revenues for the business.
EIRA	42 SMEs projects received innovation vouchers of up to £6k to engage with EIRA expertise and foster a long-term partnership. EIRA covered 80% of total project cost, with the companies topping up the remaining 20%.

Project	Outcome / Impact
Pitch-In	A collaborative project between Sheffield (partner), AMRC (Catapult) and loeTech (SME) demonstrated the feasibility of securely migrating a legacy manufacturing plant to IoT at low cost. This prompted multiple collaborations with loeTech, highlighting the sustainable benefit of small-scale collaboration seeding and how universities can leverage the reach of the Catapult demonstrators.
SPRINT	SPRINT supported interactions between SMEs, universities and larger industry partners within the sector through its innovation voucher scheme, contributing to growth of the innovation ecosystem for the UK space sector.
IBbD	The SMEs working with the project were often engaging with design consultancy for the first time, and over the course of the CCF project began to expand into innovation strategy rather than just individual product projects. IBbD completed diagnostics with 96 SMEs, and consulted with many more.
Pitch-In	A series of proof-of-concept demonstrators showed how easily SMEs can improve productivity by using existing and readily available digital technologies that can be implemented on a low-cost basis. One example is a digital job-tracker piloted by a small family-run manufacturer which previously used a paper sheet to track orders through the system. Low cost scanners are now being used to digitise the location and status of jobs, print tracking labels, record when a job enters and leaves the facility using barcode scanning, and then store all these records centrally in the cloud, so that live job progress can be viewed at any time.
SWCTN	Okko Health was founded to improve eye disease patients' ability to get medical care at the point that it is most needed, and won further development funding from Bayer AG, angels and Innovate UK. An Automation Industry Fellow received SWCTN support for a project to create an app that allows patients to test their eyes through weekly games, and visualise the results, giving them the confidence to monitor their own eye health and book earlier appointments.
IBbD	Drone Defence approached IBbD to improve the usability and technology of their product design to give it larger appeal for their specific market. Upon successful completion of the design collaboration, Drone Defence grew their team from 2 to over 20 individuals, gained a mixture of private and grant investment, moved premises to a larger site and are now becoming a market leader for their product ranges."

As with the increased R&D activity, it can be difficult to link these impacts solely to the CCF project interventions, as they will also be supported by the existing capabilities within the company. The immediate return on investment from the CCF funding can be seen through the funding received from the industry partners, through cash and/or in-kind effort. It is expected that many of these relationships will continue beyond the end of the programme, delivering further outcomes and impacts later on. Longer-term returns may also come from licensing revenues to the HEPs, and from improved economic performance of the company partners.

There are many examples cited in the end of project reports for the individual CCF projects of companies which have benefited from funding and investment, new partnerships, new product

development, increased revenues, job creation, increased exports and access to new markets, stimulated by their engagement with the programme.

6.6 Investment raised

The CCF projects have been successful in generating outcomes relating to investment. These fall into two categories: Access to Finance initiatives to raise funds which can support future spin-outs; as well as direct investment into the spin-outs and other commercial opportunities from the CCF projects themselves.

£315.2 m

Access to finance
funding

Six of the CCF projects included a specific aim around improving **Access to Finance**. Some are trying to raise a legacy VC fund that will continue to invest in its pipeline of spin-out projects. This requires the CCF project to be able to demonstrate that they have sufficient deal flow and scale to justify a dedicated fund, whilst maintaining their unique identity that will attract investors.

Case Study: Northern Gritstone

Northern Gritstone successfully raised a first close of £215m in May 2022, and a final close of £312m in October 2023 (after the completion of the CCF project), to invest in companies in some of the UK's fastest growing sectors such as advanced materials, energy, health technology and cognitive computation. The fund uses a non-traditional structure, with a longer timescale allowing them to take a patient capital approach with extended support for their investments. The fund was established as an outcome of the NTI CCF project, to invest into a pipeline of spin-out projects established from the Universities of Manchester, Leeds and Sheffield.



Northern Gritstone is already delivering significant impacts: to date, the fund has invested into 20 new companies, spanning lifescience, health technology, energy, computing, advanced materials and other technologies. These are predominantly spin-outs from the partner universities, but the fund can also invest in early stage companies based in the North of England outside of these universities, so contributing to the wider entrepreneurial ecosystem in the region. It has also brought in additional investment from co-investors into these spin-outs and startups. The investments have allowed these companies to create over 95 additional jobs, with significantly more to follow as the investments are fully used by the companies. At 31 March 2024, Northern Gritstone's investee companies employed 598 people in total.

The Covid-19 pandemic, and subsequent financial slowdown has affected investment confidence, and made the fundraising climate more difficult. Both the Venture North fund (from the Northern Accelerator) and Midlands Mindforge (from MICRA) are still seeing to close their fundraisings. Both have successfully raised some initial funding however. Scale-Up Programme also reviewed their ambitions to raise an Innovation & Impact Fund in the light of market conditions.

Northern Accelerator has partnered with Northstar Ventures to raise a seed investment fund, and is targeting raising a dedicated venture capital fund for spin-out businesses from North East universities. It will invest in seven inter-connected markets; healthy ageing, the care economy, lifelong learning, climate tech, future work, future homes, and future cities.

The partnership of eight research intensive universities that made up MICRA established Midlands Mindforge in 2023 to accelerate the commercialisation of university spin-outs and early-stage IP rich businesses in the region. They plan to raise up to £250 million to found and scale science backed companies in sectors such as Clean Technologies, AI & Computational Science, Life Sciences & Health Tech, creating highly skilled jobs and supporting the UK's ambition to become a science and technology superpower.

The ongoing legacy of these funds is likely to continue significantly beyond the timescale of the CCF projects themselves. For example, Northern Gritstone is taking a long-term investment approach, and aims to continue well beyond the traditional 10 year timeframe of a VC fund. The companies that they support will also continue to produce additional contributions and impacts as they grow and scale. In addition, further impacts are expected in terms of bringing more co-funders into the regions, and strengthening the regional ecosystems.

Other Access to Finance approaches have facilitated interactions between the opportunities supported by CCF projects and additional sources of investment funding. Some examples of these initiatives include:

- ASPECT Angels, linking angel investors with the ventures created with support from the ASPECT project: www.aspectangels.com
- MTSC has a long-term vision to raise and manage a £5-25million MedTech venture fund, and as a first step introduced the Micro Investment Fund, a convertible loan note scheme to provide funding to ventures founded through their accelerator cohorts
- Scale-Up Programme/SETsquared is working with Innovate UK on the Future Economy Programme and the Regional Angel Investment Accelerator (RAIA) which enable early-stage innovation-led businesses to raise non-dilutable grant funding alongside Angel co-investment, and provides links to 12 business angel networks outside the “Golden Triangle”

As the spin-outs and projects that are supported by the CCF projects developed, they have also received **direct investment** from VC and corporate investors, providing additional return on investment from the CCF funds. Whilst some of this investment has already been received, most of this return is likely to continue to arise after the end of the programme as the companies grow and scale.

£149 million
Investment/leverage
into projects and spin-
outs

Project	Outcome / Impact
SWCTN	The project brought together an informal Investor network within the South West with an understanding of the potential of Creative Technology Businesses and an appetite to invest in sustainable South West businesses. Also explored the use of crowd funding to support the next stage of development of the prototype projects for those businesses who do not currently fit the traditional investment model.
Clean Growth	Provided an Investment Readiness service linking SMEs and investors
MTSC	Opportunities nurtured in the Accelerator programmes have raised a total of at least £13m in VC funding
Northern Accelerator	Successful launch of £1.7m Northern Accelerator Seed Investment Fund, and ongoing fundraising for a larger VC fund.
ASPECT	Zinc-led missions during the initial ASPECT project resulted in 46 ventures which secured £15.5m in equity investment, £1.9m in grants and created 167 jobs..
MICRA	Supported Zayndu to conduct product testing of their innovative seed sterilisation equipment for industrial partners and to rent incubator space at LU Science & Enterprise Park. Zayndu created four jobs, and planned to create more following investment from Oxford Technology and others in March 2021.
NTI	Supported Opteran in the development of 4th wave AI for autonomous technologies. The company completed an initial raise of £215k pre-seed investment from various High Net Worth individuals and has now raised a total of £12M from Northern Gritstone and other investors. Other spin-outs included Aegiq (£1.5M from angel investors and venture capital), Slingshot Simulations (closing £3m investment led by Northern Gritstone), 4-Xtra (Closing £2.75m led by Northern Gritstone), Imperagen (£3.5M closed including £1M from Northern Gritstone)
SPRINT	The UK Space Agency recognised the value of the SPRINT project and brand, and invested into it, widening the scope of the project to reach more HEPs and SMEs within the Devolved Nations..
IBbD	7 SMEs supported by the IBbD project raised investment from angel, VC and crowd funding sources.
Advanced Therapies	£7m received to build a new gene therapy vector manufacturing facility, which will double the capacity available in London to produce GMP grade viral vectors for gene therapy, benefitting HEPs and SMEs across the UK
Scale-Up Programme	4 in 10 company members of the Scale-Up Programme reported that scheme had helped them to secure investment. Between them all these companies have raised investment of £713million between 2018 and 2023.

6.7 Development of skills

Formalised training represented a key part of the CCF programme. Most of the CCF projects included some form of training, focused on developing the skills and knowledge of four main stakeholder groups; knowledge exchange professionals, industry professionals (especially from SMEs), academics (including early career researchers), and in some

12,969

Number of people
trained

cases students. Skills development has taken many different forms, including online training materials, bootcamps, workshops, accelerator programmes, and internships. Taken together, these training courses have strengthened the entrepreneurial capability of at least 13,000 individuals engaged with HEP commercialisation activities. Several of the CCF projects reported that they provided training courses, but did not provide a total or a detailed breakdown of the number of people trained.

