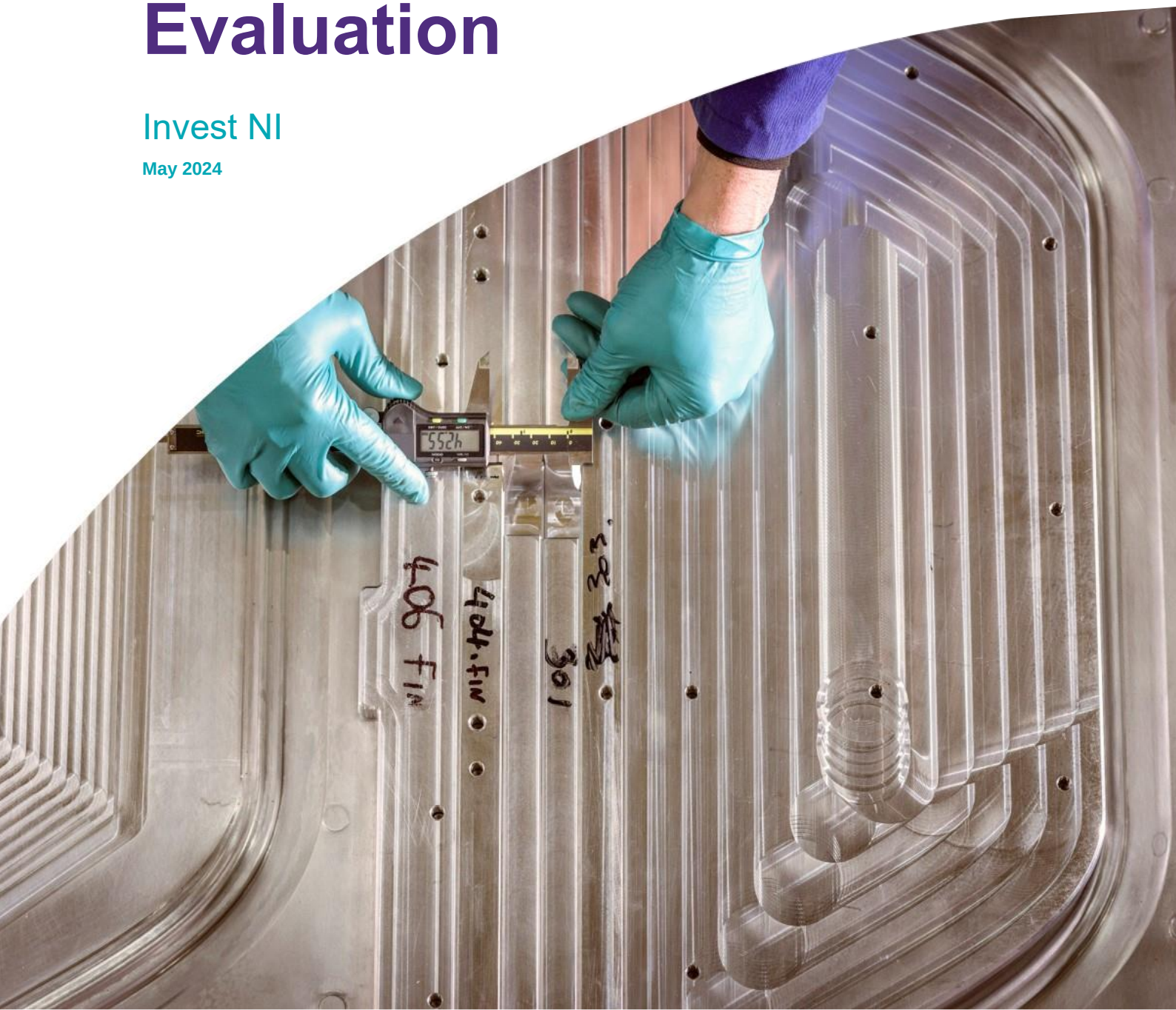
Competence Centre Programme Thematic Post-Project Evaluation and Phase II Interim Evaluation

Invest NI

May 2024



Contents

1. Introduction & background

1. Introduction & background

1.1 Introduction

Invest NI has appointed Grant Thornton to undertake an evaluation of its Competence Centre Programme (CCP). This will comprise final evaluations of Phase I and interim evaluations of Phase II. The CCP began in 2013, establishing four centres focussed on specific sectors, as outlined below. This proposal, and the sectors concerned, followed the Matrix panel's recommendation that collaborative forums - where academic, business and policy stakeholders congregated to address emerging innovation opportunities by exploiting the science and technology capabilities in Northern Ireland – should be established. Recommendations from the Centres of Excellence Evaluation (2007) also highlighted the need for a new mechanism that would facilitate and encourage knowledge transfer mechanisms and provide for greater involvement of industry in industry-academia collaborative projects.

Competence Centres were intended to address these recommendations by encouraging and enabling the growth of local hubs of innovation, undertaking applied research for the direct benefit of Northern Ireland businesses in key areas of potential. These centres, in line with the established international model, became collaborative bodies led by industry and resourced by highly-qualified researchers associated with higher education institutions. They are empowered by their funding, delivery structure and remit, to undertake market-focussed applied or pre-commercial research for the benefit of industry and of the respective fields in Northern Ireland. They seek to establish and/or maintain a competitive advantage and critical mass for industry in NI, by forging connections between industry and academia, and combining their relative strengths and expertise to unlock innovative advances.

In 2009, Invest NI undertook a call for expressions of interest to industry groups, for proposals to establish Competence Centres in relevant priority areas in line with the Matrix Review. Twenty-three expressions of interest were received and following a selection process, five applications were shortlisted and provided with approximately £20k of funding to develop a full proposal. This process demonstrated that identifying research projects, and gaining the necessary financial commitment from business, is both elongated and complex. It requires intensive activity to get to a stage where the proposed Competence Centre can deliver on the objectives of all parties.

Invest NI acknowledged these difficulties by funding the appointment of a research expert for each of the four centres that went onto become CHIC, CASE, NIAECC and Agri-Food Quest. This required funding of approximately £85k and covered full-time resources to work with the industrial partners to develop a five-year business plan and research strategy. Of the resultant five strategies, four were progressed through to establishment as Competence Centres, each with circa. £5m of Invest NI funding for a five-year operational period. Invest NI was to fund 100% of the university research costs and 75% of core operational costs, with industry required to contribute significant contributions in kind, as well as cash contributions. The Cloud Computing Competence Centre was not progressed past SOC stage; the remaining four projects, which progressed to establishment, and their realised operational period, are detailed in Table 1.1.

Rigorous interim mid-term evaluations were conducted following a period of 2.5 to 3 years for each centre. The interim evaluation was used as a basis for inviting Centres to proceed to a second phase,

subject to appraisal and casework approval. Of the Phase I centres, CASE and CHIC progressed to Phase II operations. For this Phase, CASE was progressed for an initial four-year period and CHIC was progressed for an initial three year period, before CHIC Phase II was extended to a five year period.

Table 1-1: Competence Centre Programme Phase I

CHIC Phase I	CASE Phase I	NIAECC	AFQ	CHIC Phase II	CASE Phase II
1 June 2013 – 29 Feb 2020	1 Sep 2013 – 30 Sep 2019	5 Feb 2014 – 4 Feb 2020	1 Oct 2015 – 31 March 2023	01 June 2019 – 31 May 2022 – 31 May 2024	01 Oct 2019 – 31 March 2024

This evaluation will comprise final evaluations of the Phase I Competence Centre Programme (CCP) centres, as outlined above. The respective chapters of CHIC and CASE will also consider an interim evaluation of Phase II operations.

The Competence Centres under review engage a wide variety of stakeholders from the research and industry communities, forging both domestic and international connections. It is hoped that the infrastructure and collaborative environment provided by the centres help these partners overcome barriers to realising R&D advances to discover new products, services and processes; thereby scaling their business and reaching new markets.

Market research covering benchmark centres in the UK, Ireland and further afield, demonstrate that the time lag associated with realising benefits from such strategic innovation investments can be substantial. As such, key to this evaluation will be understanding any monetary and non-monetary benefits, both current and anticipated, that could be attributed to the centres.

1.2 Purpose of this evaluation

The main objectives of the Competence Centre Programme, as outlined in the Strategic Outline Case stage and refined thereafter, are as follows:

- Strengthening industrial research capabilities in a mid-term perspective – by fostering medium-term collaborations in the form of strategically important research programmes
- Creating critical masses and sizable research groups for applied research – by giving incentives for collaboration between industry and academics.
- Maximising the impact of the research base by unlocking the research capabilities and facilities for the benefit of industry.
- Accelerating the commercialisation of research from the local universities by bridging the gap between research findings and their development into commercial propositions.
- Becoming visible and attractive for foreign partners – by achieving international visibility

The main objectives of this thematic evaluation are as follows. Each centre will be considered individually, as well as an overall consideration of cumulative impact and associated recommendations to maximise this.

i) To set out the objectives of the Programme and each Centre, and assess the extent to which it met its stated objectives and all associated targets.

ii) To review the validity of rationale for the Programme, including the nature and scale of the market failures and equity issues; and to examine the degree of complementarity with other Invest NI interventions and the extent to which it overlaps with other supports.

iii) To gauge the continuing fit of Competence Centres with DfE policy, namely 10x.

iv) To assess the appropriateness of the delivery model, building on the findings and conclusions of the interim evaluations, how this could be improved and the effectiveness of the intervention's management and operating structures.

v) To compare the support offered by each Centre against equivalent services available to businesses in other similar regions and identifying, where appropriate, potential service options for consideration going forward. To benchmark the management, performance and impact of the programme against appropriate comparators.

vi) To review progress against the action plan, in relation to the recommendations arising from the interim evaluations, for the Phase II centres in particular.

vii) To assess a logic model of the overall Programme and consider how this could be applied to each individual centre.

viii) To examine the factors contributing to any variation in performance across Centres, e.g. as relating to membership profile including company size, engagement with Invest NI and other relevant characteristics.

ix) Assess the contribution of the programme to boosting R&D, innovation activity and business performance amongst participating firms, including:

a. The extent to which Competence Centres support projects which industry members could not undertake without collaboration.
b. The proportion of supported projects that lead, or are anticipated to lead, to follow-on-investment through further R&D or commercialisation activities.
c. The need for follow-on support to optimise project outputs and outcomes, including legacy impact post-Invest NI funding.
d. The influence of the programme on the product /service range, markets and operations
e. Whether it has enabled businesses to grow and become more competitive.

x) To identify the internal and external factors which have impacted upon the performance of each Centre and overall Programme since the interim evaluation period.

xi) To determine the Return on Investment (ROI) associated with each Centre and overall programme.

xii) To assess the economy, efficiency and effectiveness with which public funds have been used and the extent to which each Centre, and the overall CCP, represents VfM.

xiii) To consider the merits of Invest NI continuing to operate a Competence Centre Programme, including an assessment of whether the strategic context remains valid and if need, demand and market gap still exist, while cognisant of the triple bottom line of DfE's 10X Vision; Innovation, Inclusivity and Sustainability. This will address whether the need and demand for the programme varies according to different company characteristics.

xiv) To identify recommendations, particularly relating to the current phase II centres, to enhance the economy, efficiency and effectiveness.

1.3 Approach to the evaluation

Grant Thornton's approach to the evaluation combines quantitative and qualitative analysis, to answer the questions posed in the terms of reference for the evaluation. Specifically, the evaluation team undertook the following:

- Evidence Gathering
    - Invest NI Engagement: Meetings with the evaluation steering group, representatives from Competence Centre Programme management and Invest NI representatives to discuss approach, gain context and delve into operational/delivery issues.
    - Wider engagement: Grant Thornton engaged with Centre Steering Groups, managers, a selection of industrial and academic stakeholders, benchmark competence centres in the UK and Ireland, as well as NI research and innovation policy representatives.
    - Testing intervention logic: an assessment of the policy alignment (with a focus on continuing and emerging need), market gap, current provision by Invest NI and in the wider NI marketplace.

- Participant Engagement: a survey of participants/alumni of each centre, alongside one-to-one consultations and phone calls, were used to gain feedback and useful insight on how each of the centres performed, are managed, impacts leveraged, attainment of objectives, and whether there is any need for improvements. The consultations followed a semi-structured discussion format. The topics covered in the consultations included operational, governance, effectiveness and impact themes.

  Survey questions were a mix of qualitative and quantitative questions. These questions were designed to ensure accessibility, as well as ensure for a high level of engagement. Email links were issued to all participant contacts provided, with responses boosted by email reminders to non-respondents, leveraging of centre managers to follow up individually, and 75 telephone calls placed by the evaluator.

  A total of 54 responses were received across the Competence Centre Programme, out of a total possible population of 201 participants. In terms of statistical significance, the sample gives a 95% confidence level with a margin of error of +/-11%, or a 90% confidence levels with a margin of error of +/-10%.

- Assessing the Evidence
  - Assessing data and insights: following the completion of the evidence gathering phase, an assessment of outturn performance against the original objectives is made. This drives a consideration of any economic benefits to date, levels of additionality, value for money (VfM) and recommendations for any successor supports.
  - A range of outcomes: centre performance has been measured on the basis of baseline turnover and Business Expenditure on R&D (BERD) from available tracking data and 2021 performance in the same variables, and applying 'impact factors' from survey evidence to account for how much performance change can be attributed to the centres. Grant Thornton's approach also excluded outliers to allow for companies that had recorded exceptional increases. Socioeconomic treatment of CHIC's contribution has been considered and discussed in more detail in chapter 6.

1.4 Invest NI operational challenges

An uncertain economic, policy and organisation backdrop has already impacted the CCP through the cessation of funding. It is also likely to have impacted the performance of the centres, particularly during and post COVID (2020 and beyond). In the context of evaluating the programme, the constrained and uncertain NI budgetary environment and Invest NI's recent operational review are important points to highlight.

1.4.1 NI Budget challenges hinder activity

The Northern Ireland budget is a key contextual point to note when considering the current and future performance of the CCP and availability of funding. In December 2021, Invest NI were asked to pause issuing any new Letters of Offer to customers, or commit to activity that would have a financial impact on 2022/23 budgets and beyond, whilst a budget consultation was ongoing. Whilst this pause was originally expected to last for a couple of weeks, it extended through to the end of March 2022, effectively stalling performance across Invest NI's three main performance areas – R&D, Skills and Jobs. The 2021-22 target for Total Investment in Skills was not met, as companies delayed progressing training plans because of the COVID-19 restrictions and the continuation of The Coronavirus Job Retention Scheme. It is within the context of constrained budgets, and the introduction of the funding prioritisation model for Invest NI programmes, that Invest NI was unable to commit to further funding of the Competence Centre Programme.

1.4.2 The Independent Review of Invest NI

The Independent Review of Invest NI, published in January 2023, made a number of recommendations to align Invest NI's business outreach supports more closely with relevant strategic frameworks, and increase their impact and efficiency. This both reaffirmed the relevance of the

Competence Centre Programme, but also the need to rationalise the programme offer and prioritise funding.

Focus on productivity

The Review reaffirmed the vital need to focus on productivity, with Invest NI's core purpose being to drive a high-performance Northern Ireland 10x economy, via supporting businesses to 'increase exports sales, drive high value job creation, attract inward investment, improve skills, and boost productivity'. With productivity levels in NI consistently among the lowest in the UK, there is much progress to be made in this regard. Focus must be placed on the crucial issue of productivity in Invest NI's suite of supports.

In connection to this, the Review cited Invest NI's programme targets as adopting too narrow a focus (e.g. on job creation) and not illustrative of the full story. From the DfE 10x vision, Invest NI should prioritise areas such as productivity, innovation, skills and sustainable growth, with a greater focus to outcome-based measures. Given the critical role of R&D&I in elevating productivity levels, STEM skills development, as well as cross and upskilling of the workforce, these strategic priorities reaffirm the alignment of the CCP, but so too the need for it to prioritise people and skills in its operations.

Expand recruitment outside of the Client Company model

Almost three-fifths (57%) of Competence Centre Programme participant companies were not Invest NI clients. This is a significant differentiator of the CCP from other Invest NI supports, the majority of which are only open to Invest NI clients. In this way, the CCP aligns closely with the vision set out in the Review, and has enabled Invest NI to expand the reach of its supports far outside its client base.

Portfolio of programmes

The Review recognised the crucial role of many of the programmes offered, but cited the high number of programmes as a barrier to flexible delivery and awareness. It also cited thematic reviews of suites of programmes, such as this evaluation, as best practice. The Panel recommended a detailed review of the number of programmes and sub programmes offered, based on clear principals of prioritisation. It also recommended that Invest NI improve its partnerships with external providers and public bodies. The Review also cited the prioritisation of financial and human resources that could be realised through rationalising the programmes offered.

Internationalisation

A key part of Invest NI's remit is to promote exports and FDI. However, despite meeting targets, the Review found that its efforts were perceived as being too concentrated in promoting FDI from external firms, rather than promoting indigenous businesses to start or expand exports. Additionally, 50% of the support to inward investors was concentrated in 10 companies. The internationalisation element therefore needs to embrace, more fully, the barriers to export faced by indigenous companies. Throughout the CCP, there are several case studies of companies attracting external private equity funding, as well as developing new, or improving existing, products and services, with a view to selling these outside NI.

Improved data monitoring and reporting

The Review highlighted the divergence between the growing emphasis on 'big data' and Invest NI's level of data intelligence on client companies. Areas of improvement include internal analysis of client data, as well as an overreliance on self-reported survey data. Improved internal collation and analysis of data would improve KPI performance, even as the centres progress out of the Invest NI funding phase, with externally collected survey data used to enrich evaluations and insights as required.

1.5 Report structure

The evaluation is structured as follows:

- Chapter 2 assesses the 'need' for R&D&I supports and the policy alignment of such interventions.
- Chapter 3 considers a benchmark assessment of the CCP, alongside the overall programme-level economic contribution and variations between centres which may have impacted such performance. It outlines the potential overall thematic impact of the CCP.
- Chapters 4-7 assess each of the Competence Centres (with two phases for CASE and CHIC) individually.
- Chapter 8 draws the preceding chapters together into a thematic assessment of the Competence Centre Programme, providing recommendations for the overall programme as well as each individual centre.
- The appendices detail progress against the interim evaluation action plans and the economic modelling methodology adopted in this evaluation.

2. The need for R&D&I supports

2. The need for R&D&I supports

2.1 Introduction

Competence Centres are entities that facilitate a collaborative format for academics to undertake market focussed strategic research to drive industry opportunities. This is a unique way to achieve competitive advantage in the industry by leveraging the existing research infrastructure to accelerate the development process. The environment of a competence centre also facilitates the sharing of intellectual property, knowledge and research to increase industry engagement in R&D&I.

Invest NI's Competence Centre programme applies industry relevant academic research to develop human capital in areas that are multi-disciplinary or have cross-sectoral relevance. The programme will develop and commercialise new technologies, ultimately supporting business growth in Northern Ireland and increasing the capability of the regional ecosystem. The objectives of the programme have been outlined by Invest Northern Ireland, with the programming aiming to:

- Develop existing core capabilities (facilities, equipment and technology expertise) that can be exploited by a wide range of businesses through research programmes;
- Incentivise the development of technologies;
- Encourage diverse business participation, especially from SMEs and supply chain companies;
- Provide a critical mass of researchers.

The Competence Centre programme provides the resources required to achieve these incentives, giving businesses the opportunity to scale industrial processes, produce technology demonstrators and develop a supply chain. The programme provides businesses with access to skills and equipment they would not otherwise have access to, to accelerate the development of technologies. These will be assessed by the Technology Readiness Level scale and be produced in the range from 3 to 7.

While competence centres can directly support business growth across Northern Ireland, they can also play a pivotal role in strengthening the research landscape for businesses undertaking future endeavours. The programme can achieve:

- Improved long-term collaboration between industry and academia.
- Improved transfer of knowledge.
- New areas of research defined using a bottom-up approach.
- The development of critical mass of research in priority areas for the NI economy.[1]
- Public funding to leverage additional research business expenditure.
- A change in the research culture and attitudes of both industry and academia.
- Stable predictable funding, over a 5 to 8 year period, both for the management of the centre and for businesses, to encourage them to invest and to sustain a focus on achieving their vision.

[1] Catapult Hauser Report of Technology and Innovation Centres

2.2 Innovation as the fuel for a 10x Economy

The Department for the Economy (DfE) published the '10X Economy' in May 2021, setting out an economic vision for a decade of innovation. DfE has identified three pillars, also known as the 'Triple Bottom Line', to capture their vision for Northern Ireland, these being **innovation**-led economic growth, **inclusive** growth and **sustainable** green growth. Driving economic growth through innovation requires a holistic approach towards upskilling and reskilling the current and prospective workforce, unlocking higher skilled jobs, developing new ideas and opportunities, and fostering an enabling environment for start-ups and business growth.

The 10X Strategy, reaffirmed in the 2023/24 Delivery Plan[2], sets out clear innovation objectives to be achieved by 2030, to:

- Increase total R&D expenditure by 55%.
- Have 450 more R&D performing businesses.
- Make 55% of NI businesses active in innovation.
- Achieve Innovation Accreditation across 10% of NI businesses.
- Increase the proportion of individuals leaving NI HE institutions, with first degrees and post-graduate qualifications in narrow STEM subjects, from 24% to 27%.

"Several 10X Metrics are being used to capture Northern Ireland's performance in moving towards an innovation-led economy: total R&D spending as a share of GDP; the number of innovation active enterprises; tertiary level educational attainment; and labour productivity levels".[3]

Analysis of these figures shows both the historically lagged performance of NI productivity and innovation, as well as the significant potential for unlocking economic growth through buoyant growth in these indicators. Current data shows that, over the period 2018 to 2020, Northern Ireland had the lowest rate of innovation active businesses (38%), 7 percentage points lower than the UK average. Despite this, the number of businesses active in innovation in Northern Ireland grew at a faster rate (19%) than the UK average (18%), from 2016 to 2020, and grew more than London (11%). Over this same period, the number of innovation active businesses in Northern Ireland was most pronounced within several key sectors, including hospitality, food & clothing, and transport.

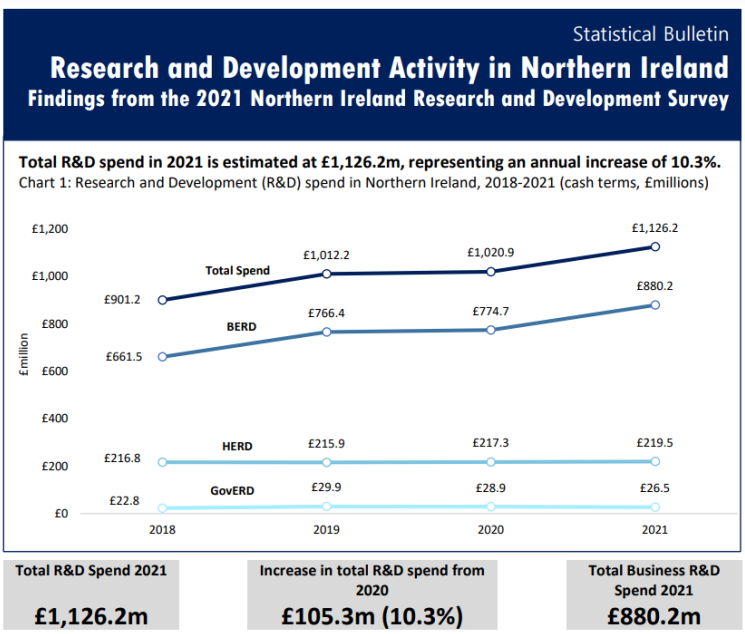
There is a growing consensus not only in NI, but across the UK, Ireland and Europe, of the requirement for R&D&I spending to maintain and unlock economic growth. In recent years, the UK government has surpassed the OECD average for gross domestic expenditure on R&D (2.71% of GDP)[4] with the UK spending 2.93% of GDP in 2021. This was the fourth highest share of GDP behind three G7 nations, with the USA spending the most on R&D (3.47%) followed by Japan (3.27%) and Germany (3.13%). The UK government's total expenditure on R&D remained at £66.2 billion in 2021, with Northern Ireland spending £1.1 billion, illustrated in Figure 2-1.

[2] https://www.economy-ni.gov.uk/sites/default/files/publications/economy/10x-Delivery-Plan-2023-24.pdf

[3] Small Advanced Economy Insights on Innovation Policy for NI

[4] Purchasing power parity in real terms

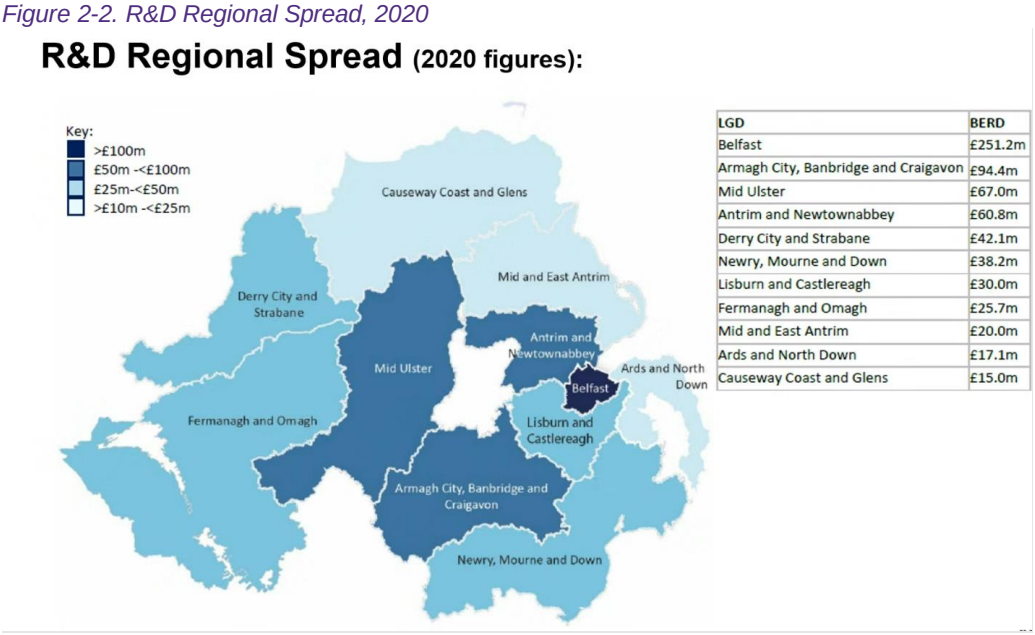
Figure 2-1. R&D Activity in Northern Ireland, 2021



Source: NISRA

In 2021, Business Expenditure on R&D (BERD) accounted for the majority (75%) of NI's total R&D expenditure, experiencing an increase of over £200 million from 2018. In 2020, the majority of NI's R&D spend was concentrated in Belfast (Figure 2-2) accounting for nearly 40% of spend, with each of the remaining regions ranging from 2% to 14% of spend. Funding programmes and strategies such as the 10X Economy are significant contributors to increased innovation activity in NI, who experienced the largest growth in R&D expenditure across all UK regions from 2018 to 2021, having grown by 27%. In comparison, R&D expenditure only grew by 10% in Wales and by 13% on average across the UK. In fact, Northern Ireland ranked 5th place amongst UK regions in 2020 for R&D spend per job (£707) and was around twice the expenditure of Wales.[5]

Figure 2-2. R&D Regional Spread, 2020



LGD	BERD
Belfast	£251.2m
Armagh City, Banbridge and Craigavon	£94.4m
Mid Ulster	£67.0m
Antrim and Newtownabbey	£60.8m
Derry City and Strabane	£42.1m
Newry, Mourne and Down	£38.2m
Lisburn and Castlereagh	£30.0m
Fermanagh and Omagh	£25.7m
Mid and East Antrim	£20.0m
Ards and North Down	£17.1m
Causeway Coast and Glens	£15.0m

Source: NISRA

[5] NI Productivity Dashboard 2022

Although Northern Ireland has experienced the greatest growth in the number of businesses who are active in innovation and R&D spend, Northern Ireland remains to be one of the least innovative of all the UK regions and remains to have the lowest R&D expenditure. This directly limits productivity growth. If the UK underperforms on productivity relative to key counterparts, Northern Ireland's underperformance is even more acute, at 21% below the UK average in 2021 and at £24,007 GVA per head.[6] Output per hour worked appears to be the main contributory factor, followed by lower economic activity rates.[7] NI GVA per head did increase by 6.4% between 2020 and 2021, meanwhile the UK increased by 7.3%. In comparison, Wales have roughly double the population size of Northern Ireland and had a lower GVA per head (£22,380 in 2021), as well as a total output of £25,665 (GDP per head) compared to £27,154 (GDP per head) in Northern Ireland.