	Total
Academics	11,323
KE professionals	42
Total industry	305
Unspecified individuals	1,299
Total	12,969

Initially, many of these training courses were delivered in person, fostering the development of networks amongst cohorts of individuals with shared interests. The onset of the Covid-19 pandemic forced many of these training opportunities to pivot towards online delivery, with the subsequent accumulation of an archive of online material which can be reused with future trainees. Post-pandemic, there was a trend towards more efficient, effective and innovative ways to deliver courses. The widespread accelerated adoption of digital and online learning, virtual classrooms and online collaboration was taken as a new challenge, and an opportunity for scaling and delivering the learning content and support beyond the initial projects, nationally and potentially internationally. Typically, a blended approach to delivering courses was seen as best practice to ensure flexibility and accessibility, for example having in-person training but using online tools for 1-2-1 follow-up conversations. In deciding which method to use the CCF projects considered the market segment and delivered based on market needs, geographic goals, the needs of participants (following the pandemic many preferred online training, including time poor SMEs), efficiency and experience. Widespread accelerated adoption of digital and online learning, virtual classrooms and online collaboration provided a new opportunity for CCF projects to scale and deliver their learning content and support beyond their location, to national and potentially international participants.

The training aimed at SME partners is described in Section 6.5 above.

Some examples of successful skills development approaches aimed at academics and students are shown below:

Project	Outcome / Impact
ASPECT	Many training and development events held for academic social science researchers, reaching 4,424 academics and students
MICRA	5,822 academics received enterprise training over the course of the project. Their online flexible learning programme was very popular and highly cost effective. Courses were delivered on Board awareness, IP for healthcare academics, licensing masterclasses, raising finance,

Project	Outcome / Impact
Northern Accelerator	<p>340 academics in total went through their Academic Programme of Support which had two tracks:</p> <ul style="list-style-type: none"> • support for ERCs to understand and engage with routes to commercial impact (“Innovators”) • training programme for more senior researchers which focuses on the knowledge, understanding and commercial skills academics need to establish spin-out enterprises (“Future Founders”) <p>The program was successfully adapted for online delivery during the pandemic. Tailored workshops were also delivered on IP Awareness and Company Director Duties (“Directorship Awareness”).</p>
THYME	<p>Nine workshops were held for bioeconomy researchers to enable them to identify commercial possibilities in their research and understand the first steps to build a bioeconomy business, bringing the total number of early career researchers trained in the project up to 120. Topics included key entrepreneurial skills, such as communications, understanding financing, human resources, business scale-up and business problem solving</p>
EIRA	<p>Training provided to around 200 individuals – a wide range of professional services staff and early career researchers – which has covered topics including commercialisation, value proposition and Intellectual Property Rights (IPR) and accessing/applying for funding.</p> <p>Eight online quick guides were developed to provide an overview of topics including consultancy, KE, industry funding and enterprise and remain available to provide a legacy of guidance and support.</p>
ASPECT	<p>Aspect piloted the Aspect Research Commercialisation Accelerator, to build skills in social sciences entrepreneurship and commercialisation both for KE staff and researchers. In the follow-on project, ASPECT secured ongoing funding to expand this ARC Accelerator, a world-first SHAPE-specific programme to support SHAPE ventures creation.</p>
MTSC	<p>At the end of the project, MTSC was in the process of agreeing international licensing of their digital training content with Centre for Continuing Professional Development, and Imperial business School Executive Education.</p>
SWCTN	<p>Commercialisation and business training was provided for individuals through the Fellowship programme. A cohort of industry, academic and new talent fellows from across the region collectively explored the challenges, opportunities and areas of growth within the respective theme. Each cohort engaged in collaborative workshops and individual research. The learnings were shared publicly via an industry showcase, as were the prototypes. There have been 75 individuals awarded innovation fellowships across the three themes/years.</p>
SWCTN	<p>One partner ran a ‘Talent Development Programme’ and another co-ordinated a ‘Prototyping the Business’ seven-part programmes with experts and practice workshops to provide business development training. SWCTN also had a ‘Routes to Investment’ fund which connects members with financial and legal experts to learn about IP, accountancy services and access to finance.</p>
Bloomsbury SET	<p>3 Innovation Fellowships of £300,000 were awarded. These projects were up to two years, and designed to support early and mid-career researchers working in veterinary and/or human health to develop skills in the priority areas.</p>

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Project	Outcome / Impact
MTSC	The learnings from the evaluative approach to accelerator design taken by MTSC were shared with 4 other accelerator - NHS AAC, Hamlyn Centre HASID programme, Conception X, Start Codon
Grow MedTech	Grow MedTech developed a series of 22 guidelines (available via their website) for technology transfer, innovation and business development practitioners in UK universities on successful innovation for medical technologies, together forming a comprehensive 'Academic's guide to medtech translation'. These were supported by infographics and short videos.
UK SPINE	UK SPINE supported KQ Labs and the Crick Institute Summer School, including an ageing research theme, for graduate students considering entrepreneurial endeavours.
MTSC	Added commercialisation elements from the CCF project to the student curriculum. 7 accelerator cohorts were run over the 5 years of the project, supporting ECRs in commercialisation of medical technology innovations
EIRA	Students and recent graduates were offered Innovation Internships with businesses based in the region Formed cohorts of early career researchers from partner HEPs who were trained together in commercialisation and business engagement skills, leading to some cross-institution collaborations for grant applications..
Grow MedTech	Used the application forms for their funding streams as a learning tool to guide the academic applicants through the commercial development pathway
THYME	Outreach activities raised awareness, and communicated and educated school children and the community about the bioeconomy sector. A range of educational materials that link to the National Curriculum in a variety of bioeconomy topic areas are available to download. THYME partners have also created an online bioeconomy quiz which has had over 1100 players, and they have sold 107 educational board games (numbers as at April 2020).
THYME	One-day workshop for a group of high school student entrepreneurs, who designed a hydroponic plant growth system called BIO-HEX which allows customers to grow plants using less water than conventional growing methods.

The training delivered by the CCF programme resulted in the upskilling of many thousands of people, who have been enabled to deliver the outcomes and impacts described in this evaluation. The legacy of many of these training courses will continue beyond the end of the CCF programme, not just for those trained, but also in the continued availability of the online training materials, and ongoing delivery of some of these training programmes supported by new funding mechanisms.

Case Study: ARC Accelerator

The logo for Aspect, featuring the word "Aspect" in a bold, sans-serif font. The letter "A" is green, and the remaining letters "s", "p", "e", "c", "t" are dark blue.

The ASPECT CCF project provided an integrated training programme for its award holders, which was developed and refined over the course of the project. SHAPE entrepreneurship, whilst similar to traditional spin-out development, will often have different business models, different goals, such as more social ventures, work with different sectors, such as government, and face different challenges. To address these issues, alongside access to funding for commercialisation activities, participants in ASPECT received:

- a virtual training bootcamp, led by industry experts, to develop key entrepreneurial skills
- specialised, sector specific training
- access to key experts who have been there before, including investors and networks
- dedicated mentorship support to help validate their idea, develop the business model, and support their pitch for further funding or investment

To allow this established and tested training programme to endure, ASPECT successfully bid for £3.9m in further funding from ESRC and AHRC to continue to deliver this ARC Accelerator programme. The training has now been refined into a 4-stage programme: Discover, Launch, Accelerate, and Scale. arcaccelerator.io

7 Added Value

The interviews for the previous studies identified several examples of unexpected outputs and outcomes that would not have been possible without the influence of the CCF funding. As the key aim of the programme is to encourage collaboration within and between the projects, we have looked at other benefits that have come from this increased collaborative way of working. We have also looked at potential contributions to KE policy and to strengthen local entrepreneurial ecosystems.

7.1 Collaboration

The primary aim of the CCF programme is to enable collaborative delivery of KE between different HEPs. This inevitably results in organic learning and exchange of KE best practice amongst the members of each consortium. All of the CCF projects had to include a minimum of 3 HEPs, and the majority of the projects included 3-5 HEP partners, though a few were larger with up to 9 HEP participants. Across the programme portfolio, at least 60 different HEPs directly benefitted from this increased KE collaboration. In the interim review, several people commented that they found these CCF projects to be much more truly collaborative than other projects they have come across in the HEP sector. As described further in Section 7.2 below, the programme as a whole also encouraged collaboration between different CCF projects, leading to dissemination of learnings across the KE sector.

CCF project partners have gone on to successfully bid for other collaborative projects, including for funding to continue some of the activities within their projects. This is not surprising, given the importance of inter-personal relationships in establishing effective working processes. It also reflects the observation that some CCFs found it easier to develop bids and define working practices when these were built on existing relationships in other areas. Seven of the CCFs had at least partial consortia who had worked together before they applied to the CCF programme.

CCF projects also found that KE-academic collaboration was stimulated by the programme, and most of the projects included both KE and academic staff in their operational and governance processes. Bringing these two groups to work together as part of the same team emphasised the integration of KE into academic work, being a natural continuation of research and teaching, rather than a separate activity. Two projects also incorporated the business school into their project management, adding another dimension to these collaborations.

Several CCF projects reported that new academic-academic collaborations were stimulated, particularly by the availability of funding for translational projects. Some of the CCF projects required that projects bidding for their PoC funds should include academics from at least two HEPs; in others these relationships developed naturally from the other activities delivered in the project. At least ten CCF projects reported this type of collaboration being stimulated within their projects.

The delivery of a successful CCF project is dependent not only on academic and KE staff, but also on the involvement of other central services, including finance, procurement, legal, contracts, and communications. In some cases, this introduced some initial tensions as the CCF led to an unanticipated increase in the workload of these departments. A number of projects,

however, used these challenges to introduce more streamlined ways of working, for example to allow one partner to sign a Non-Disclosure Agreement (NDA) on behalf of the whole consortium. There were also collaborative efforts to align legal contracting and IP arrangements, and combined procurement processes. For the projects with a focus on SME engagement, concerted efforts were made to enable internal university systems to be more responsive, flexible and streamlined, so reducing the barriers for these companies to engage.