The Productivity Institute has analysed more up to date data, identifying Northern Ireland as the worst performer of the 12 UK regions in 2022, based on 18 key drivers of productivity. According to their 2022 report, Northern Ireland performs better than most other UK regions regarding export intensity, R&D per job, and gross fixed capital formation. However, the report found that business innovation, entrepreneurial activity, and employer provided training, all require improvement if we want to influence future productivity. A key takeaway from this report is that, despite being a focus of policymakers, continued political uncertainty on local businesses, as well as relatively low levels of FDI, are having a significant impact on the region's productivity.

2.3 Barriers to Innovating

With micro businesses dominating the Northern Ireland economy (89% of businesses in March 2023), innovation – and in particular, encouraging these smaller businesses to innovate - is at the forefront of building a competitive advantage in a 10X Economy. However, the very nature of this environment often means that businesses do not have the resources to undertake innovation activities, due to a suite of barriers faced. This section will discuss some of these barriers preventing businesses from engaging in innovation, including resource constraints, time costs and skills gaps.

Valley of Death

The gap between early stage, often publicly funded research and later-stage commercial application, is commonly referred to as the 'Valley of Death'. This is where innovation may be stifled due to a lack of applied translational research corresponding to the middle part of the technological readiness scale. In this stage, the risk of failure is heightened due to the increase in investment required, before tangible commercial return can be forecasted. This presents an often-prohibitive risk for private stakeholders, potentially outweighing any future return.

Private companies can be hesitant to fund a project with their own resources, particularly when the findings of academic research have not yet revealed the potential for a product to scale. Investment opportunities may also be restricted by high factor prices, in particular where more investment is required in the scaling up stage and to navigate the regulatory, safety and intellectual property procedures. In some cases, this can also be caused by public funding for R&D increasing the demand for research capital and labour inputs.

This can have a knock-on effect for incomplete markets, where an initial lack of demand (due to a lack of knowledge of the benefits) can inhibit potentially profitable R&D. The speed of development in the adaptation of new products and technologies can be a decisive factor in the international competitiveness of both firms and countries. Firms, therefore, require the capacity to accelerate new opportunities quickly and effectively in a globally competitive economy.

Overall, sufficient public support is required over a long time-period, to avoid delays which may impact profitability. Competence centres help to address these risks for businesses, by reducing investment capital requirements for companies entering certain markets, offering the potential for in-kind

6 Current basic prices

7 https://www.ulster.ac.uk/__data/assets/pdf_file/0005/414662/Understanding-Productivity-in-NI-May-2019.pdf

contributions to be made, rather than upfront cash payments, as well as open access prototyping, scale-up and demonstration facilities.

Crowding out

Government R&D spending may not necessarily lead to genuine 'additionality' in areas where private R&D financing is plentiful. This can crowd out innovation projects that do not have access to available private R&D finances. Current innovation programmes that have already put measures in place to tackle this include the Department for the Economy's InnovateUs programme. A relevant feature of the programme, discussed in section 2.5, is the 25% spending cap on 'Advanced Web Based Technologies'. The purpose of this is to prevent spending being concentrated in a particular area of innovation or a particular industry.

Time lag for benefit realisation

The lengthy time horizon and staggered speed of development and subsequent commercial outcomes, as noted when discussing the innovation Valley of Death, create a time lag between the initial research investment and the realisation of returns. Over time, the estimated return to the initial investment can evolve and may not be linear or guaranteed. In particular cases, such as healthcare, the research process can take a significant number of years before there are any tangible monetary benefits, ultimately impinging upon a business' balance sheet in the short to medium term. Larger companies may be able to absorb this shorter-term impact in anticipation of future returns; smaller counterparts may not be able to.

Financial barriers

From 2018 to 2020, NISRA identified that 38% of SME's in Northern Ireland are active in innovation and 36% are engaged in innovation-related expenditure, compared with 42% in the UK. In comparison, 44% of large businesses engage in innovation related expenditure, which is 10% lower than the UK rate. NISRA's breakdown of innovation activity shows that 53% of innovation-active businesses in Northern Ireland are investing in advancing technology and machinery. Larger and more expensive facilities for technical innovation require capital that can often be procured only by larger, more patient investors, who are scarce in Northern Ireland's micro-dominated landscape.

NISRA also identified that only 5% of NI's innovation activity involves the acquisition of external knowledge and market research. DfE aims to help businesses understand that innovation is much wider in scope, not only realised in the form of data and analytics or emerging technology. It can also be achieved in the form of process improvements, skills development opportunities, and in improving agility in delivery, business management and business growth.

To tackle the financial burdens of innovation in a small advanced economy, funding programmes are in place to target innovation. The PEACE Plus programme has dedicated £1 billion from 2021 to 2027 which will, in part, be directed towards economic transformation. Another £1 billion of investment has been injected into Northern Ireland through City and Growth Deals, which aim to build innovation capacity and capability. Competence centres can also offer financial relief to SMEs by funding academic research that could propel project growth, as well as provide access to physical capital such as machinery, laboratories or equipment owned by academic institutes.

Perception

As previously touched upon, DfE aims to help businesses change their perception of what constitutes innovation activity, as well as elevating the potential that innovation presents for products and services within firms. In particular, the Programme for Government highlights the role of collaboration as means to achieve innovation and strengthen productivity and business growth. The strategy identifies a general fear from local businesses who believe that collaboration may cause them to lose their intellectual property or competitive advantage. As such, local businesses fail to see the value or opportunity that innovation can bring.[8]

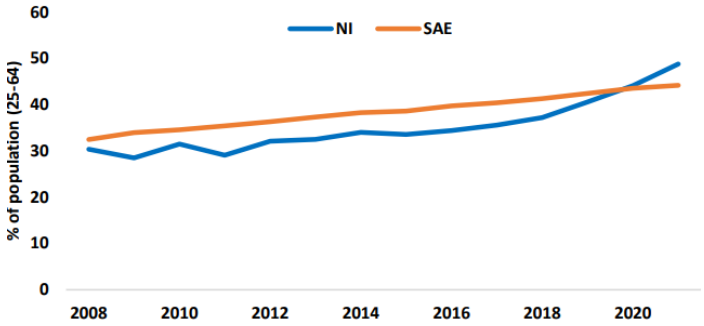
[8] PfG Consultation Document

Innovation skills gap

Utilisation of skills can also drive productivity and innovation in workplaces, according to the OECD Skills strategy for Northern Ireland, 2020. This is a particularly prominent issue in NI, where the employment rate has lagged behind that of the UK with an average five percentage point gap over the last two decades, a factor consistently associated with higher levels of economic inactivity. This strategy aims to bridge NI's employment rate with the UK, by 2030. This strategy puts skills at the core of policy response for economic growth and even highlights the concept of increasing the innovative capacity of businesses as a viable way of strengthening skills use. It encourages collaboration across NI's world-class academic institutes with industry, in order to propel Northern Ireland's transition towards more high value-added activities and support economic growth.

The PfG states that almost one-third of all jobs worldwide are likely to be transformed by technology in the next decade. To keep up with necessary changes, populations need to be equipped with the skills to participate in new opportunities. In particular, highly skilled individuals are noted to be key to the invention of new technologies, and for establishing and managing high performing businesses.[9] The Northern Ireland (NI) Skills Barometer is a tool, commissioned by the Department for the Economy (DfE), to provide a better understanding of the future skills needs across the NI economy. The 2021 report finds that, by 2030, almost two-fifths (37%) of new workers will require NQF level 6 and above qualifications.

Figure 2-3. Percentage of Population (25-64) with Tertiary Level Education (Level 5-8), Small Advanced Economies (SAE) and Northern Ireland.



Source: Landfall Strategy Group, OECD

The OECD Skills Strategy also highlights that larger firms tend to make better use of skills than their smaller counterparts. This in part due to their capacity to employ a dedicated human resources function, and to access the skills and knowledge for innovation. This was evident in the previous finding that a larger proportion of large businesses across NI were more likely to participate in innovation activities or engage in innovation-related expenditure. To encourage innovation, initiatives need to remove barriers affecting SME's when they account for the majority of businesses for NI.

2.4 Innovation at the forefront of policy

Invest NI has policies in place that are informed by the overarching policy environment and seek to achieve similar outcomes. As such, this section aims to outline a range of well-established regional, national and organisation-specific policy aims that seek to achieve better outcomes through R&D&I, for the Northern Ireland economy.

Programme for Government (PfG) Framework

A consequence of the absence of an NI Executive has been the lack of a Programme for Government. As a result, the Consultation on draft outcomes framework 2021 remains the best indication of the strategic direction of any incoming Executive. The draft Framework contains nine

[9] https://www.economy-ni.gov.uk/sites/default/files/publications/economy/Research-Bulletin-23-1-SAE-Insights-on-innovation-policy-for-NI.pdf

strategic outcomes, with a stated focus on fostering innovation, developing Northern Ireland's skills base, helping to excel business growth, establishing a significant position in global markets and investing in the economic infrastructure. Key strategic areas in the PfG draft outcomes framework of most relevance to this evaluation include:

- Developing a new Skills Strategy for Northern Ireland;
- Helping businesses recognise and achieve their high-growth potential by supporting start-ups, as well as assisting existing businesses to scale up, expand and grow.

The framework adopts an outcomes-based approach to achieve the ambitions of the Draft PfG. These outcomes highlight the role of innovation in driving productivity, as well as creating opportunities to upskill and collaborate as a means to attract foreign direct investment for R&D&I. Out of the 14 outcomes set out in the framework, the following are aligned with key indicators in this evaluation:

- We prosper through a strong, competitive, regionally balanced economy
- We are an innovative, creative society, where people can fulfil their potential
- We have created a place where people want to live and work, to visit and invest

The Competence Centre Programme drives innovation and collaboration to ultimately achieve the selected outcomes set out in the framework. The programme drives new economic growth innovation, contributing to increased businesses innovating and the quality of innovation in those businesses. It uses a network of experts to create new industry opportunities that make Northern Ireland an attractive place for people to work and invest.

Economy 2030 – Draft Industrial Strategy

Economy 2030 sets out the Department for the Economy's Draft Industrial Strategy and long-term vision to transform Northern Ireland into a "globally competitive economy that works for everyone." It sets out a plan to build a globally competitive economy based on five priority pillars for growth:

- Accelerating Innovation and Research
- Enhancing Education, Skills and Employability
- Driving Inclusive, Sustainable Growth
- Succeeding in Global Markets
- Building the Best Economic Infrastructure

The Competence Centre programme provision supports the delivery of all of these growth pillars. The Strategy proposes that resources should be targeted to achieve economic competitiveness. As part of the third pillar - Driving Inclusive, Sustainable Growth – equipping more companies with the relevant resources and encouraging them to scale-up and achieve their growth potential is a key component of the Competence Centre programme.

'Supporting research excellence' enables local businesses to develop and exploit new, cutting edge technologies which lead to new products and services for global markets and facilitates the development of world-leading clusters. Competence Centres directly support this, achieving the goals set out in the pillars 'Succeeding in Global Markets' and 'Accelerating Innovation and Research'. By taking a collaborative approach, the Competence Centre programme connects industry to academia, improving innovation practices and the capability of businesses competing in both domestic and international arenas. The Competence Centre programme directly supports the following Actions set out by the Strategy:

- Support the local research base, including universities, to increase the number of sustainable spin out companies in Northern Ireland;
- Promote and develop global research excellence, foster greater industry/academic collaboration and better align research with economic opportunities and our sectoral strategy;
- Increase innovation opportunities and support for business collaboration regionally, nationally and internationally;
- Develop our international position as a destination for learning, attracting the best academic staff and collaborating on research.

10X Decade of Innovation

The ambition set out in NI's economic vision is for a ten times better economy, unlocked through a step change in attitudes towards R&D&I (Research, Development & Innovation). Northern Ireland's decade of innovation will encourage greater collaboration and innovation to deliver benefits for all people, businesses and sectors. This ambition will be realised by focussing on innovation in areas where we have real strengths and making sure that these gains mean something to all businesses, people and places in Northern Ireland.

The DfE harnessed expertise across industry, academia and government to identify key technological strengths, consulting with the MATRIX Panel who advised on commercial exploitation of R&D and science and technology in Northern Ireland. This action identifies the value in the role of accelerating R&D&I to increase Northern Ireland's competitive advantage.

The 'Trade and Investment for a 10x Economy'[10] document, published in June 2021, followed the publication of a '10X Economy' which sets out the overall ambition for the future of the economy. Attracting inward Foreign Direct Investment (FDI), it is suggested, can support the ambitions of our '10X Economy' in the shape of capital, employment and supply chain effects; while wider economic spill-over benefits are associated with technology and knowledge transfer, agglomeration and capital investment in R&D[11]. Trade and Investment for a 10x Economy sets out several ambitions aimed at supporting investment in R&D:

- To take a collaborative approach, equipping individuals and businesses with the information and skills to seize opportunities in Northern Ireland's cluster of growth and opportunity areas.
- To look to international best practices, prioritising innovation to expand business activity across national and international markets.

The three pillars that capture the vision of the 10X Economy, that were previously identified in section 2.2, include; innovation led economic growth, inclusive growth and green growth. We have broken down the most relevant ambitions of the strategy under these three pillars that most strongly align with the aims of the Competence Centre programme.

Innovation
• The 10X Delivery Plan 2023/24 aims to launch productivity-focused investment toward new technologies, to create a competitive advantage. New technologies to market often fail, increasing the risk for SME's, including the financial risk and time invested. Competence Centres de-risk applied research that is generally far from market by reducing the cost (25% of total costs) largely provided by way of in-kind contributions. This method also ensures that effective Knowledge Exchange takes place.
• 10X prioritises the development of new technologies and clusters in which NI has the potential to hone a competitive international advantage in; these include cybersecurity; software engineering and AI; robotics; advanced composites; zero carbon tech; transport; energy and agri-food; digital transactions; food chain, and virtual production. CC's embrace a wide sectoral mix, with the inclusion of peer networking and allow businesses to engage in market-relevant research in the development of their research agendas.

[10] https://www.economy-ni.gov.uk/publications/trade-and-investment-10x-economy-priorities-northern-irelands-inward-investment-trade-and-exports

[11] Trade and Investment for a 10X Economy

Innovation

- The speed of development in the adaptation of new products and technologies is increasingly seen as a decisive factor in ensuring the international competitiveness of both firms and countries. CC's foster an environment of knowledge sharing amongst businesses who are at different stages of product development. The programme aims to remove the fear of collaborating with competitors to achieve timely advancements in R&D&I.
- The mentoring elements of CC's supports enable businesses to realise strategic and operational advances in their businesses. This will help to open up access to markets for NI businesses to export new products and services (including through significant investments such as the city deals infrastructure) abroad, raising awareness of NI as a centre of excellence in the respective cluster area.

Inclusivity

- Inclusive innovation directly impacts productivity and the overall level of talent in the workforce. The financial assistance given by Invest NI towards these supports helps to address the financial barriers faced particularly by SMES, when compared with larger counterparts. Given that the vast majority of NI's business activity and employment is concentrated in SMEs, targeting them in funding supports helps to ensure the widest coverage and spread of benefits resulting from public expenditure.
- The 10X strategy focuses heavily on talent and skills, and how these are assets with the potential to realise the Strategy's ambitious vision for Northern Ireland. Innovation activities that upskill or reskill the workforce enables businesses to adapt to the fast-paced changes and promote the necessary resilience.
- The Competence Centre model is often described as a 'big company' model as large companies generally have the resources, knowledge and expertise to drive strategy and deliver market-led research. However, SME involvement is also essential and while they may be resource constrained and less able to participate directly in the research, they benefit from networking, the formation of new partnerships and informal and formal knowledge transfer. It is essential that Northern Ireland Centres have programmes that facilitate SME involvement.
- Areas of socioeconomic benefit are prioritised by the CCs, including fields of healthcare, food supply, sustainable energy and sustainable manufacturing. Given the market failure created by the time lag for returns to R&D&I investments to be realised, companies may otherwise not be able to make the financial and time investment in strategic research into these fields, or may not be able to justify making them if the resources are there, instead prioritising more lucrative, short to medium term projects.

Sustainability

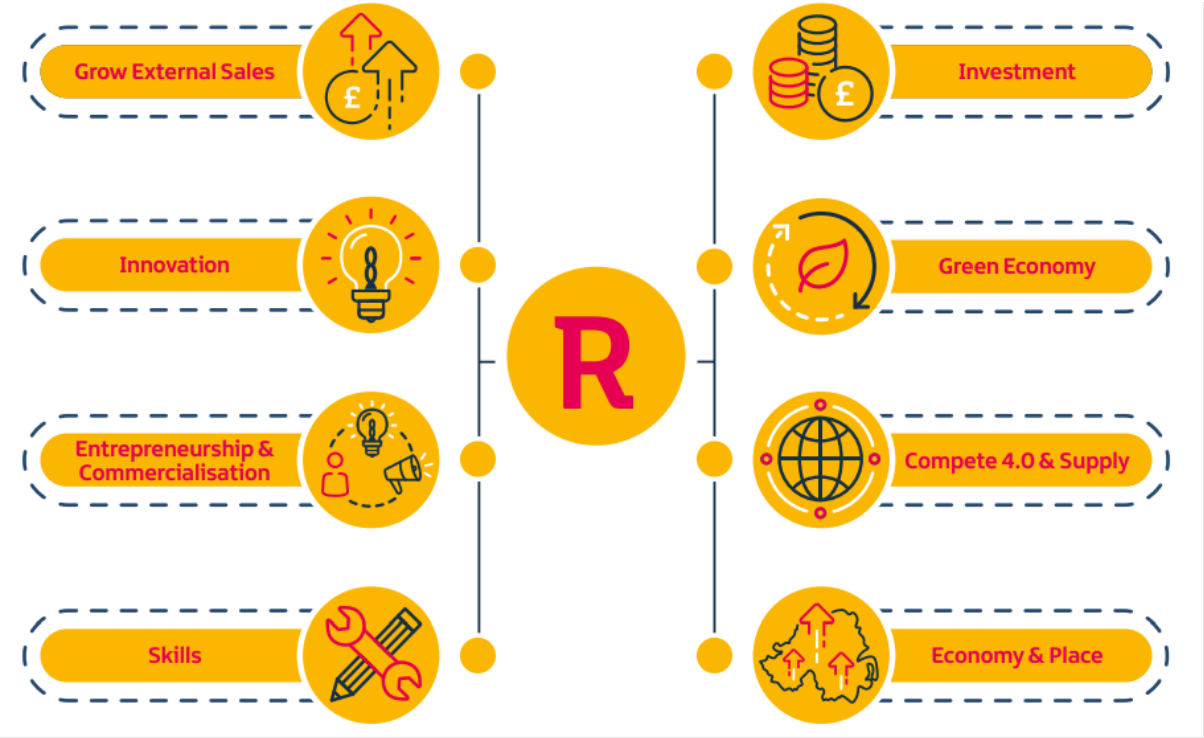
- Green tech and renewable energy (in particular capabilities such as off-shore wind and hydrogen capture and storage) are growing areas of competitive advantage in both Northern Ireland and Ireland, shown by both commercial and academic activity. The funding provided to further connections between industry and academia, permit access to specialist equipment and skills, and offer training on aspects such as commercialisation through the competence centre programmes can help to build the critical mass required in these areas of emerging potential.
- The adoption of green tech and innovation is an example of a medium to long term investment; the up-front costs (even if part-funded) of making such capital investments can deter micro and SMEs from making these changes. Green tech and renewable energy is the overarching focus of the CASE Competence Centre, which is currently in its phase II and was the centre with the highest number of phase I participants.
- Sustainability is also at the heart of a diverse range of fields, including those focussed on by CHIC, NIAECC and AFQ. The recently published Draft Circular Economy strategy for Northern Ireland illustrates the potential for these sectors to contribute towards NI's sustainability targets. The strategy states: *'By 2050, Northern Ireland will have an innovative, inclusive and competitive economy where business, people and planet flourish, with responsible production and consumption at its core.'* This illustrates the requirement for key sectors of the economy – particularly manufacturing and agri-food in the NI context – to be 'on board' with, and working towards, incorporating circular principles and re-use/re-purposing of raw materials/waste products from other industries in their processes. The skills and competencies – particularly the knowledge transfer occurring and the industry-academic partnerships promoted – by CASE and the CCP in general, are key to distributing this knowledge among the wider business base.
- Stakeholders felt that environmental and carbon awareness not only among the general public but, crucially, among senior business representations in NI was low. CASE in particular has become a 'trusted

Sustainability
voice' in communicating the importance of sustainability and potential social and financial gains from innovation advances in this field. • Illustrative of this awareness raising role within the local community, as well as the promotional role it plays in raising awareness of NI's potential, was its hosting of the inaugural Northern Ireland Energy Summit in June 2023.

Invest NI Business Plan 2021/22 and the Draft Business 2022/23

This Business Plan sets out eight strategic objectives, in Figure 2-4, that aim to contribute to the trade, investment and jobs generation that will help to realise Northern Ireland's economic recovery and future success. The Business Plan lays out intentions from Invest NI to work with the Department for the Economy in 10X work-stream development groups to achieve outcomes that align the 8 strategic objectives with the pillars of the 10X Economy.

Figure 2-4. Strategic Objectives



Source: Invest Northern Ireland

The Draft Business Plan (BP) 2022/23 is updated to encompass 10 strategic objectives which have been expanded to focus on inclusivity, as well as funding sources and City Deals. The BP also assesses Invest NI's performance in the 2021 calendar year according to employment creation. The Plan outlines the competing priorities that Invest NI faces, in the context of limited and volatile funding arrangements, and details the Funding Prioritisation Model that has been introduced. This will result in some projects no longer being funded, and new projects being funded to ensure that funds are allocated efficiently and creating the biggest impact.

Invest NI's Competence Centre programme aligns closely with their Business Plan through the following strategic objectives:

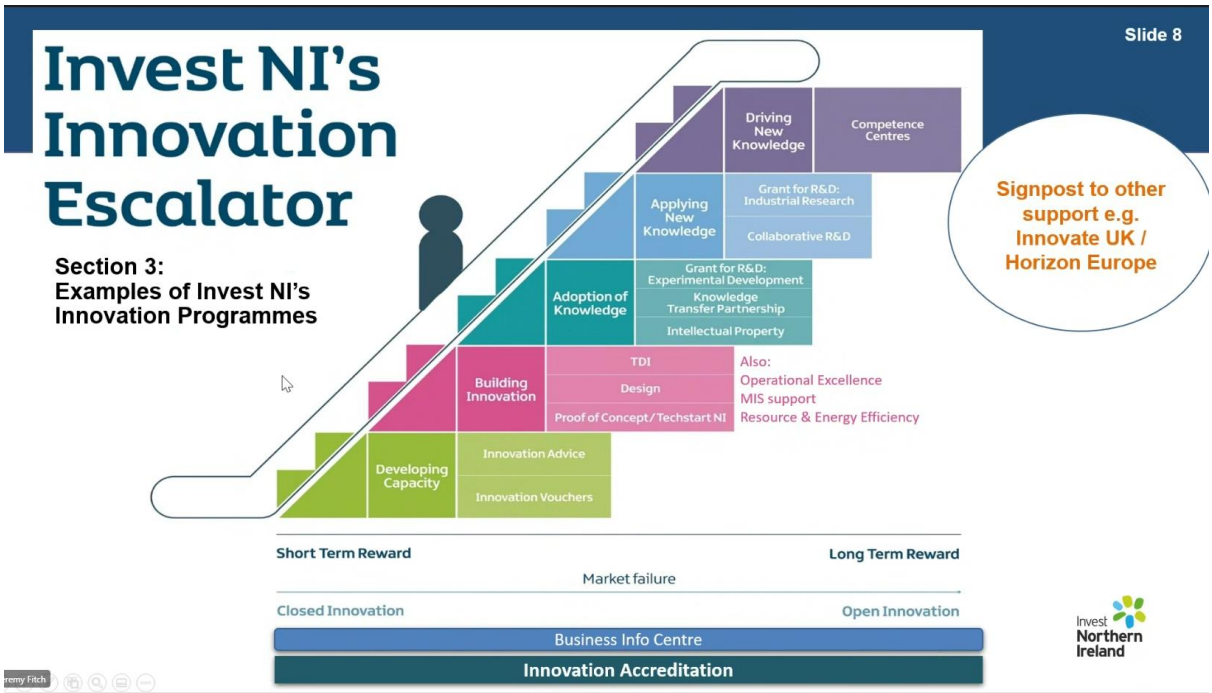
- Investment and job creation,
- Innovation,
- Entrepreneurship,
- Skills,
- Productivity, and
- Inclusion and place.

This is because the programme engages directly with decision makers, as well as a wide range of policy, academic and industrial stakeholders, empowering them to take decisive action to engage with R&D&I as a means to benefit the future of their business/respective fields. Invest NI operates at arm's length as a funder, with competence centres operating with significant autonomy. The programme focuses on investing in R&D&I in order to elevate productivity and innovation, equipping companies with the skills and equipment to improve existing and develop new products and services, improving their businesses processes to foster industry growth. These all have the potential to drive significant productivity advances through both tangible (financial) interventions and intangible 'mindset' impacts.