The final type of collaboration that has been stimulated by the CCF programme, that of HEP-industry partnership, has already been discussed in Sections 6.4 & 6.5. As the programme progressed, more reports were received of the development of new relationships between companies, whether SME to large company or SME to SME, through interactions brokered by the CCF projects.

Some examples of new collaborative approaches stimulated by the CCF projects are shown in the table below:

Project	Outcome / Impact
Grow MedTech	Included a secondment scheme, to provide opportunities for research collaborators in the Leeds and Sheffield City Regions to progress technologies. Two-way exchanges were supported between academia, industry, healthcare settings, innovation enablers and charities.
SWCTN	Built a cohort of 75 engaged academics who built new production relationships, creating a community of people with shared goals
ASPECT	The project began with 3 funded partners and four additional founder members. As the project grew, particularly in the follow-on phase, overall membership reached nearly 50 members at its peak. Discussions also took place about joint activities and collaborations with a KEC membership body, and a range of international organisations.
Ceres	Catalysed a number of new collaborations, examples include: collaboration between UEA and Uni of Lincoln on EPSRC's Internet of Food Things Network; collaborations between Uni Hertfordshire and Syngenta in pesticide pollution and between the University of Hertfordshire and Rothamsted in airborne pests. Facilitated 20 research collaborations, involving a mix of HEPs, government research institutes and SMEs. Project proposals have involved academics from 27 different disciplines, not just traditional ag/plant science departments: chemistry, physics, robotics, AI, computer science, computer vision and image processing, soft robotics, deep learning, weed science, plant pathology, plant breeding, plant physiology, plant genetics, microbial genetics, microbiology, bioplastics, entomology, material science, nanosciences, food waste fractionation, engineering, agricultural engineering, electrical engineering, environmental modelling, meteorology and food technology as well as agriculture.
ASPECT	Partner Zinc ran "missions" which engaged the different HEPs, along with problem-owners, industry and other stakeholders to address important social challenges - for example, missions included "To add 5 more high-quality years to later life", "Mental Health", and "Environmental Harms".

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Project	Outcome / Impact
Bloomsbury SET	Sandpit events with >40 participants were used to develop ideas for KE PoC projects. These sandpit events helped academics from across the universities to engage and come together to discuss ideas and develop joint projects (which require academics from at least 2 HEPs). These events led to academics forging new links across the HEPs that have knock-on benefits e.g. applications for joint research funding grants, sometimes in new areas and/or for larger joint grants. They have achieved a cultural shift in their academics, away from single-discipline approaches to tackling infectious disease, towards interdisciplinary teams as a preferred way of approaching complex issues in human and animal health through 'best with best' collaborations between life sciences and social sciences/humanities.
Grow MedTech	Technology development projects involved 45 universities outside of Grow MedTech (15 of which were involved in funded projects).
ASPECT	25 Interdisciplinary collaborations involving SHAPE subjects with STEM (including work with MTSC).
SWCTN	Falmouth University, in partnership with Exeter University, were awarded ERDF funding to deliver a £2m Immersive Business project in Cornwall. SWCTN's Immersion theme highlighted potential development themes that underpinned this follow-on project.
Scale-Up Programme	SETsquared (the precursor to Scale-Up Programme) was a partnership of five universities. Cardiff came onboard as a partner specifically within the Scale-Up Programme with funding from the Higher Education Funding Council for Wales (HEFCW). This has proved to be the catalyst needed for them to become a full member of SETsquared, continuing this collaboration beyond the end of the CCF project.
Northern Accelerator & Scale-Up Programme	These two CCF projects have collaborated together, to extend the Northern Accelerator <i>Executives into Business</i> scheme to companies supported by the Scale-Up Programme. 10 Executives were placed by the Scale-Up Programme.
UK SPINE	The project brought together stakeholders from a range of organisations, including university Business Partnerships Office, tech transfer specialists, the Translational Research Office, Research Services, an translational academic research unit, the Medicines Discovery Catapult, and the Crick Institute. This helped to develop a shared understanding of the challenges which exist when considering treatments for ageing - including identifying key knowledge gaps and potential for future research and policy strategy.
MICRA	262 IP cross-referrals between the 8 TTO sites over the course of the project.
Clean Growth	An SME offering electric courier services expanded into medical waste in collaboration with another SME member within the network. Similarly, academics across the partnership collaborated on additional research projects, some involving all three universities.
Cross-CCFs	EIRA worked with a company using their Innovation Voucher scheme, and introduced them to another CCF where they are now carrying out a joint research project. SPRINT and IBbD both worked with the same solar panel company, with IBbD providing NPD support, and SPRINT giving technical expertise.

7.2 Commercialisation policy & practice

The high profile of the CCF projects, along with the size of the awards was influential in gaining the attention at senior level within the HEPs, drawing attention to the importance of KE, both inside the university system, and in those which interact with it. The governance structures of many of the projects included direct involvement of senior university management at the PVC/VC level, leading to the challenges and risks associated with KE becoming better understood, as well as the benefits being more widely recognised. The mechanisms for governance, coordination and consensus decision-making that have been developed for the CCF projects can then be re-used in other collaborative situations.

The programme as a whole makes a very interesting collection of the breadth and challenges of KE. The group of 18 projects is a manageable number to be explained to external policy makers and interested parties, and provides a good cross-section of the huge variety of activities, approaches and successes of KE in the HEP sector. The CCF projects have also provided a good opportunity for the TT functions to use their entrepreneurship and innovation to design and deliver some interesting and ambitious projects. As such, the CCF programme can be seen as a successful showcase for HEP KE activity and impact. Greater understanding can only lead to better aligned policy decisions.

A major benefit reported from the collaborative nature of the projects was that the partners benefitted from learning about and understanding how their peers carry out KE, exposing them to new ideas and opportunities. A number of the CCFs commented that they had recruited a mix of people from both within the KE sector and outside it, bringing new ideas approaches. Although it might be expected that the larger, more research active universities would be the ones to be “teaching” the partners with fewer internal KE resources in their project, in fact 13 of the projects stressed that the learning is in all directions. For example, the HEPs receiving lower levels of research funding are often much more active within the industrial landscape or involved with SME engagement in their local communities. Many of the projects went on to harmonise certain procedures to take the best from each of their members’ approaches.

Several of the CCFs, including MTSC, Grow MedTech, ASPECT and Pitch-In developed best practice guides and materials which were made freely available on their websites. These covered a wide range of topics, such as how to develop a business case for introduction of IoT technologies, industry engagement tools, how to assess early stage technology opportunities and what makes a successful Accelerator programme.

Research England helped to foster some of these cross-project learnings through holding joint CCF events, which were very well received, offering a “safe space” where the projects could discuss their challenges and solutions in an open and constructive manner. Direct links were also formed between projects to share knowledge and information on topics of mutual interest. These events were interrupted by the Covid-19 pandemic, which curtailed face-to-face interactions, and forced the CCF projects to focus on how to manage continued delivery of their projects in the new circumstances.

In the follow-on phase of the project, RE set up a Programme Enhancement Team (PET) to help to maximise the benefits of the programme, improve learning and development, strengthen the cohort of projects, and support wider dissemination of insights across the Higher Education

sector. The CCF PET collated reports on the knowledge generated by the projects on good practice in commercialisation, which have been made available to the CCF and KE community to ensure that these are taken up as widely as possible. The PET has also run events and developed guidance documents for future rounds of the programme. These networking and knowledge-sharing activities between the projects were welcomed, and maybe even more could have been done to foster these communities of practice, and extend the learnings more widely in the KE sector.

Some examples of the learning opportunities and changes in KE practice that have been stimulated by the CCF scheme are shown in the table below.

Project	Outcome / Impact
Advanced Therapies	Following the expansion of the scheme outside London during their Follow on project, good practice in contract negotiation for the closure of their collaborative contracts was transferred to the new partners. This resulted in an average contract closure rate below two months and in one case, a contract was finalised within a week from sending a first draft contract to the partnering university.
IBbD	Standard procedures and support mechanisms needed to run a design consultancy service within an academic organisation were proposed by DMU, honed by the partners, and adopted throughout the CCF
MICRA	Introduced the e-Lucid express technology licensing platform for all the high volume, low value licences across the partners, freeing up significant internal administration time; joint development of case study portfolios and dissemination through In-Part. The first product on the site was distributed >270 times, including to 15 SMEs or large industrial partners.
MTSC	Conducted a best practice study looking at existing processes within the partners and from international examples, visiting more than 7 accelerator programmes to develop their own accelerator plan. The findings have been compiled into a report for further dissemination including on the website. The best of these practices have been spread more widely, and integrated into the Imperial StudentLab accelerator scheme.
THYME	Placements for academics/KE staff from one partner into another to share best practice, drive collaboration, share contacts and improve
MICRA	Procurement of shared patent attorney services
Several CCFs	Introduction of common IP and commercialisation processes, including shared legal templates in some cases

7.3 Place

The CCF programme was agnostic with respect to place, and there were a mix of projects which attempted to build national capability within a specific field (often based on common technology or industry sectors), and projects which had more of a local or regional flavour.

Historically, there have been significant disparities in regional productivity, with a large proportion of innovation activity focused on the “Golden Triangle” that links Oxford, Cambridge and London. About half of the CCF projects had a regional focus outside the Golden Triangle,

and aimed to redress some of these disparities to gain regional attention from both industry and investors. For example, the Northern Gritstone, Venture North and Midlands Mindforge Access to Finance projects all specifically aim to bring more VC-style investment into regions which have historically had lower levels of investment activity, despite having a combined critical mass of university research which match those found in Oxford, Cambridge or London.

The relationships that have been developed in the CCF projects led to new bids with a regional focus, such as Strength in Places, or InnovateUK regional angel investment accelerators. The regional CCF projects also expanded their collaborations to include other local players, such as local and combined authorities, the Local Enterprise Partnerships (LEPs), regional business networks, Growth Hubs, Catapults in the region, and so on.

Some other examples of positive effects on regional economies that have been delivered by the CCF projects are shown in the table below:

Project	Outcome / Impact
Pitch-In	Sheffield worked with Barnsley’s Digital Media Centre to further their IoT ambitions and infrastructure, extending the work of the CCF project outside its specific cities into other parts of the region.
Advanced Therapies	Revived networking meetings post-Covid, which attracted good attendance from around 450 local members in London
Northern Accelerator	Built a close strategic relationship with their local LEP, which recognised the relatively high contribution to R&D that is provided by the universities in their region
Thyme, Ceres, and Advanced Therapies	Leveraged existing regional infrastructure, by working running joint activities with the BioVale network; AgriTech East; and MedCity & the Cell and Gene Therapy Catapult respectively
Scale-Up Programme	Expanded their regional footprint, by adding the University of Cardiff to their partnership
Grow MedTech	A Leeds City Region Memorandum of Understanding around developing the medtech expertise in the city was signed involving Grow MedTech alongside other relevant healthcare players
THYME	THYME developed KE materials which were disseminated to 20 regional schools. They developed a Bioeconomy Outreach Centre to provide an educational learning space for school groups and teachers and bioeconomy-related outreach events, activities and meetings. Together these reached over 400 students at 55 schools.
THYME	Researched the graduate employability skills gaps in regional bioeconomy businesses; working with industry and education stakeholders to better inform university education programs and the development of a new, research-informed bioeconomy curriculum framework to provide a talent pipeline for the sector. This will benefit both local SMEs and graduate employability prospects.
THYME	Combined CCF expertise on the bioeconomy with gaming expertise in the partner HEPs to create the Virtual Thyme Region (VTR). They worked with a consultancy to design and build this as a virtual map of facilities and expertise in the region which created lots of interest and won money from EPIC Mega Grant (\$50K) to develop it further.

Project	Outcome / Impact
EIRA	Innovation Internships placed 137 interns into 82 local businesses, with 42 students and graduates being retained in this employment. This allowed the businesses to gain temporary access to a technically skilled individual, and expanded the skillset of the interns.
UK SPINE	The number of primary stakeholders and project partners for the CCF was expanded nation-wide but disproportionately so in areas where the initial UK SPINE partner presence was the strongest.
SWCTN	SWCTN catalysed local investment into innovation spaces. A brand-new creative technology-focused incubation space gained University support at Bath Spa University, mixing free and paid-for desk space for students, graduates, researchers, freelancers and SMEs working on creative technology projects. With SWCTN Fellows, microgrant recipients and associates among the first residents, it provided development space for new businesses emerging from the Network. The University of Plymouth launched a New Digital Fabrication Lab and Immersive Visualisation Lab to develop skills, resources and programmes for students, industry and cultural partners to catalyse innovation.
Pitch-In	IoT became a core part of Oxfordshire's Local Industrial Strategy and Energy Strategy, highlighting the CCF's local governmental influence.
Northern Accelerator	Now recognised locally as the central method by which the universities are supporting spin-out creation in the region and a key part of how they deliver their impact, civic agenda and support levelling up. The emergence and successes of the programme has supported the universities' voice in regional strategic discussions.
NTI	Regional government organisations identified the Northern Gritstone programme as an engine for regional growth and investment, with an expectation that a significant proportion of the businesses that the fund invests into will be located within the three cities of Manchester, Sheffield and Leeds.

7.4 Additionality of follow-on funding

Following the completion of the initial three-year funding period, seven of the CCF projects successfully bid for funding for an additional year of operation, and a further four received funding for a two-year extension (see Section 4 for details). These project extensions built on the successes of the previous projects, and expanded the activities to provide additionality over the original work. The programme as a whole had been affected by delays imposed by the Covid-19 pandemic. Although the management processes for the projects were able to quickly adapt to lockdowns, and training and workshops were rapidly re-purposed to online delivery, there were unavoidable delays to many of the collaborative R&D projects that generally required access to laboratory or engineering space. RE provided no-cost extensions to the projects, which was very useful, but many of the CCF projects still felt that they were just beginning to really show results from their activities, and welcomed the opportunity to continue to adapt and expand their projects.

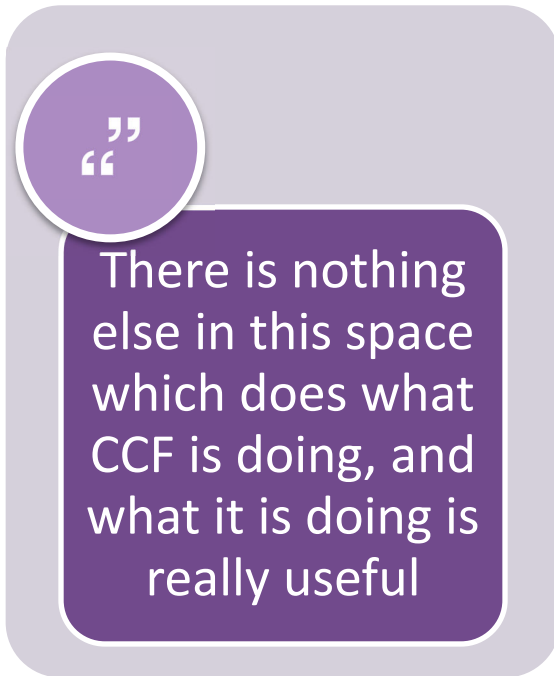
Several of the CCF projects, including MTSC, Bloomsbury Set and Advanced Therapies used their additional follow on support to extend their project activities to additional HEP partners, covering a wider geographical scope. ASPECT also added many further HEPs to their project network, expanding the reach of these CCF projects significantly. At its peak, ASPECT had nearly 50 members. These project expansions increased the dissemination of the learnings from the original projects to new project partners, as well as spreading the activities and benefits more widely.

Because the projects already had their staff, operational structure and governance processes in place, they were usually able to be more efficient in the start-up phases, and become effective more quickly than the original projects. They were therefore able to begin producing relevant outputs and outcomes from the start of the extension, showing the additionality of providing continued support to established successes. One of the main ways in which the extension funding can be shown to be additional to the initial funding is through the acceleration of outcomes and impacts during the 1-2 years of the follow on projects, compared with the achievements of the first 3 years. Some examples of this are shown in the table below:

Project	During initial 3 year project	During follow on project
Clean Growth	3 year initial period: 225 R&D projects 156 new or enhanced products and services	1 year follow-on: 88 R&D projects 65 new or enhanced products and services
Scale-Up Programme	3 year initial period: 293 SMEs signed on 182 R&D projects with partner HEPs £8.8m R&D funds for collaborative projects	2 year follow-on: 168 SMEs signed on 129 R&D projects with partner HEPs £6.1m R&D funds for collaborative projects
Northern Accelerator	3 year initial period: 50 R&D projects 26 Executives into Business placed 5 Scale-up investments made 27 spin-outs formed	2 year follow-on: 48 R&D projects 17 Executives into Business placed 6 Scale-up investments made 11 spin-outs formed
THYME	3 year initial period: 20 industrial collaborative R&D projects 5 new products and services	1 year follow-on: 20 industrial collaborative R&D projects 5 new products and services
MTSC	3 year initial period: 79 academics trained 8 new products and services 15 spin-outs formed	2 year follow-on: 46 academics trained 11 new products and services 22 spin-outs formed

Comments from the CCF project participants confirmed that they found the 4-5 year timespan of their extended projects was better suited to the ambitions of the scheme, and in particular allowed them more time for the long-term nature of commercialisation activity to begin to show longer-term outcomes and impacts. These are expected to continue to arise beyond the end of the programme.

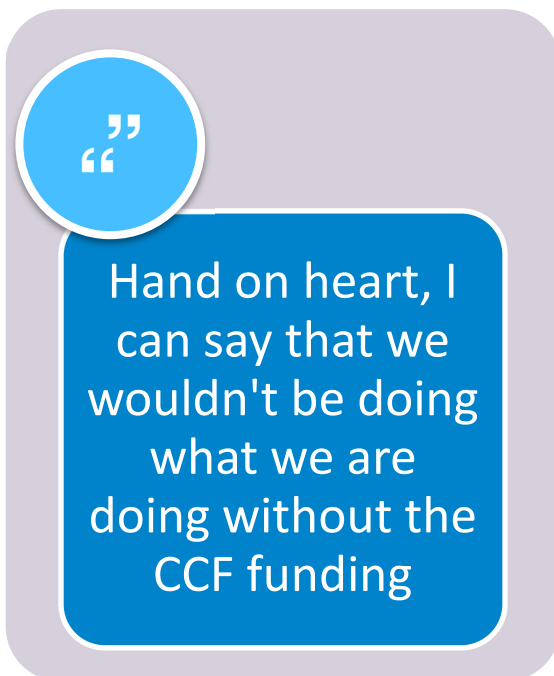
In interviews for the previous reviews, we received consistent enthusiasm from the CCF projects for the CCF programme as a whole, and for their specific projects in particular. The quotes below are just a small selection of the very positive feedback received from the CCF project leaders:



There is nothing else in this space which does what CCF is doing, and what it is doing is really useful



It's a fantastic programme - there are real synergies from working together




Hand on heart, I can say that we wouldn't be doing what we are doing without the CCF funding



I'm convinced the approach is right - it is a hugely positive, valuable opportunity


In addition, several projects have carried out surveys and end-of-project reports which examined the views of the other project participants. For example, Northern Accelerator reported very positive feedback from participating academics with an overall “excellent” Net Promoter Score (NPS) of 77. Very positive responses have also been received from the academics, businesses, SMEs and spin-outs who have engaged with the programme.

Some examples of the comments received from those outside the project partnerships include:




The Exec [into business] we have on-board is taking more of an advisory role. He is brilliant - fits in with the team and extremely knowledgeable and adaptable (which is so important for start-ups!)