2.5 Market study of R&D&I supports available in NI

As highlighted in this strategic context, the vision for the Competence Centres Programme aligns closely with a suite of regional and national strategies; this section will further explore how Invest NI's provision of this support addresses the Department for the Economy's 'triple bottom line' principles of Innovation, Inclusivity and Sustainability. Invest NI offers a range of supports from mentoring support, direct funding to launch a product, office space and informal networking opportunities. This offering can appear crowded and may confuse SMEs regarding what form of support they are most likely to get successfully or which most applies to their specific stage in the innovation ladder. Figure 2-5 clarifies this using Invest NI's Innovation Escalator, which demonstrates how the organisation's range of supports varies according to outcomes and timelines. At the beginning of the escalator, INI offers innovation vouchers in the form of a £5,000 grant to get more companies actively involved in innovation; this may allow businesses to tap into expertise for a particular product or challenge they are facing and offers short-term reward. Competence centres are placed at the top of the escalator; this is due to the more advanced stage they represent in the innovation journey, with consortium companies being actively involved in carrying out research. It also demonstrates the longer-term potential reward for businesses and the industry as a whole.

Figure 2-5: Invest NI's Innovation Escalator



Source: Invest NI

The Department for the Economy's InnovateUs

The focus of InnovateUs is to encourage a greater participation in innovation activities across Northern Ireland. The programme focusses on SME's to acquire the skills necessary to engage in innovation activities, to undertake further forms of upskilling or development to enhance learning and innovation capacity, as well as promoting collaborative working between small businesses and Further Education (FE) colleges. In order to take advantage of academia as a means to accelerate business growth, InnovateUs provides project-based mentoring. Four funding options are available for academic institutes, from £1,000 to £6,000, to support the provision of 10 to 60 hours of face-to-face or online mentoring to businesses. The 2023/24 criteria encourage

work on Advanced Web Based Technologies, but with a 25% cap on budget spend to ensure that funding projects are inclusive of a range of innovation activities and sectors. The Competence Centre Programme directly aligns with this strategy by facilitating the collaboration between academic institutes to inform the growth of industry-related knowledge and skills.

InterTradeIreland Innovation Boost

InterTradeIreland notes that innovating businesses have a higher likelihood of expanding and growing. Their provision of specialist support focusses on converting knowledge into a commercial reality, making the process more productive and efficient, as well as adding confidence to businesses, ultimately leading to increased turnover. Their Innovation Boost offers funding of up to £56,000 /€67,900 to help businesses solve any critical business problems they may be facing, or to develop or improve products or services. This funding can be used towards an academic expert, as well as a contribution to the salary of a project manager. The role of the academic expert is to help:

- Streamline business processes that increase efficiency and performance
- Develop and implement new technologies and systems
- Improve capabilities in innovation, design and technology.

This programme encourages clustering and networking opportunities, and is inclusive to small business by covering a proportion of the costs that would otherwise prevent them from undertaking innovation activities.

Other Invest NI innovation support

In line with the recommendations of the Independent Review of Invest NI, a market study of Invest NI's innovation supports is prudent when considering the market gap and need for a Competence Centre Programme. Below are a selection of other innovation supports provided to businesses, though it is noteworthy that many categories of support (such as leadership and exporting programmes) seek to indirectly foster an innovation mindset and focus.

Table 2-1 Other Invest NI innovation support

Support	Target audience	Key elements	Benefits	Analysis: differentiating features to competence centres
Grant for R&D	New Invest NI customers must: • be in manufacturing or an export services sector • have turnover above £250K a year • sales outside of Northern Ireland worth more than 25% of turnover, or greater than £250K a year • exhibit a high growth potential	INI target innovation and competitiveness, offering advice and financial support to develop new products, services and processes. This comprises financial support of up to £50k[12] for companies that are new to R&D, to: • Investigate or plan your idea • Make and test a prototype • Experiment and refine your design • Handle intellectual property costs Financial support greater than £50k	Business support a range of indicators key for business growth. This includes improved sales/turnover, increased profits, operational efficiency, business sustainability and productivity.	R&D support is provided to businesses who already have an idea but lack the support to accelerate it to a service closer to market, ready for commercialisation. Businesses can be connected with experts in industry, academia and research bodies, who can fill in the skills gaps in their R&D project.

[12] The £50k limit is typically for companies that are new to R&D. Invest NI support for R&D can extend beyond this.

Support	Target audience	Key elements	Benefits	Analysis: differentiating features to competence centres
		is available for follow-on R&D.		
Innovation vouchers	Businesses that have an innovation project that is new or improved from a previous offer.	£5K is granted to connect innovation projects with expertise from a public sector knowledge provider, such as a University or College (NI and ROI).	Academia and knowledge sharing is being harnessed to develop and/or commercialise new or improved projects or processes	Smaller project focus with a short-term goal This represents a 'one to many' style of support, compared with the much smaller target sample of the Competence Centre Programme.
Knowledge Transfer Partnership Scheme	Businesses with projects that have a transformative element, are driving strategic change and are boosting commercial performance.	A Knowledge Transfer Partnership (KTP) is a subsidised three-way partnership between a business, a high-calibre graduate and an academic institution. Programmes include: • Technical KTP • Management KTP	It aims to improve competitiveness, productivity, efficiency and profitability, as well as gaining: • "…*Graduate skills;* • *Access to knowledge and research in third level institutions* • *A channel for commercialising research* • *Support through new product, service or process development*" [13]	KTPs and Competence Centres both mechanisms aim to bridge the gap between academia and industry and enable connections between them, fostering innovation and enhancing business performance. However, KTPs differ in structure and purpose: • KTPs aim to transfer knowledge from academia to businesses. They help companies apply the latest technical research to achieve specific business objectives. • A KTP usually involves a three-way partnership between a business, university and a recent graduate, who works 'in house' at the company. • The focus is often on a specific project or challenge that that particular company faces, whereas CCs involve more broad-

[13] Knowledge Transfer Partnerships

Support	Target audience	Key elements	Benefits	Analysis: differentiating features to competence centres
				based, strategic challenges (given the consortium structure). As such, businesses share a higher burden of costs than in CCs (with relevant implications for IP ownership rights).
Collaborative Growth Programme	Networks of at least four NI SMEs.	100% funding up to a maximum of £25,000.	Allows businesses to expand into different areas and compete in markets usually beyond their individual reach, as well as form new business connections.	This programme primarily focuses on fostering an environment that stimulates collaboration between businesses, to enable them to share knowledge as well as physical capital assets.
Innovate UK	Invest NI are partnering with Innovate NI and Innovate UK. The latter organisation hosts programmes for SMEs in NI seeking specialist sector knowledge or funding to improve business operations or develop product ideas.	This encompasses the Catapult Network Research & Technology Organisations Specialists help innovation-focused businesses establish an approach to investment that realises their growth potential.	Access to a network of academics and industry, hubs, laboratories, testbeds, factories and offices for cutting edge R&D.	Innovate UK, and in particular the Catapult Network, is a larger scale programme with a wider international reach. The Catapults offer an opportunity for collaboration with competence centres, in particular given their planned involvement with the Belfast Region City Deals. Innovate NI innovation accreditation offers a recruitment pool for competence centres, both current and prospective, including 'ecosystem management', as mentioned in the respective recommendations section.
Horizon Europe	Businesses helping to tackle climate change, achieve the UN's Sustainable Development Goals and boost the EU's competitiveness and growth.	Provides a network which shares knowledge and technologies to collaborating businesses.	Local and international network formation; ESG guidance; strategic driver for the business plan.	Specific focus on international collaboration, requiring a team of at least 3 businesses from different countries.

The presence of other provision does not dilute the rationale or logic for Invest NI provision. Subsequent engagement in this strategic case with benchmarks in the UK and Ireland, as well as consideration of non-Invest NI supports and stakeholder engagement echoed these findings. The provision of innovation support in Northern Ireland can seem at first to be a somewhat crowded market; nonetheless, upon considering how these supports align with the specific stages of innovation (from lower TRLs to approaching commercialisation/scaling), the rationale for the scope of supports is aligned to the complexity of this journey.

2.5.1 Collaborative R&D&I supports

Within the Northern Ireland market, there are a range of other R&D&I supports. This section presents an overview of this other provision, and offers an assessment of what this means for Invest NI provision, including whether it is can be combined with Competence Centre Participation or not.

These providers are all highly regarded in the market but Grant Thornton suggest that there are key differentiators between these courses and Invest NI's provision. Firstly, these courses tend to focus on the individual whereas Invest NI's provision has a clear business performance rationale, typically resulting in a business growth plan as a key output. Secondly, these courses tend to be (but not exclusively) availed of by people in larger organisations. Invest NI's courses are specifically targeted at their SME client base. As such, the presence of other provision does not, in the evaluator's opinion, dilute the rationale or logic for Invest NI provision.

Table 2-2 Collaborative R&D&I supports, Northern Ireland

Support	Target	Fee	Provider	Key elements	Benefits	Analysis of alignment with competence centres
QUBIS	Start-ups	The programmes are fully funded by QUBIS and third parties.	Queen's University (QUB)	Training and development programmes Resource to help commercialise innovative technologies Created 100+ spin-outs Have academics who specialise in IP discovery etc. and help facilitate the connection of specialists who can help build a start up Innovation to Commercialisation funds e.g. £35,000 available to "get out of the lab"		Academia is utilised to bring products to market, there is less focus on strengthening the research for the industry in general.
Ulster Bank Accelerator	All business owners	Free for Ulster Bank Business members	Ulster Bank	Skills and Knowledge development for: • Accessing new markets • Attracting talent and building an effective team	One-to one coaching to scale businesses Network of partners	The bank provides capital infrastructure in the form of co-working hubs, but no operational expenditure; the business and

Support	Target	Fee	Provider	Key elements	Benefits	Analysis of alignment with competence centres
				• Accessing growth funding • Leadership development • Developing a scalable infrastructure.	Community for business owners to share knowledge.	idea must be fully operational and develops in-house, rather than with partners. Knowledge sharing is conducted from business to business and does not involve academia or a host university.
Catalyst	Entrepreneurs SMEs	Majority are free 'Way to Scale' is an optional £95 for 3 weeks of training per company	Catalyst	Programmes for entrepreneurs or early stage start-ups to share knowledge and expertise.	Mentoring and shared communities to help entrepreneurs scale a business.	Mentoring programmes and shared workspaces.
Ormeau Baths	Entrepreneur Investors Institutions/organisations	Resident Membership - £275 Explorer Membership - £175	Ormeau Baths	A membership to a co-working space which provides access to other members. 20+ global partners 200 members Ormeau Labs: Fundraising Sprints in partnership with the British Business Bank and InterTradeIreland.	Resident – Hot desks and meeting rooms Explorer – Dedicated desks full time Private office space Ormeau Labs offers advice to support members with a fundraising campaign.	Predominantly an office sharing space, where you can choose to interact with other businesses and collaborate It does not offer financial support or academic expertise to develop a project.
CSIT, Centre for Secure Information Technologies ECIT, Institute of ElectronicsCommunications & Information Technology	High-tech FDI and start-ups	Annual Fee: Full Member: £30,000 Associate: £5,000	Queen's University	A host to one of only seven UK Innovation and Knowledge Centres (IKCs) An in-house team includes engineers who work alongside the academic researchers. Queen's utilises consultancies and collaborative partnerships to focus on IP licensing and the creation of new ventures.	The scheme aims to: • Enhance the quality, accessibility and scale of academic cyber security research and postgraduate training being undertaken in the UK; • develop world class research	The centre works with a number of large multinational firms to focus on creating early stage critical mass in an area of disruptive technology.

Support	Target	Fee	Provider	Key elements	Benefits	Analysis of alignment with competence centres
					• develop new value and venture creation The centre has attracted 100 high-tech Foreign Direct Investment (FDI) and start-up companies – who have employed more than 2,000.	
NITC, Northern Ireland Technology Centre	Any business from looking to access technology		Queen's University	NITC helps businesses source the appropriate funding, supporting the collaboration between education and industry, for projects that apply technology for a social and economic benefit.	Research projects are supported if they benefit both industry and academia, regardless of industry, achieving wider reaching benefits.	NITC prioritise the long-term benefits of the research being carried out Financial support is mainly sought through external sources e.g. regional development agencies (Invest NI: Innovation Vouchers, R&D Funding).
ASK	Local businesses needing specialist advice in finance, marketing, IT, HR, business planning.		Antrim and Newtownabbey Borough Council	The programme aims to help local businesses by providing specialist advice, skills and knowledge.	One-to-one mentoring on business specific problems or gaps.	Only offer mentoring to businesses and does not provide support to commercialise new products or develop research interests.
BT Ireland Innovation Centre	Engineers, postgrads, researchers with research projects relating to AI, IoT and Telecommunications.		Ulster University (UU)	The Research and Engineering Centre of Excellence is a £9m funded research initiative in the intersection of Artificial Intelligence, the Internet of Things (IoT) and Telecommunications.	The centre supports 19 postdoctoral researchers and 12 PhD students Created up to 50 graduate opportunities/jobs.	Resources are focussed on the research, albeit for industry application, it does not work with businesses or work on the commercialisation process.

Support	Target	Fee	Provider	Key elements	Benefits	Analysis of alignment with competence centres
NORIBIC, The Northern Ireland Business Innovation Centre	SME's in Northern Ireland		Innovate NI	The innovation centre provides expertise for SME's looking boost growth.	Businesses can access a network of support professionals across Europe.	There is little support for working with/or the benefits to academic institutions through longer-term research or product commercialisation.
Innovation Factory Belfast	Local entrepreneurs/businesses looking to start/develop a project	Shared space membership from £80pm Access to events and workshops from £70pm Office/Desk Space from £200pm		The provision of office space, shared space and conference facilities.	Members benefit from the exchange of knowledge between each other, as well as access to an in-house business support team All of which can support the development of new and creative ideas.	There is little support for working with/or the benefits to academic institutions through longer-term research. Offers shared working spaces.

A major pipeline initiative is also worthy of note in the context of competence centres. The Advanced Manufacturing Innovation Centre will operate at the interface between academia and industry, by creating new opportunities for innovative manufacturing in the Belfast City Region. Involvement of both Queen's University Belfast and Ulster University will ensure that real-world industrial challenges based on market need are solved through cutting-edge research.

Support	Target	Fee	Provider	Key elements	Benefits	Analysis of alignment with competence centres
AMIC, Advanced Manufacturing Innovation Centre	Manufacturers		Queen's University	Manufacturing industry partners have been connected with experts from the University of Cambridge's Institute for Manufacturing to develop a Strategic Technology Roadmap for Northern Ireland. Building work for a £98m flagship facility at Global Point in Newtownabbey, is expected to start in	The flagship facility provides the physical capital to scale-up R&D Create innovative and creative products Generate jobs Create economic growth Solve real world industrial challenges	The centre will be a location for businesses, engineers and academics to test new ideas and scale to a global market. There is significant potential – and need - for the competence centre stakeholders to inform the direction of the city deals. There is also the

Support	Target	Fee	Provider	Key elements	Benefits	Analysis of alignment with competence centres
				Spring 2024 and aims to be operational by Summer 2026.	and enable our companies to access global markets.	potential for partnerships, e.g. with CASE.

During the Grant Thornton Evaluation, the benchmark analysis established the need for innovation capability provision from a range of stakeholders, including both public and private providers. The alignment analysis with the Competence Centre Programme demonstrates that these centres remain a nuanced intervention with an identifiable market gap, particularly in light of the significant public intervention required.

3. Thematic overview

3. Thematic overview

3.1 Introduction

The subsequent chapters will assess each of the centres and phases encompassed by the Competence Centre Programme. The evaluation also requires a thematic assessment and consideration of the overarching governance of the programme. This section will consider the provision of benchmark supports in Ireland and the UK, as a means of assessing whether Invest NI provision of the CCP remains relevant), and provide an aggregation of potential impact.

3.2 Benchmark agencies' competence centre programmes

This section will discuss public sectors supports provided by other Investment Promotion Agencies (IPAs) and business enterprise bodies, namely Innovate UK, Enterprise Ireland and Scottish Enterprise, that are relevant benchmarks for the Competence Centre Programme. These case studies have wide spread and well-established innovation centres that facilitate the provision of R&D&I. Each body provides a programme of funding to businesses across the UK and/or Ireland, to varying degrees, and facilitates their collaboration with academia, to achieve industry specific market-leading projects.

3.2.1 Innovate UK Catapult Network

Innovate UK established and operates the Catapult Network, which brings together nine expansive not-for-profit technology innovation strands with multiple sub-centres across the UK. Catapults are physical centres with cutting-edge R&D infrastructures including hubs, laboratories, testbeds, factories and offices, as well as technical expertise. Catapult count among their members, thousands of innovative businesses across a wide range of sectors, such as manufacturing, space, health, digital, energy, transport, telecoms, the urban environment and many others. The nine catapults cover the following themes:

- Cell and Gene Therapy
- Compound Semiconductor Applications
- Connected Places
- Digital
- Energy Systems
- High Value Manufacturing
- Medicine Discovery
- Offshore Renewable Energy
- Satellite Applications

Catapult centres aim to build upon underdeveloped or under-funded areas that present significant potential for the UK economy. They attempt to significantly reduce the barriers faced by businesses seeking to invest in R&D&I, by removing the uncertainties around financing. Longer term, stable investments can generate a more significant impact on the development of new products, services and processes. This is achieved through the availability of a wider network of knowledge and fostering of partners, as well as cutting edge knowledge generated by research organisations and academia. The de-risking of innovation is also facilitated by Catapult by enabling businesses to test products in a real-world environment before accelerating to commercialisation, an often financially risky process

due to the high failure rates. Some of the ways that Catapult help businesses to realise their potential include:

- Progressing innovations toward the middle levels of technology readiness levels.
- Providing products and services that address market failures.
- Providing access to physical capital that businesses lack in-house in order to realise innovation advances e.g. laboratories and specialist equipment.
- Providing a programme of workshops e.g. on how to optimise system performance, covering business processes as well as sector-specific offers.
- Rapid commercialisation through business development and IP awareness training.
- Fostering of knowledge sharing networks.

The network aims to bridge the gap for SMEs and start-ups by offering the toolkits that larger businesses have access to, including support for technology and process innovation, as well as commercial readiness advice. Employment for Catapult participating businesses grew almost 16% faster in the 6 years after the start of any interaction[14]. Services and high-tech companies experienced the most pronounced impact, reporting on average 30% faster growth in turnover in the medium term, compared with non-engaged firms. It was also identified that the services offered by Catapult had a larger impact on micro and small enterprises compared with larger counterparts, growing in the medium-term by almost 40% faster in terms of employment and by more than 50% in terms of turnover, demonstrating a faster growth in labour productivity as well.

Catapult network: key takeaways

- The Catapult network has the strategic priority of business growth, with innovation as a means to achieving this, rather than research and innovation advancements in general.
- The centres are geographically dispersed, with a presence in all of the devolved nations. The network also provides 12 regional co-working spaces for member companies.
- The scale of intervention of the Catapult network is much wider ranging than the CCP, thanks in part to the scale of funding involved - £1.6bn for the Catapults for the next five years (April 2023 – March 2028) from government alone[15], compared with Invest NI's initial £20m commitment to phase I of the CCP. As discussed in phases II of CHIC and CASE, time in the marketplace, network effects and positive word of mouth all increase the impact of the competence centres. This can be seen in the scale of Catapult's operations and the established impact, as discussed in this case study. Thus far, the substantial public funding has enabled the Catapult network to support[16]:
    - 18,785 industry collaborations
    - 11,916 SMEs
    - 5,560 academic collaborations
    - 5,130 employees (2022)
    - The High Value Manufacturing Catapult alone comprises 7 centres across the UK; 3,000 staff; 5,500 company interactions per annum, and a turnover of £0.5bn.[17]
- Cross-catapult collaborations are common within the network.
- There is a prominent focus placed on commercialisation:
    - Products are developed in the TRL range; 3 to 6
    - 40-50% of projects progress to a commercial project
    - IP doesn't remain with the HVMC, but with the companies. This is made possible via their tiered membership structure, whereby some membership options feature much lower public funding, thereby falling outside the remit of state aid legislation.

[14] UK Research and Innovation, Innovate UK

[15] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1185134/catapult-network-review-2023-update.pdf

[16] Our Impact - The Catapult Network

[17] Consultation with HVM Catapult personnel

Catapult network: key takeaways
• Catapult has a significant international network and reach, having conducted c. 1,120 international projects.

3.2.2 Enterprise Ireland Innovation Supports

Enterprise Ireland (EI) works with Irish enterprises to help them establish and expand domestically and internationally by competing in global markets to support sustainable economic growth, regional development and secure employment. A key tool to securing and accelerating business growth is innovation, which is reflected in EI's suite of supports. The agency works with entrepreneurs and business people across the full business development spectrum - from early-stage entrepreneurs, to established business owners and Irish multinational companies.

Table 3-1: Enterprise Ireland innovation supports

R&D&I Support	Description
Exploring Innovation Grant	The grant encourages SME's to research new technologies and innovation activities in their industry, to develop a project plan for R&D engagement. Advice is provided for new ideas including; legal advice and whether it is technically achievable or makes financial sense. An Exploring Innovation study is eligible for up to 50% of expenditure (max. €35,000).
The Agile Innovation Fund	Helps companies in sectors with rapid design cycles keep their advantage by offering an online application and Fast-Track-Approval process. Companies can access up to 50% funding up to a max. Total project cost of €300k.
The Research and Development (R&D) Fund	Supports the development of new and/ or improved products, processes and/ or services for bigger RD&I projects. Companies can access over €150k for projects costing over €300k. Large Digital Process Innovation projects fitting the same criteria can benefit from the R&D Fund. A bonus of up to 15% is available for R&D projects that involve collaboration between 2 companies.
The Intellectual Property (IP) Strategy	Supports strategy development to manage and exploit patents, designs, trade secrets, copyright and branding, for an RD&I project.
Technology Centres	A joint initiative between Enterprise Ireland and IDA Ireland allowing Irish companies and multinationals to collaborate with research institutions; who are empowered to undertake market focussed strategic R&D for the benefit of industry.
Knowledge Transfer Ireland	The KTI web portal helps companies to easily find technology, expertise, IP and facilities available in

	Ireland's higher education institutions and State research organisations.
Disruptive Technologies Innovation Fund	The Department of Business, Enterprise & Innovation (DTIF) facilitates collaboration between Research Performing Organisations (RPOs) including universities and other institutes, and industry. This fund supports the development and adoption of new disruptive technologies and applications, aiming to help break into world markets and strengthen the competitiveness of the enterprise sector.

3.2.3 Enterprise Ireland Technology Centres

The Technology Centre programme is a joint initiative between Enterprise Ireland and IDA Ireland. Since 2013, it has allowed Irish SMEs, start-ups and multinationals to work in collaboration with over 300 industry-focussed researchers and engineers, on up to 5,000 market-focused strategic R&D projects. The programme encompasses nine centres, all of which aim to increase the level of interaction between existing EI programmes – these being the Technology Gateway Network, Technology Centres - and industry and academia in Ireland. The programme aims to achieve the following outcomes:

- Increase the number of innovation active companies
- Pilot manufacturing capability for new product / process development
- Enhanced technology validation and testing capabilities
- Test bed generation
- Enhanced training potential for key industry staff on emerging technologies

Enterprise Ireland Technology Centres: key features and takeaways

- The EI Programme has displayed dynamism in its approach towards continuous improvement of the programme. This has included engagement with industry stakeholders to identify impactful new areas for technology centres: Industry feedback influences the opening of new centres and closing of inefficient centres. It has also included discontinuing and significantly reviewing centres identified as having lower than projected impact in the market place.
- Coverage:
  - The programme hosts 9 technology centres across Ireland, spanning a range of sectors including engineering, food and beverage, pharmaceuticals and medical devices, ICT, education and training, and finance.
  - Regarding the scope of specific TC's operations, Meat Technology Ireland[18] has five indigenous multinational core members:
    - represent 80% of Ireland's beef and lamb processing pool
    - account for 25% of total Irish food and drink exports
    - have a combined annual turnover of over €3bn and c€2.3bn of exports.
- The centres offer a tiered membership stricture, with EI clients receiving up to 50% discount
- The TRL focus of the innovations targeted is in the 4 to 7 range
- The programme has a strong focus on facilitating the provision of equipment and leading-edge technology; At least 5 companies must utilise the technology in the first 18 months of investment. It must have shared access with IoTs/Universities

[18] Enterprise Ireland Technology Centres

Enterprise Ireland Technology Centres: key features and takeaways
• An international focus is stressed for the centres. For example, Learnovate works with 10 universities across 7 European countries.

3.3 Scottish Innovation Centres

The Scottish Innovation Centres were established in partnership with the Scottish Funding Council and Scottish Enterprise, as well as Highlands and Islands Enterprise. There are seven funded innovation centres that aim to support transformational collaboration between universities and businesses, and add value through secondments, industrial studentships, spaces for collaborative work and shared access to equipment. The £120m Innovation Centre Programme was launched in 2012, to strengthen innovation and entrepreneurship across Scotland's key economic sectors, in order to create jobs and grow the economy. These sectors include precision medicine, digital health and care to data, aquaculture, biotechnology and construction. The programme not only aims to forge links between academia and industry, but aims to upskill the next generation.

Scottish Innovation Centres: differentiating features and takeaways
• They are somewhat larger scale operations than the CCP e.g. through the Built Environment – Smarter Transformation (BE-ST) centre, businesses can access a network of 80,000 connections. • Sustainability and ESG elements are closely incorporated into the SIC programme, for example, through the Sustainable Aquaculture Innovation Centre. • The approach to innovation highlights and fosters the requirement for a pipeline of STEM skills. An example of this is the Data Lab[19]. Since 2014, the Data Lab Academy has provided full scholarship funding to over 880 students on MSc courses in Data and AI-related subjects at 11 Scottish Universities. • In 2023, the Data Lab introduced a search tool (Funding Finder) that leverages data and AI to help businesses navigate the UK funding system and find uniquely tailored funding and support opportunities.

3.4 Delivery Structure of the Competence Centre Programme

3.4.1 Operational autonomy

A key principle of the CCP was that centres operated independent of daily involvement from the funder, Invest NI. Rather, their strategic direction and the parameters for awarding funding was governed by the centres' Research Strategies, as well as by key governing documents. The research strategy:

- Details the broad areas of strategic research necessary to address challenges facing the sector within the coming 3 to 5 years.
- Defines the high-level research objectives and outlines the potential focus.
- The research areas are:
    - Aimed at addressing the research needs of the broad industry group, and
    - Define the expected outcomes and potential impacts for the research partners and industrial members.

The centres are self-governing, hosted by a Research Organisation but under the management and control of an industry-led board. This was intended to guarantee independence from any one

[19] https://thedatalab.com/partner-with-us/

institution, despite the host's location. The following control documents governed the competence centres' activities and approach to pursuing research objectives, these being particular to each centre.

- Competence Centre Business Plan
- Competence Centre Research Strategy
- Invest NI Letter of Offer

From the commencement of the Programme (2014), centre managers operated within this operational autonomy within the framework of these control documents. However, at that time there was no Centre Manager Guidance document; rather, a 'lessons learned' log was developed by Invest NI during this period, recording case studies and suggesting iterations to the original delivery and management structure for the centres. This culminated in a draft guidance document being issued to all centres in July 2018, with a formal version following in November 2019.[20] Whilst these guidelines do not replace or supersede the control documents, which have been appraised and approved by Invest NI and subject to a Letter of Offer, they provide an important basis for centre managers to consult and adhere to, particularly in the context of multiple stakeholders, host institutions and vested interests.