- Academic Participant in Northern Accelerator



Match making process was the most valuable aspect. It spurred really useful conversations and got us talking to academics they would not have spoken to otherwise.

- SME Participant in Advanced Therapies



We have developed a product for a new market which we would likely not have been able to compete due to limited resources without SPRINT. This has not yet realised commercial revenue yet but if successful will return approximately GBP 100k revenue.

- Business Participant in SPRINT



I doubt we would have applied for the NIHR grant without the support of the Scale-Up Programme ... The Scale-Up Programme is helping us to access new markets, scale the team, test technology across the NHS and speed up the adoption of new technology.

- Spinout Participant in Scale-Up Programme

8 Future Recommendations

As discussed above, one of the main achievements of the CCF projects has been to provide mechanisms which support collaboration across HEPs and industry, and kick-start relationships that will continue long after the projects have completed. The ability to use CCF funding to add more people to support commercialisation activity which sustains these relationships, and to provide PoC funding were highly valued, but also seen as difficult to replicate using other funding sources. RE could build on these underlying approaches to continue to make knowledge exchange and commercialisation more successful.

Individual projects lead naturally to organic sharing between the participants, but expanding this to other CCF projects and into the KE community more widely is more challenging. The pan-CCF events that were held at the beginning of the programme were very popular, and seen as extremely valuable to help the participants to compare approaches, and to share solutions to common issues, such as governance approaches or State Aid. There were also some events organised by the individual projects which involved other CCF projects, but all these wider interactions were curtailed during the Covid-19 pandemic. More could be done to facilitate communities of practice for groups of CCF projects that have addressed similar types of commercialisation activity. PraxisAuril (soon to be re-named Knowledge Exchange UK) has offered the ability to host these communities of practice, but a more structured approach may have increased the sharing between the CCF projects. As the original CCF projects are joined by CCF-RED projects, the number of participants continues to grow, and this group of CCF alumni between them have an enormous wealth of experience and learning from the projects that is continuing to be shared and disseminated. Similarly, there was also a desire to widen the links and connections that were provided by RE, for example to the Catapult network, or to the investment community, or to regulators. Continuing to find opportunities to facilitate wider sharing and collaboration amongst the KE community will benefit KE practice.

Many of the CCF projects have developed best practice guides and materials which they made freely available on their websites. These cover a wide range of topics, such as industry engagement tools, how to assess early stage technology opportunities and what makes a successful Accelerator programme. Now that the projects are complete, efforts should be made to ensure that these resources are maintained and disseminated further. These resources will grow and mature as the projects develop, providing a rich source of reference materials, and after the close of the CCF scheme. For example, there may be a role for RE, PraxisAuril or others in providing a repository for this material. Some of the learnings from the projects have also been gathered together and published in the interim report on best practice and learnings to inform national policy development from the CCF- PET⁶.

Several of the recommendations on project and programme design that were discussed in the previous reviews and reports have already been successfully adopted by RE to improve programme design in the CCF-RED programme. Examples include:

- Adopting a more flexible approach to HEP participation in multiple bids. Whilst it is recognised that some constraints are required to ensure that individual HEPs do not end

⁶ <https://www.ukri.org/publications/connecting-capability-fund-ccf-interim-report/>

up stretched by participation in too many successful projects, the narrow demands in the original call led to unexpected consequences as the bid partners evolved, and a potential bias towards less innovative projects.

- Earlier information and signalling of the potential subjects of future calls, to allow more time for project consortia to develop their ideas and align the partnerships.
- Ensuring that there is a reasonable lead-time between project award and project start date, allowing the projects sufficient time to identify suitably qualified staff to manage the project. For long-term projects (3 years +), a six-month lead-in time is recommended, although it is recognised that this may not always be possible due to funding cycles.
- Adoption of some programme level KPIs to allow reporting and collation of consistent measures of success that can be aggregated across the whole portfolio of projects, even if they are not all relevant to every project.
- The experimental nature of the CCF is key to the success of this project. Allowing for project flexibility and reprofiling to move funds between activity streams, and fast efficient decision making within RE has enabled the projects to make iterations and improvements, particularly in response to the challenges posed by Covid-19. Autonomy and flexibility with regards to the use of funds has been vital.

Other recommendations from the CCF project participants are likely to be more difficult for RE to adopt. One big concern for the original projects was that the length of projects may not be sufficient to be able to demonstrate concrete outcomes, particularly for more ambitious schemes. The type of impacts discussed in this report may take 10-15 years to demonstrate, particularly for spin-outs. This was exacerbated by the Covid-19 pandemic in the middle of the initial funding period. Not all projects were equally successful, and the follow-on funding allowed some of the CCF projects to achieve a 4-5 year timespan, which was felt to be more reasonable to be able to deliver solid outputs and stretch KPIs. Some of the CCF projects still felt that spreading the same funding over a longer period, or use of no-cost extensions could have benefited the impacts they could have achieved.

Related to this is the difficulty of how to continue to report on the ongoing outcomes and impacts from the projects once the funding has completed, and it is no longer possible to employ dedicated staff to monitor and track these impacts. Perhaps some of the project funding could be set aside to support a low level of ongoing monitoring.

Another common theme was a feeling that the projects could achieve more if there were mechanisms to allow funded participation from HEPs in the devolved nations or even internationally. It is recognised that RE's remit does not extend to these nations, but perhaps more thought could be given to a collaborative approach with the equivalent funders in these countries to provide a joined up scheme.

There is a tension between RE's ambitions to continue to investigate and support additional new approaches to innovation in collaborative KE activity, and the desire of the established projects to identify continuing funding to support their activities. The size and scale of the CCF programme has been praised, being sufficient to achieve significant impacts, and also large enough to get the attention of senior management in the HEPs and other external stakeholders. The overall scale of the programme was also seen as a good balance between enabling enough projects for a good proportion of the HEPs in England to be able to participate and benefit, but

small enough to allow the programme to be understood as a whole with 18 different projects showcasing the diversity of KE activities. This scale has proved difficult to replicate from other funding sources, however, and several of the CCF projects have not found any mechanisms to continue all of their previous activities. This is to be expected, as the experimental nature of the programme means that not all activities will have been found to be beneficial. The projects which have successfully continued a significant portion of their activities have only been able to do so through attracting further grant or public funding. In particular, the pump-priming of relationships through the provision of PoC funding is very difficult to achieve from non-grant funding sources.

9 Evaluation of the CCF Programme

Throughout our earlier reviews of the CCF programme, the overall experience of the HEPs in the programme and their individual projects was universally reported as extremely positive. There was a high level of enthusiasm for the programme, even as the projects reached and passed the end of their funding periods.

The sections above give many examples of the long-term outcomes and impacts that were beginning to emerge from the 18 projects in the programme by the end of their project term. This includes additional funding leverage, training and skill development, increased commercial readiness, increased industry engagement, particularly with SMEs, new spin-outs, and the foundation of specific investment funds.

In this section we examine the evidence to evaluate how well the CCF programme has met its original aims and objectives, using the evaluation questions posed by RE as a guide.

EQ1: To what extent did the CCF support the creation, enhancement or development of collaborations between HEPs and industry partners to drive commercialisation success?

Forming collaborative relationships between partners was at the heart of the CCF programme, and all the CCF projects were very successful in this aim. Every project included at least three HEPs, and the largest (ASPECT) reached nearly 50 HEP partners as members or associate members during the project. HEPs which were part of an existing collaboration reported that they were able to move more quickly in the early stages of the project. This was also shown by the way in which the follow-on projects were able to rapidly demonstrate successful outcomes and impacts. Nevertheless, the projects that brought together new partners also reported that they were able to form very successful partnerships, and that the scheme allowed them to bring together groups of organisations that would not normally interact, to mutual benefit.

The projects also clearly increased the number of collaborations between HEPs and industry partners, with at least 3,176 new relationships with businesses reported by the projects, leading to at least 1,845 collaborative R&D projects. This does not include the far larger number of industry participants that attended workshops, meetings and seminars, or joined networks and mailing lists associated with the CCF projects. These relationships are far in excess of the thirteen formal non-HEP project partners that were included in the original bids.

The geographical spread of the projects across the country has produced a widespread effect on businesses in the regions. Several projects had a local or regional focus, and reported that it was easier to build relationships with more local companies (particularly SMEs). Others had a national focus on a particular sector, and were able to engage with relevant companies, regardless of location.

There are multiple instances given above of commercialisation success arising from these enhanced collaborations, including:

- The MTSC project developed collaborations with complementary service providers (including PA Consulting, VITA Healthcare, Team Consulting, Novartis, Nvidia), which donated in kind support to their projects.
- 311 R&D projects with partner HEPs were developed with support from the Scale-Up Programme, focused on SME engagement. In one case study, the University of Surrey worked with Chassis Autonomy to design, develop, manufacture and operate the capabilities of their CS1 steer-by-wire second generation steering system. This product design was finalised, and put into production using funds from their first investment round.
- Projects funded by the Bloomsbury SET led to the development of 10 data linkage/mathematical models/databases/laboratory tools, 2 vaccine candidates, 5 diagnostic products and 2 new antimicrobial/antimalarial drugs, 6 prototypes and 5 clinical trials. They have formal partnerships with large and small companies for these projects, including industry leaders MSD Animal Health.

EQ2: To what extent, and how did CCF funding complement HEIF in approach and delivery, in particular the impact of direct funding for collaborations, and have HEPs sustained these collaborations through HEIF or other means?

From the interviews carried out in the previous reviews, the participants clearly believed they received many positive effects from the CCF programme that would not have been funded by other funding streams. HEIF funding, in particular, is used to support a wide range of different types of KE activity within an organisation, and will face many competing demands on its use. Large scale collaborative projects involving multiple HEPs are therefore very difficult to coordinate and fund solely from HEIF, particularly as HEIF funding is allocated to an individual HEP based on their individual KE achievements. As shown below, however, HEIF has been used in some instances to maintain some aspects of these collaborations once they have been proved to be successful and valuable.