The production of a final set of guidelines is a welcome progression since the interim evaluation, with centre managers feeling positive about having a standardised code to adhere to. However, the delay in finalising these, and the five-year gap between commencement of the Programme and production of formal guidelines, resulted in confusion and at times a lack of transparency. Moving forward, any further Invest NI funding of the CCP should be supported by a comprehensive Centre Manager guidance document; this should be a 'live' document with intermittent reviews to account for emerging trends and challenges. It should also be tailored to each centre, given the nuanced membership demographics and operational processes connected with each centre/industry.

A benchmark review has also highlighted areas for improvement in this governance element. The Scottish Innovation Centres (IC) have two additional documents that set parameters for funding partners to work together (the IC Programme Governance Framework) and for IC boards to carry out their duties (Good Practice Governance Guide for IC Boards).[21] Though these are addressed somewhat in the business plan, more detailed and updated guidelines for these cohorts (particularly as issues arose during the course of a centre's operations) could better guide the remit and efficiency of the programme, particularly given the relative autonomy within which they operate. The IC Board guide, for example, stipulates maximum service tenure for board members succession planning arrangements. It also recommends that each IC has a full governance structure diagram made available on their website, to increase transparency and awareness.

3.5 Marketing and engagement

Competence Centres provide a forum and interface for industry to collaborate with academia; for this, recruitment of sufficient and representative companies (particularly SMEs) is a critical part of their remit and activities. Outreach efforts, evidenced following review of centre-level documentation, as well as through engagement with management and alumni, included the following elements:

- Centre promotion e.g. demos, tours, company site visits
- Establishing collaboration through relationship building with industry
- Building local, National & International partnerships with research and industry stakeholders, and developing Memoranda of Understanding (MOU)
- External funding efforts, including attendance at funding information provision sessions
- Identification of funding opportunities and signposting participants/members to same; engagement with these external funders, such as the EU Commission and Innovate UK
- Engagement with third party expert advisors

[20] Invest NI Competence Centre Programme Guidelines for Centre Managers, Version 2.0, 1st November 2019

[21] https://www.sfc.ac.uk/innovation/innovation-centres/innovation-centres-key-documents.aspx

- Proposal preparation for R&D funding scheme
- Advice and drafting of business development efforts such as business plans and proposals, independent of the CCP projects
- Dissemination and awareness raising of research results including preparation of academic papers, presentation at conferences/workshops including internationally
- Informal knowledge transfer to industry members and externally, where applicable, to embed new knowledge developed in the CCP

The engagement of the centres with local and international stakeholders varied according to the centre concerned, as well as according to the nature of the respective industry.

The evaluator notes that the level of awareness of a competence centre has been a key determinant of its success and impact. This has been difficult for phase I centres, given the short life span and lead times for recruitment. For phase II, by virtue of the centres being in operation longer, an organic awareness and word of mouth has led to higher impact recruitment and awareness levels. The role of social media is also growing in importance for centres, with active LinkedIn pages and dedicated websites providing successful lead generations and CHIC and CASE phase II centres.

3.6 Potential aggregate economic impact

As noted in their respective business plans, from the outset it is apparent that competence centres are not commercially viable in their own right, but rather require significant public support. Throughout phases I and II this has taken the form of majority funding from Invest NI, this being 100% of research spend and 75% of core spend. Through competitive leveraged funding, as well as industry in-kind and cash contributions play a role in centre financing, public funding has remained the dominant source. This can only be justified through consideration of the market gap for and need for innovation investments, explained in chapter 2 of this evaluation. The case could also be made that the potential Benefit Cost Ratio (BCR) and link between public expenditure on R&D has on leveraging Business Expenditure on R&D (BERD) makes the competence centres beneficial from a socioeconomic standpoint.

The results that the data analysis, primary engagement and economic impact modelling yielded are detailed below, showing a potential **ROI of between -0.1 and 0.1 for society** and **leveraged BERD of £3.38m to date**. This shows a marginal return (or loss if not inclusive of socioeconomic returns to healthcare innovation) to date, which aligns with much of the available evidence on length of time lags for returns to R&D&I expenditure and competence centre programmes in general.

Furthermore, a conservative modelling approach has been employed, particularly regarding the calculation of attribution. The results are only an indication of potential returns to date and cannot be relied on, for several reasons:

- The small population size of the competence centre programme (in particular strands such as NIAECC, where n=11),
- The limited survey response rate, further reducing the sample size,
- The time lag since competence centre participation (in some cases this was 6+ years), particularly as benefits tend to be realised over a longer time period.
- The difficulty of isolating CCP impacts and differentiating from other factors, such as COVID-19, for example,
- The variation in demographic composition of the centres (which some being dominated by companies with large turnovers in excess of £100m),
- The variation in number of collaborative projects participated in (ranging from between 1 to 7+),
- The lack of non-Invest NI client data to model impact (and corresponding biases), and
- The likelihood that Invest NI client companies had availed of several other supports, making the determination of additionality challenging.

Table 3-2: Competence Centre Programme thematic performance

GVA impact		
	Baseline	**Inclusive of CHIC socioeconomic return**
Total cost (Invest NI)	£ 22,444,674	
Economic impact (GVA), net	£ 20,422,679	£ 24,667,402
BCR	0.9	1.1
ROI	-0.1	0.1
BERD impact		
BERD activity generated, net	£ 3,380,261	

Source: Invest NI, Grant Thornton analysis

Overall, the sample size of 54, from a total population of 201, corresponds with a 95% confidence interval and 11% margin of error. However, a suite of assumptions, benchmarks and Invest NI tracking data was used to arrive at this set of indicators, given that the survey respondents often overlooked variables such as turnover and R&D performance, as well as additionality attributed.

3.6.1 Logic model for the Competence Centre Programme

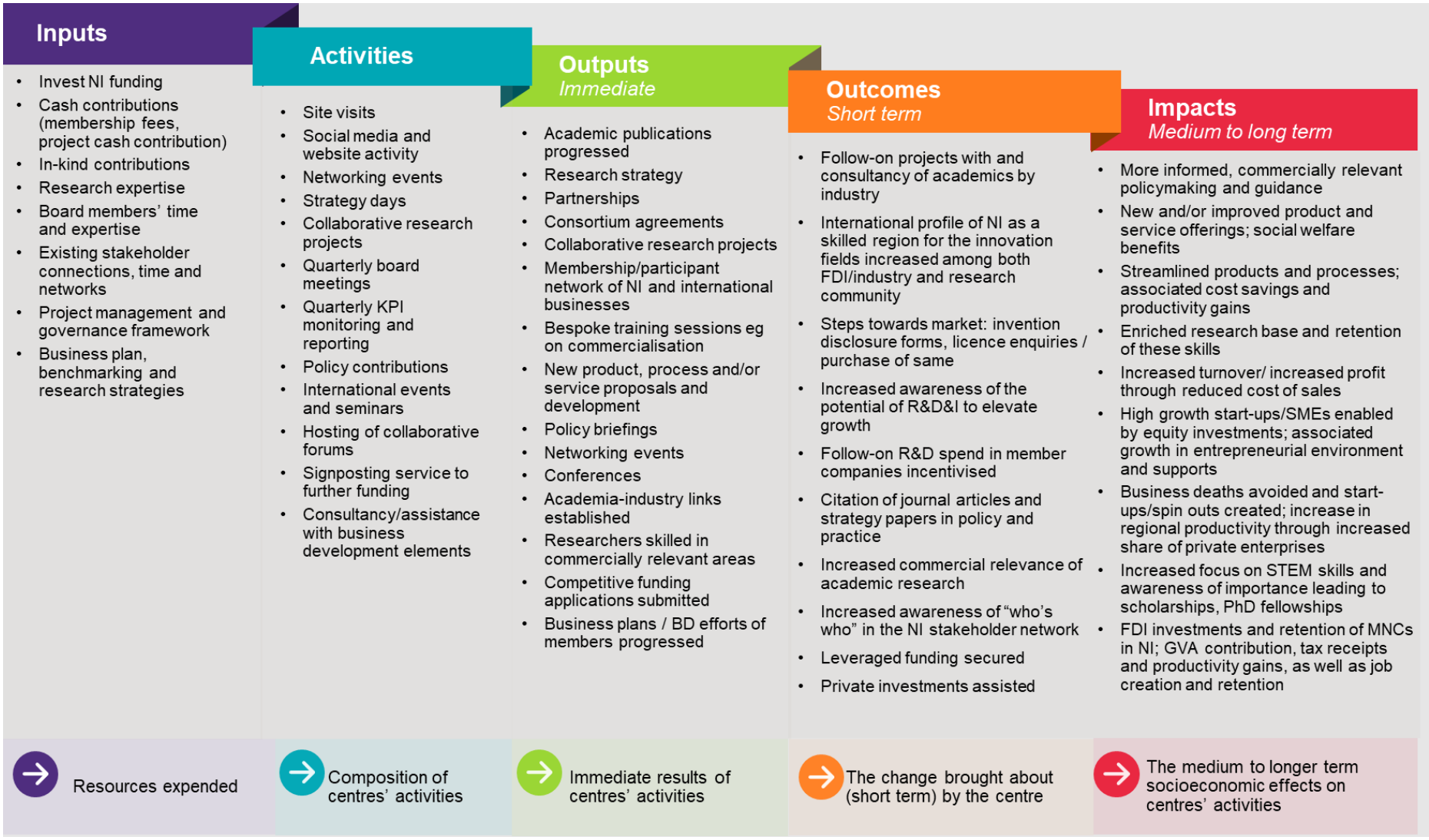
A logic model can be used to understand the rationale for public investment in competence centres, through outlining the outputs and their associated outcomes and impacts. Through outlining the theory of change (ToC) in the process of producing the logic model, stakeholders are made to focus on these anticipated impacts (short term) and outcomes (medium to longer term). The Catapult network governance framework expects that each existing catapult have a logic model from its outset, that it reviewed and refreshed at frequent intervals.[22]

Each Competence Centre operates within its own nuanced fields/sectors, addresses varying market failures and will encompass divergent activities and outcomes; nonetheless, an indicative logical model has been compiled in Figure 3-2 to apply to the programme in general. While there was no evidence of a logic model in the business plans, ministerial submissions nor quarterly centre reports, a performance management framework incorporating a logic model was developed in 2013. This was the basis for selection of the KPIs and associated targets which were subsequently reported against. These were incorporated within the full casework submissions (generally as appendices). The absence of this material from centre business plans is due to the logic model/KPIs and business plans being developed in parallel by centres and Invest NI during this early stage of programme development. The Guidelines for Centre managers version 3.2 which issued in October 2020 also set out a summary logic model which showed examples of key outputs, outcomes and impacts which should be collected by Centres post completion of projects.

An established approach towards monitoring impact during the lifetime of centres (rather than waiting for interim and final evaluations) is to maintain an outputs and outcomes log. The completion of company-specific logs could be included as part of the initial membership agreements, with companies reporting on an agreed set of indicators to centres. The centre manager could monitor the performance of individual members, follow-up where underperformance is occurring, and oversee the production of an outcomes log.

[22] Innovate UK Catapult Programme Evaluation Framework, November 2017

Figure 3-3 Competence Centre Programme Logic Model



3.6.2 Additionality

Given the lengthy time lags involved in realising returns to R&D&I investments, coupled with the number of projects distant from market (at lower TRLs), inclusion of additionality in any potential impact is particularly important in the CCP. The following types of additionality were considered: activity additionality; impact additionality; displacement; substitution, and leakage.

3.8.2.1 Activity Additionality

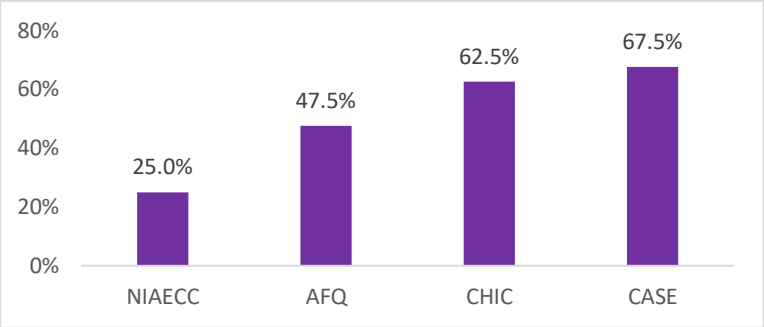
Analysis of activity additionality was informed by survey sample responses to the following questions:

1. We are keen to understand whether you would have availed of publicly funded innovation/R&D support without the Competence Centre Programme.
    - I would not have undertaken any R&D/innovation actions
    - I would have done something at a later date and on a reduced scale
    - I would have done something at a lesser scale (Invest NI's financial support was crucial)
    - I would have done something at a later date
    - I would have found a direct equivalent to the Invest NI support within the same timescale

2. Do you think that without the Competence Centre Programme from Invest NI you would have been able to get the same or similar support elsewhere? (Yes/No)

Combining analysis of the responses to the above questions and attributing appropriate weightings led to the following results for activity additionality, illustrated below. The findings aligned with the feedback collected in the consultation phase, providing a sense check for the relative additionalities. These additionality results were applied to Turnover impacts (with turnover then converted to GVA based on the appropriate sectors) and R&D impacts.