In previous interviews, the CCF project participants and external stakeholders stressed that the CCF programme was complementary to (and not a substitute for) the existing regular HEIF funding. HEIF funding is an essential mechanism to provide the fundamental services and facilities that enable the organisations to manage their individual KE activities. Without this underpinning capability, they would not be in a position to benefit from the additional activities and collaborations that CCF has funded. The CCF funding allowed the organisations to experiment with higher risk commercialisation activities, with HEIF supporting continued KE activity across the whole HEP.

The EIRA project included some partner universities that do not receive any HEIF funding at all, and so did not have in-house funding for KE support. During their project, EIRA enabled 60 KE interventions to a value of £474K for these non-HEIF funded institutions who were unable to access similar funding prior to EIRA. The University of Essex also provided support to these institutions in bid development and contracts management, enhancing their KE skills.

Another example of the way in which a CCF project has complemented HEIF funded support was given by SPRINT, which provided university agnostic innovation and BD support, in which all partners are equal with the innovation advisors shared across the network, rather than

embedded within one – a model which is also used by other CCF projects. SPRINT reported that this model worked very well with the support of university management, and the SPRINT team supplemented the core university KE resources.

Sustainability has been a challenge for some of the projects, and there has been a need to prioritise which activities can be maintained. Keeping the team together was one of the most common aims. If the project staff remain within the HEPs in other roles, then the informal networks between them will continue to bring benefits and opportunities for collaboration. Internal HEP funding has been found by some projects to continue to support project director or project team member positions. HEIF was mentioned by several of the CCF projects as a source of this funding to maintain posts, or for lower costs activities which can be absorbed by the individual HEPs in many cases, or supported through internal funds. Examples include networking events and some training.

CCF projects which have built a network or community typically aimed for this activity to become self-sustaining. Some activity has been continued using relatively low levels of administrative support, or at larger scale through the use of membership fees or by charging for events, to support more of this networking activity. Expanding the network further increases the opportunity to bring in more funding.

The most difficult aspect of CCF funding to replace has been the PoC projects. This is seen as being essential to move opportunities from the university sphere to a state where they become more commercially valuable. This has long been recognised as an area where more can always be achieved with more funding. However, sources of such funding are always likely to be from grant, government, or subsidised sources due to the high risk nature of this stage of development. Finding alternative sources for PoC funding was viewed by many of the projects as the biggest challenge that they face in supporting their continued activity.

Most of the projects reported that they have taken a “mosaic” or “tapestry” approach to sustainability, stitching together disparate funds from multiple sources.

- Following the end of their project, Advanced Therapies has retained the talent within their knowledge exchange team, with appointment of the UK Advanced Therapies Director to a permanent position within Kings College London, and extension of the contracts for other staff members. Supplemented by sponsorship and consultancy funding, this will allow the partnership to continue.
- Manchester, Leeds and Sheffield TTOs have all made a 15-year commitment to Northern Gritstone, creating a strong incentive to continue the NTI collaboration. These HEPs recognise that the ambitions and scale of NG can only be achieved through the universities working together, having closely aligned TTOs that produce a strong collective ongoing pipeline of commercialisation projects, and they intend to continue collaborating in this manner.
- ASPECT have moved to a membership-fee based model which will fund its core operations, with this membership fee usually obtained from the HEP partner’s HEIF allocation. This has been supplemented with other sources of funding and partnerships, such as the additional grant funding received from ESRC and AHRC to support the continuation of the Aspect Research Commercialisation (ARC) Accelerator.

Of the 18 CCF projects, the partners in at least ten of the projects (ASPECT, NTI, Northern Accelerator, Scale-Up Programme, Clean Growth, EIRA, Advanced Therapies, Ceres, MICRA, MTSC,) are still actively working together, and continuing to reap the collaborative benefits that they derived from the CCF programme. Five others (Bloomsbury SET, Grow MedTech, Pitch-In, UK SPINE, SWCTN) have retained websites describing their activities and achievements, and providing legacy learning materials for their partners and the wider sector. In addition to this formal activity, the individual connections made between organisations are expected to continue to encourage sharing of experiences and expertise between individual partners, and to form the basis of future collaborative bids and activities.

EQ3: To what extent, and how, did CCF support, strengthen and enhance the contribution of English HEPs to productivity and economic growth and delivery of the objectives of the Government's Industrial Strategy and other Government priorities?

The original objective of the CCF programme was “*To strengthen the contribution of English Higher Education Institutions to productivity and economic growth and to delivery of the objectives of the Government's Industrial Strategy*”. As the programme progressed, Government policy evolved and the Industrial Strategy was replaced with other priorities with overlapping aims. Likewise, the CCF programme evolved to emphasise the need to align with these newer priorities. Throughout, the CCF projects have delivered activities which align with these overarching policies.

The aim of the Industrial Strategy was to boost productivity by backing businesses to create good jobs and increase the earning power of people throughout the UK with investment in skills, industries and infrastructure. Subsequently government's plans for growth and prosperity, highlighted the importance of selected key industries where the UK has strengths and potential to grow

Harnessing the world-leading research in the partner HEPs and investing to bring these closer to market is central to all the projects, working with established industry players, innovative SMEs, and spin-outs to develop technologies which can tackle priority issues and move the solutions into the real world. The ultimate benefit to the UK includes new products and services, as well as more high growth companies, employing staff and returning value to the country through taxes and economic growth. CCF projects aimed at SME engagement, such as Scale-Up Programme, Clean Growth, IBbD, MTSC and Pitch-In, align with these government priorities to catalyse private sector R&D and boost the research activity of companies which may not previously have tapped into the innovation within HEPs or accessed R&D grants. At least 1,417 SMEs were helped by the CCF programme, and over 200 new spin-outs were founded.

Different CCF projects focused on the innovation needs of industry sectors which have been identified as priorities for the government. These include Advanced manufacturing; Aerospace, space, aviation; AI and data, quantum computing; Ageing society; Clean energy; Clean growth/Net Zero; Construction; Creative industries; Food & agriculture; Health & wellbeing / healthcare; Smart cities; and Transport.

Skills development has also been a recurring theme across Government policies, and many of the CCF projects have contributed to building capacity in talent and leadership and promoting a research and innovation culture within HEPs, and in upskilling their partner companies.

The wide geographical spread of projects has inevitably supported government aims to increase innovation and economic development across the country, catalysing opportunities and supporting regional growth.

EQ4: To what extent, and how, did the collaborative aspect of CCF increase and/or enhance the effectiveness of the use of the university knowledge base to deliver commercial and business applications and wider applications for the economy and society?

The collaborative aspect of the CCF programme is its central premise, and the individual CCF projects reported that this element both worked really well in practice, and delivered benefits in multiple ways. As one participant put it: *“It’s a fantastic programme - there are real synergies from working together”*.

One way in which the collaborations increased the effectiveness of the commercialisation activities within the partner universities was through the critical mass or scale that combining the resources of the HEPs provides.

- For Northern Gritstone, and the other CCF projects that are looking to raise an investment fund, by bringing together the research capacity and spin-out pipeline of three or more universities together, they are able to offer an investment opportunity on a par with or above that of the more traditional investment hotspots of Cambridge, Oxford or London.
- Combining resources can also make it easier for businesses to access multiple HEPs, and be routed to the most appropriate partners through a single contact point. Scale-Up, EIRA, MICRA and others used this to broker relationships between businesses and researchers at multiple HEPs within a geographic region, across a range of specialisms.
- This also allowed THYME and others to speak with a more coherent voice with regional partners, increasing their influence and making it easier for local authorities, regional networks and others to interact with the HEP sector.
- In other projects, such as Bloomsbury SET and UK SPINE, their PoC funding was deliberately structured to bring together the best expertise from different HEPs to solve a particular problem.

Some CCF projects used their collaborations to bring together disparate researchers with a shared specialism or industry focus.

- For UK SPINE, SPRINT, SWCTN, this again gave businesses a single point of access to multiple HEP resources, this time focused around accessing the most appropriate collaborators for their particular industry.
- Having a sector based focus allowed some CCF projects, including SPRINT and MTSC to employ specialist KE and business development professionals with deep industry knowledge to find partnerships and broker deals, and share these professionals across a group of HEPs that would not on their own have sufficient deal-flow or resources to justify engaging this level of specialism.

For businesses (and other external stakeholders), the advantages of these CCF projects included having structured programmes tailored to their specific needs, the availability of PoC funding to

de-risk the initial engagements, a single point of access making it easy to reach multiple HEP resources, and a network of researchers and other businesses with complementary interests.

Some of the efficiencies delivered by collaboration within the CCF projects were at a more practical level:

- For some of the training schemes and accelerators, having a larger combined pool of academics, students and early career researchers to choose from allowed these programmes to run training tailored for specific topics (eg med-tech spin-outs for MTSC, or social enterprises for ASPECT), and build cohorts which could mentor and support each other.
- At Clean Growth, the partner universities were able to use one set of administrative resources to manage and organise their network, allowing them to reach more businesses without duplicating effort.

Another key theme running through all the CCF projects was the sharing of good practice and learnings from the scheme, whether that was within each individual project, between CCF programme members, or to the wider KE community.

- The most obvious and organic sharing occurred through sharing of best practice from other HEPs within a CCF project. Several projects commented on how useful they found these interactions, and some such as Ceres noted that these learnings benefitted all the partners, not just those which might be more traditionally viewed as strong in commercialisation. Each partner had their own strengths and weaknesses, and value to offer to the others.
- This sharing of knowledge and support led to at least two of the HEP participants forming the first ever spin-outs from their organisations.
- As the projects progressed, there were a number of cases where the approaches being developed within one project were shared and adopted by others. Examples include the adoption of Entrepreneurs into Business by Scale-Up Programme, after it had been tried and tested within Northern Triangle. Or the pooling of ideas, knowledge and contacts across the CCF projects that were aiming to raise an investment fund.

RE helped to foster some of these cross-project learnings through holding events (though this was interrupted by Covid). They also set up a Programme Enhancement Team (PET) to help to maximise the benefits of the programme, improve learning and development, strengthen the cohort of projects, and support wider dissemination of insights across the Higher Education sector. The CCF PET collated reports on the learnings from the projects on good practice in commercialisation and on programme management, as well as running events and developing guidance documents for future rounds of the programme. These networking activities between the projects were welcomed, and maybe even more could have been done to foster these communities of practice, and extend the learnings further in the sector.

EQ5: To what extent, and how, did CCF deliver economic and societal impacts?

The economic and societal impacts of the CCF programme will arise from the outputs of the collaborative research, business partnerships, and spin-outs that have been generated by the projects. These are already beginning to bear fruit and at least 338 new products and services

were launched through the programme. However, it is expected that additional impacts will continue to be generated for many years to come, particularly for high-tech spin-outs which can take 10-15 years to mature and bring products to the market.

These are a very small selection of the wide range of economic and societal impacts that are being generated from the CCF projects:

- Clean Growth has introduced a new carbon accounting and net zero planning service for SMEs: Net Zero 360. This is helping a whole range of companies to reduce their carbon impact, helping to reduce climate change as well as benefitting the companies themselves.
- MICRA supported Aston Vision Sciences (AVS) in the commercialisation of a portable, early-stage, eye impairment diagnostic instrument, their mission being to make eye healthcare and treatment accessible to everyone.
- Ceres spin-out Agaricus Robotics is developing a robot that can harvest fresh mushrooms without damage, reducing labour costs and addressing labour shortages, and leading to 20-30% yield increases.
- Pitch-In collaborated with the Royal College of GPs to develop an understanding of using IoT in social prescribing which has led to the development of a National Social Prescribing Observatory.
- In collaboration with Cornwall Museum Partnership and the Local Enterprise Partnership, Falmouth University received support from SWCTN to develop immersive experiences in five regional museums to engage visitors.
- Scale-Up Programme helped Chassis Autonomy to design, develop, manufacture and operate the capabilities of their CS1 steer-by-wire second generation steering system.
- Bloomsbury SET funded a research project to develop and pilot a field-ready prototype of a new design for a barrier bed net against mosquitos, leading to the purchase of 300,000 nets by Against Malaria Foundation to carry out a large-scale trial.
- The THYME project's outreach impacts included the Bioeconomy Outreach Centre, which provides a unique educational learning space for school groups, teachers and the public. They encouraged participation through a bioeconomy board game, an electronic quiz, hand-on projects for school pupils and contributed to the Royal Summer Science Society Exhibition where 14,000 people viewed THYME multimedia.
- UK SPINE established a drug discovery pipeline in age-related disorders. For example, a virtual screening collaboration delivered enabling assays and novel hit molecules, along with associated translational biomarkers.
- IBbD supported start-up Airhead to create a superior pollution protection mask for commuters, cyclists and those breathing polluted air in urban environments.
- EIRA worked with Outfield Technologies to develop an imaging solution used in their crop management tools to assess the colour of apples in a commercial orchard from a drone survey, in order to predict the quality of the orchard yield.
- Virtual Reality games to make physiotherapy exercises for upper limb rehabilitation more fun and encourage repetition, particularly for children were supported by Grow MedTech.
- ASPECT funded a collaborative project between university researchers and Mobilise that identified how best to support local authority carers during a public health crisis, informed by the Covid-19 pandemic.

- An Advanced Therapies Confidence in Collaboration project established an imaging pipeline for human skeletal muscle derived cells that could be used to increase the chances of successful transplantation.
- An MTSC participant created a therapeutic musical trumpet which uses engaging games to improve compliance with breathing exercises in chronic respiratory conditions, whilst capturing vital data.
- Solar2Water, supported by Northern Accelerator, developed a portable technology that generates potable drinking water from atmospheric moisture and could be of real value in conflict and disaster zones.
- Body Rocket used SPRINT collaboration to test and validate its new, real-time aerodynamic drag meter for cyclists.
- Imperagen, supported by NTI is building unique technology to accelerate the design, optimisation, and validation of novel enzymes for large molecular drug discovery.

Similarly, the range of applications addressed by spin-out companies that have been founded with the help of the CCF projects, and to be further developed with the help of the Access to Finance funding raised is very broad, with the potential to deliver a myriad of societal impacts, through health technology, clean energy, AI & computing, advanced materials, healthy ageing, the care economy, lifelong learning, climate tech, future work, future homes, future cities, and many more.

EQ6: Based on the overall impact of CCF, and considering which of those impacts can be given market and non-market values, did CCF represent value for money?

Research England invested a total £111.4 million into these CCF projects: £86.4 million towards the first round of competitive funding and £25 million towards follow on funding. In this narrative study, based on case studies and non-exhaustive evidence collection, it is not possible to carry out a formal Value for Money calculation for the programme. Nevertheless, there are some proxy indicators of the value that can be attributed to the impacts of the programme.

	Total
Total amount of directly leveraged funding raised	£390,930,911
Funding raised for Access to Finance investment funds	£315,200,000
Funding raised by spin-outs and individual projects	£148,971,519
Total	£855,102,430

By all of these measures, the value delivered by the CCF programme far exceeds the amount of funding committed by RE to the projects themselves, bringing at least an additional £7.70 for every £1 invested by RE.

Several of the CCF projects commissioned independent end-of-project assessments of the impacts of their activities. Some of these investigated the gross value added from these projects, each reporting a significant cost benefit ratio of additional value delivered for each £1 of public investment:

- Advanced Therapies reported⁷ that the commercial impact of their Collaborate to Innovate funding scheme was significant: the combined net present value (NPV) of gross value added (GVA) was estimated at £4.5 million, with an additional £10.1 million GVA generated through investment in research and development (R&D). Taken together, the combined GVA of £14.6m meant the scheme had a cost benefit ratio of 1:5.92 – each £1.00 of public investment generated £5.92.
- An Impact study⁸ of the Scale-Up Programme estimated that in 2023, the members of the Scale-Up Programme directly contributed £57million of GVA to the UK economy, indicating a £7.5 return per £1 of CCF funds invested in this CCF project. Drawing on the findings of the business survey and previous research, it is further estimated that £153 million of future predicted GVA generated (by 2030) is attributable to the SETsquared Scale-Up Programme.
- An evaluation⁹ undertaken by Ekos at the end of the initial three-year Northern Accelerator project forecasted that over a 10-year period (to 2028), Northern Accelerator will deliver an estimated £76.3m in net additional GVA, and generate a return on investment (ROI) of 7.4 (£7.4 in Net Additional GVA for every £1 invested).
- An independent evaluation of the IBbD project in 2021 found over £60M new sales generated by businesses supported, which translates to a net benefit of £37.5M of additional net sales to the UK as a result of the IBbD £4.648M funding, or ROI of 3.5:1.
- An independent economic assessment of EIRA's contribution to the regional economy, showed the total GVA net present value to be £8.3million, and the total project benefit cost ratio (BCR) to be 1:3.65.

The real value of the CCF programme, however, can be seen in the economic and social outcomes described above, and the impacts that these will have for the nation and beyond. There are multiple examples of improvements to human health (development of vaccines, therapeutics, and health tech), increased productivity (new manufacturing methods, improved designs), environmental interventions (multiple companies heading towards Net Zero, development of clean energy technologies), and quality of life (mental health interventions, gaming, cultural interventions in museums and schools) to name but a few.

The programme has also strengthened lasting relationships between the HEP participants, and delivered a legacy of learning about successful approaches to commercialisation that benefit both HEPs and industry. The enthusiasm of the participants, and their keen desire to maintain access to the networks they have built, to disseminate the materials they have generated, and to continue providing the KE approaches they have developed is testament to the value that they have derived from the scheme.

⁷ <https://medcityhq.com/2023/01/30/collaborate-to-innovate-the-impact-of-our-advanced-therapies-partnerships/>

⁸ <https://www.setsquared.co.uk/programme/scale-up-programme>

⁹ Evaluation of the Northern Accelerator, Final Report, July 2021, Ekos Economic and Social Development

9.1 Evaluation conclusions

Overall, these indicators show that the CCF Programme has provided excellent value for money, in measurable economic returns, in the strength and breadth of the impacts generated so far, in contributions to the UK economy, and most importantly in the more subjective viewpoints of all the participants in the projects themselves. This is demonstrated in the continued sustainability of the activities and/or learnings of at least 15 of the 18 projects funded.

In carrying out these CCF projects, the participants have achieved the objectives of the programme and supported government priorities for increased R&D spend, improved skills, and enhancing UK productivity and economic growth. They have also led to the generation of over 200 new HEP spin-outs, as well as stimulating the growth of over 1,500 SMEs and other companies.

Appendix 1: Abbreviations & Acronyms

Abbreviations for the individual CCF projects	
Advanced Therapies	London Advanced Therapies/UK Advanced Therapies
ASPECT	ASPECT (A Social sciences Platform for Entrepreneurship, Commercialisation and Transformation)
Bloomsbury SET	The Bloomsbury SET: Connecting Capability to Combat the Threat from Infectious Disease and Antimicrobial Resistance
Ceres	The Ceres Agritech Knowledge Exchange Partnership
Clean Growth	Clean Growth UK
EIRA	Eastern ARC 'Enabling Innovation: Research to Application'
Grow MedTech	Grow MedTech: Collaborating for a Competitive Future
IBbD	Impacting Business by Design
MICRA	Midlands Innovation Commercialisation of Research Accelerator
MTSC	MedTech SuperConnector
Northern Accelerator	The Northern Accelerator - Integrating Capabilities in the North East
NTI/Northern Gritstone	Transforming UK IP Commercialisation Through Collaboration in The North of England: The Northern Triangle Initiative
Pitch-In	Promoting the Internet of Things via Collaborations between HEPs & Industry
Scale-Up Programme	SETsquared scale-up programme
UK SPINE	UK SPINE KE: free flow of knowledge to accelerate innovations in ageing
SPRINT	SPRINT (Space Research & Innovation Network for Technology)
SWCTN	South West Creative Technology Network
THYME	THYME Project (Teesside, Hull and York - Mobilising Bioeconomy Knowledge Exchange)

Acronyms used in the report

AHRC	Arts and Humanities Research Council
CCF	Connecting Capability Fund
EPSRC	Engineering and Physical Sciences Research Council
ERDF	European Regional Development Fund
ESRC	Economic and Social Research Council
HEIF	Higher Education Innovation Fund
HEP	Higher Education Provider
IP	Intellectual Property
IoT	Internet of Things
KE	Knowledge Exchange
KPI	Key Performance Indicator
LEP	Local Enterprise Partnership
PET	Programme Enhancement Team, consisting of PA Consulting and Wellspring
PoC	Proof of Concept
PVC	Pro Vice Chancellors
RE	Research England
SHAPE	Social Sciences, Humanities and the Arts for People and the Economy
SME	Small or Medium-sized Enterprise
TRL	Technology Readiness Level
TTO	Technology Transfer Office
UKRI	UK Research & Innovation
VC	Vice Chancellor
VC fund	Venture Capital fund

Appendix 2: Detailed examples

Spin-outs

- NTI supported Opteran in the development of 4th wave AI for autonomous technologies. The company is re-engineering insect brain patterns to power advances for autonomous machines by mimicking brain functions of insects, enabling complex visual and navigational challenges. The company completed an initial raise of £215k pre-seed investment from various High Net Worth individuals and has now raised a total of £12M from Northern Gritstone and other investors.
- Aegiq is a quantum computing and networking company using hybrid integrated photonics to create a platform for scalable and practical quantum applications ranging from photonic quantum computing to quantum network interconnects and quantum cryptographic communications directly compatible with existing infrastructure. These systems are powerful, compact and energy-efficient. NTI helped Aegiq to raise £1.5M from angel investors and venture capital,
- Imperagen received £3.5M investment, including £1M from Northern Gritstone with the support of NTI. This life sciences company is building unique technology to accelerate the design, optimisation, and validation of novel enzymes for large molecular drug discovery.
- NTI also supported Slingshot Simulations to close investment led by Northern Gritstone to develop their digital twin and decision intelligence technology, built on two decades of extensive experience in large-scale modelling, simulation and data science.
- Spinning-out of Newcastle University in 2017, Advanced Electric Machines benefitted from Northern Accelerator TTO support, Seed Investment Fund support and Scale-up grant funding. AEM Ltd design and manufacture electric motors and transmissions using sustainable rare earth-free materials that are used across a range of applications including commercial vehicles, off-highway, passenger car and rail. They had a turnover in 2021 of £2.3m and 55 employees, and recently announced £23m in investment to support continuing growth.
- Northern Accelerator has also supported the development of Solar2Water a portable technology that generates potable drinking water from atmospheric moisture and could be of real value in conflict and disaster zones. The project received support from a Northern Accelerator funded TTO team, benefitted from Proof of Concept funding and Exec into Business support and the founding academic attended our Future Founders training.
- PulmoBioMed is a Northumbria University spin-out structured around a medical diagnostic grade aerosol and droplet collector device for exhaled breath and environmental samples. Northern Accelerator's 'Proof-of-Concept' funding supported the development of a first functional prototype. 'Future Founders', provided business training for the academic. 'Executives into Business', supported the onboarding of the executive team, and the development of the spin-out proposition was supported throughout by Northern Accelerator-funded technology transfer professionals.
- The first three spin-out projects from Ceres were all very different and indicate the huge range of disciplines that Ceres covers under their agritech umbrella. Cellexcel Ltd has

taken a previously patented organic -solvent based approach to waterproofing biocomposites, and turned it into an aqueous method which is more suitable to industry and the environment, and is now nominated for an innovation in impact award at their host university.

- Fruitcast Ltd has allowed the work from a PhD student to continue and helped him to adapt into the CTO of a company which utilises AI and machine learning to predict strawberry harvests and so reduce food waste while increasing grower profits.
- Finally, Ceres supported Agaricus Robotics Ltd, which has taken huge strides towards the development of a commercially viable mushroom picking robot to address the huge labour crisis in this industry.
- Some of the MTSC ventures have also seen the commercial launch of their first products. SCALED was founded in 2020 with a multi-disciplinary team of experts supporting the project extends across med-tech, additive manufacturing, physiotherapists and athletes. SCALED is a wearable technology company developing custom-fit wearables for athletes to minimize the risks of harmful long-term damage from joint injuries. It can be used for leveraging injury prevention, rehabilitation and sports performance enhancement through regulated motion control.
- With the support of the MTSC programme, Charco Neurotech has developed the CUE Device, which uses pulsed cueing and high-frequency focused vibrotactile stimulation to alleviate symptoms including slowness, stiffness, rigidity, and freezing of gait in Parkinson's Disease patients. Over 3,000 people are now routinely using the device, and seeing a significant improvement. In 2021 Charco Neurotech raised \$10m from a consortium of investors (thought to be the largest seed financing round that year in Europe for a health technology device).
- William Oak Diagnostics was formed in January 2023 by Dr Alexander Patto (now CEO) and Tim Dwyer (CTO) after Alex took part in the MTSC programme. The company is developing a new lateral flow test to allow new and expectant mothers to test their micronutrient levels at home. As well as the MTSC, the company has received funding from Cambridge Enterprise and the National Institute for Health Research (NIHR) Invention for Innovation (i4i) program which is being used to show proof-of-concept of a prototype device, and expand the team.

Products & Services

- MICRA supported Aston Vision Sciences (AVS) in the commercialisation of a portable, early-stage, eye impairment diagnostic instrument with an initial MICRA grant of £25k in June 2019. AVS has now raised an additional £650K, and leases premises in the Jewellery Quarter of Birmingham employing four staff with two additional engineers joining soon.
- Pitch-In conducted a 'Social Prescribing' mini-project to develop protocols and guidelines for large-scale Internet of Things (IoT) deployment to inform public health policy decisions. Collaboration with the Royal College of GPs developed an understanding of using IoT in social prescribing which has led to the development of a National Social Prescribing Observatory and further projects.

- Pitch-In conducted a number of demonstrator projects in areas of high priority for the Government, including a 'Obesity in Children' mini-project revealing the scale of lack of exercise in primary schools (previously unquantified).
- Through their Flagship Programme, UK SPINE supported a project to deliver a working 'porous' model of ageing therapeutics discovery, providing multiple entry points for stakeholders across the pharmaceutical discovery chain.
- Grow MedTech supported research at Sheffield Hallam University to make physiotherapy exercises for rehabilitation more fun and encourage repetition, particularly for children. A suite of games to support upper limb rehabilitation were incorporated into a virtual reality game for use in the clinic and at home.
- Clean Growth supported Zedify to expand from a one city electric cargo bike delivery service to a franchise across 9 cities in the UK with significant jobs growth.
- One of the first projects that received investment from Ceres was licensed. The decision support system, that alerts growers when it is time to spray against strawberry powdery mildew, is now commercially available from Agri-tech Services.
- Two REFUEL projects supported by THYME identified potential uses for lignin-rich waste streams generated through sugar extraction processes. The research found that conventional water leaching was a relatively cheap and scalable technology that successfully optimised the quality of these sludges by removing between 60-80% of undesirable ash components. Refuel 2 used 'fast pyrolysis', to produce bio-oil from the sludges, identifying over 125 different extractable chemicals such as flavourings, fragrances, fuel molecules and fine chemicals in these oils.
- EIRA supported a collaborative R&D project with Outfield Technologies to work with the UEA, to develop an imaging solution for assessing the colour of fruit in a commercial orchard from a drone survey, in order to predict the quality of the orchard yield.
- In collaboration with Cornwall Museum Partnership and the Local Enterprise Partnership, Falmouth University received £700K from SWCTN to develop immersive experiences in five regional museums to engage visitors.
- Building on SWCTN research, an academic fellow was awarded a fellowship with Magic Leap (industry) and the Royal Shakespeare Company (RSC) to work with other Fellows to create novel immersive experiences. She has been invited to present the work at the RSC and has presented her research in Budapest and Canada.
- London-based start-up Airhead, was helped by Brunel's IBbD design team to create a superior pollution protection mask for commuters, cyclists and those breathing polluted air in urban environments. Airhead subsequently carried out a successful Kickstarter campaign raising over £300,000.
- Bloomsbury SET funded a research project with LSTM, Against Malaria Foundation (AMF) and Vestergaard to develop and pilot a field-ready prototype of a new design for a barrier bed net against mosquitos. The pilot led to the purchase of 300,000 nets by AMF to carry out a large-scale trial, and established the terms of a licence for manufacturers.
- NTI supported a project to develop anti-scale products for use in oil-wells. This led to initial discussion with potential licensees and securing on site oil-well trials with an industrial partner.
- A £25k PoC grant from MICRA progressed the development of a non-contact, non-destructive forensic evidence retrieval technology through the creation of a spin-out

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Smytec Ltd. Mentoring from the CCF helped Smytec to secure a £300k Innovate UK grant apply for further grants and recruit additional staff.

- Scale-Up Programme linked the University of Surrey with Chassis Autonomy to design, develop, manufacture and operate the capabilities of their CS1 steer-by-wire second generation steering system. This product design was finalised, and put into production using funds from their first investment round.
- Pitch-In supported a project investigating how live IoT data can inform understanding of, predict and minimise battery degradation (applicable to electric vehicles and grid energy storage), relevant to HMG's Clean Energy agenda.