Figure 3-4 Survey analysis of activity additionality, all centres

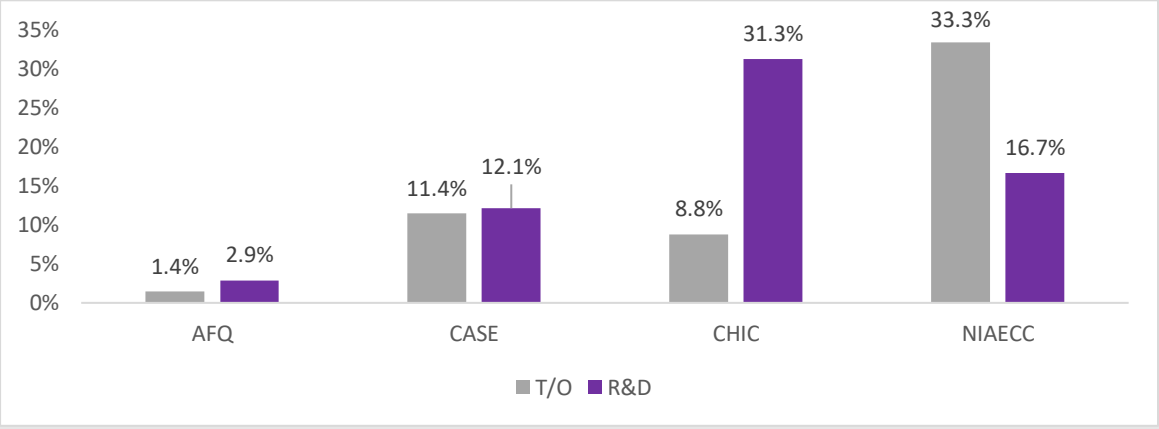


Source: Survey, Grant Thornton analysis

3.8.2.2 Impact Additionality

Though the responses to the question 'What percentage of the change in turnover, employment and R&D expenditure is due to Competence Centre involvement?' garnered few responses, these have been used as a best estimate of the CCP's impact additionality. These are conservative figures, representing a lower bound estimate of potential impact additionality. It is also noteworthy that self-reported additionality may evolve over the medium to longer term, as benefits to projects commenced or advanced in the centres materialise.

Figure 3-5 What percentage of the change in turnover, employment and R&D expenditure is due to Competence Centre involvement? Turnover and R&D analysis



Source: Survey, Grant Thornton analysis

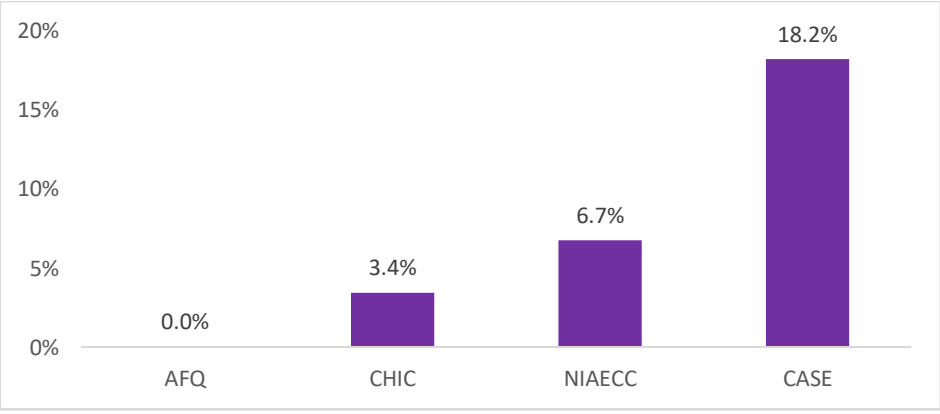
3.8.2.3 Displacement

Displacement refers to the extent to which benefits realised in the Competence Centres reduce outputs/outcomes elsewhere in Northern Ireland. Displacement was set to 0% in the economic impact assessment, due to the limited geographical remit of the CCP. Furthermore, the centre was open to Invest NI clients and non-clients alike; a majority (57%) of participant companies were not clients. The consortium nature of participation, whereby each project required at least three industrial partners, helped to ensure a less concentrated distribution of benefits and knowledge transfer.

3.8.2.2 Substitution

Substitution in this context is commonly referred to as the situation in which a firm substitutes one activity for a similar activity to benefit from government assistance. In light of the innovative nature of all the collaborative projects, it is unlikely that a material amount of comparable research was underway or planned in specific companies prior to involvement, thereby indicating a minimal (if any) rate of substitution. This was also asked in the survey (Prior to becoming a member of the Competence Centre, were you involved in a similar, but distinct, form of R&D that you ceased due to Competence Centre involvement?), with responses being no, partially (and the corresponding amount of research activity ceased) and fully. This resulted in substitution rates of between 0% and 18%, as illustrated below.

Figure 3-6 Survey results, substitution, all centres

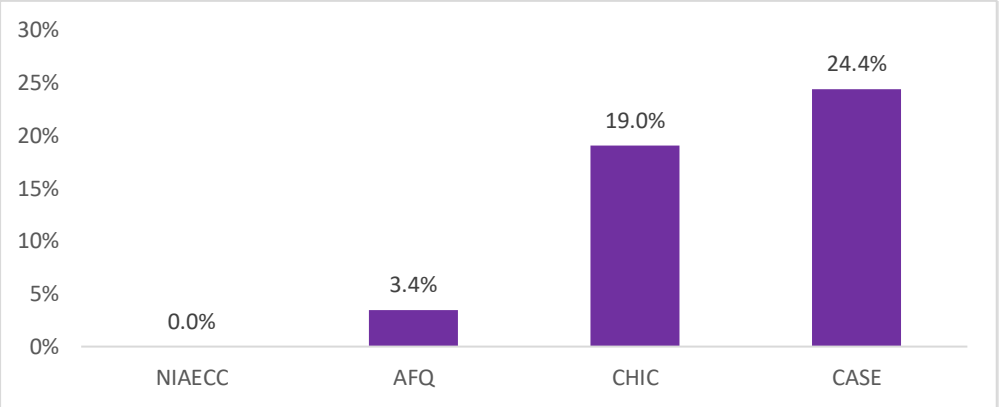


Source: Survey results, CCP evaluation

3.8.2.2 Leakage

Leakage refers to the degree to which the benefits of the CCP are retained within Northern Ireland. Leakage has been determined based on whether the company has a material presence in NI, based on Invest NI tracking data. The resultant leakage levels are relatively low (between 0% and 24%), indicating that the majority of impacts are/ will be retained in Northern Ireland.

Figure 3-7 Analysis of leakage rates, all centres



Source: Invest NI tracking data, Grant Thornton analysis

3.7 Variations between centres

Something that was perhaps not acknowledged at the programme outset was the potential variations between centres, based on the characteristics of the academic and industrial landscape of the respective fields in Northern Ireland. Whilst uniform guidance and delivery structures were applied to the four centres, in retrospect this could have been tailored (at interim stage or thereafter, by consultation with centre stakeholders) to these individual characteristics. Such variables included:

- The impact of COVID affecting each competence centre to varying degrees.
- Marketing and awareness raising initiatives undertaken by the centres, but also public and industry awareness of the respective fields.
- Demographic of participants.
- Consideration of the optimal number of participants and steps to recruit more if needed.
- Stage of R&D assimilation/ awareness of its potential.
- Strategic importance of the topics.
- Marketing approaches.

Table 3-1: CCP activity and recruitment

Participant demographics	Share
Total SME share[23]	72%
Micro	*33%*
Small	*25%*
Medium	*14%*
Large	*28%*
Invest NI client companies	81 (43%)
Non-Invest NI client companies	108 (57%)
NI-located	155 (82%)

[23] Based on Invest NI Industrial Participation data provided, sample size of 118.

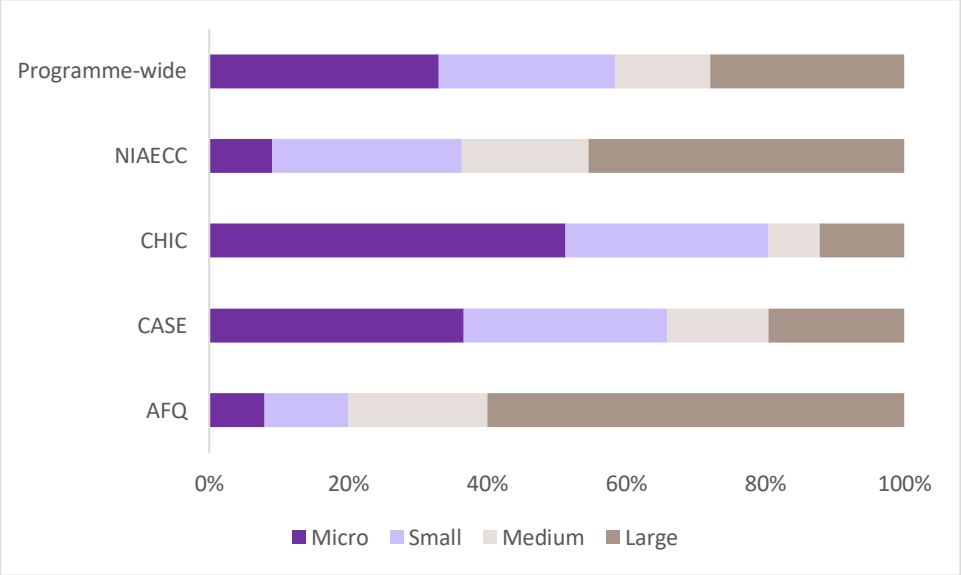
Outside of NI	34 (18%)

Source: Invest NI Industrial Participation data; Grant Thornton analysis

Several variables can serve to increase the impact of the type of R&D&I support offered by the competence centres. Firstly, the smaller the size of company, the more likely it is that the support is additional, with the enterprise being unable to finance or part-finance the research in-house. The company size (and often corresponding to this, market share and tenure) is likely to be negatively related to the positive impact of connections formed with academia and industry through the competence centre; in other words, smaller companies stand to benefit more from the new partnerships and connections, having not previously had access to such resources. Further, the absorptive capacity of larger firms is often greater than that of SMEs in relation to influencing and benefitting from a long-term strategic research programme that addresses shared challenges or market opportunities.

Centre-level analysis shows significant variation according to the demographic of participants. Whilst the slight majority (51%) representation within CHIC is of micro enterprises (<10 employees), the modal profile within both AFQ and NIAECC is of large enterprises (>250 employees), (60% and 45%, respectively). Although pointed recruitment efforts could potentially increase SME representation within the centres concerned, this is only to some extent within centres' control; for example, the agri-food industry's composition is skewed towards larger companies. This is an exogenous factor impacting the performance and/or additionality of centres.

Figure 3-2: Centre-level participant company size



Source: Invest NI Industrial Participation data; Grant Thornton analysis

3.8 City Deals alignments

The City Deals investments represent a key avenue through which to leverage the future and/or legacy impact of the Competence Centres. In many instances, given the small geographical area and size of networks in Northern Ireland, there is significant overlap of stakeholders involved in the Competence Centre Programme and anticipated and/or confirmed City Deals projects. This potential has been a key discussion point throughout consultation with stakeholders and participants of the programme, representing a 'once in a generation' opportunity totalling £1.2bn of public support (with significant private, industrial support increasing this).[24] Critically, the City Deals programmes represent

[24] https://www.economy-ni.gov.uk/articles/city-and-growth-deals#:~:text=The%20NI%20Executive%20and%20the,Growth%20Deal%20(%C2%A3252m); correct at time of writing (September 2023)

transformational capital investments, whereas the dominant focus of the Competence Centres was operational in nature, with ongoing relationships, collaboration and connections a key marker of its legacy. In many ways, the City Deals will build on this collaboration and elevate it to new frontiers. The centres have already been involved, to varying degrees, in shaping and informing the business case and planning process for the City Deals.

Table 3-8: Selected City Deals projects

City Deal	Total public investment	Centre	Related Competence Centre(s)	Host institution
Belfast Region City Deals (innovation pillar)[25]	£700m across 19 projects	AMIC (Advanced Manufacturing Innovation Centre)	NIAECC; CASE	
		CDHT (Centre for Digital Healthcare Technology)	CHIC	UU (Belfast campus)
		GII (Global Innovation Institute / Momentum One-Zero)	AFQ; CASE	QUB
Derry City and Strabane City Deal (innovation projects)[26]	£210m across 7 projects	School of Medicine	CHIC	UU
		Personalised Medicine Centre (formerly THRIVE)	CHIC	UU (DCSDC and WHSCT as partners)
		Centre for Industrial Digitalisation, Robotics and Automation (CIDRA)	NIAECC; CASE	UU
		Cognitive Analytics Research Laboratory (CARL)	AI, automation and digital health strands relating to all centres	UU
		Digital Enabling Infrastructure Programme	CASE	TBC
		Smart Cities	CASE	TBC
Causeway Coast and Glens Growth Deal[27]	£72m	6 thematic areas: • Innovation • Tourism and regeneration • Infrastructure • Employability and skills • Digital connectivity • Energy / green economy	Potential to relate to all centres as the projects advance and target certain sectors, particularly AFQ.	TBC
	£252m	4 thematic areas: • Future proofing the skills base	Potential to relate to all centres as the	TBC

[25] https://www.brcd-innovation.co.uk/

[26] https://derrycitydeal.com/projects

[27] https://www.investni.com/international-business/why-northern-ireland/city-and-growth-deals#:~:text=Causeway%20Coast%20and%20Glens%20Growth,UK%20government's%20growth%20deal%20allocation.

City Deal	Total public investment	Centre	Related Competence Centre(s)	Host institution
Mid-South West Region Growth Deal[28]		• Enable infrastructure • Boosting innovation and digital capacity • Building a high performing visitor economy	projects advance and target certain sectors.	
		ABiC (Agri Bio Innovation Centre)	AFQ	TBC
		RAPIC (Robotics, Automation and Packaging Innovation Centre)	AFQ	TBC

Source: Grant Thornton analysis

3.9 Continuing need for innovation support

A new budget prioritisation approach was discussed by the Invest NI Competence Centre Board Working Group (CCBWG) and Invest NI Board. It focused on time for return on investment, level of risk and potential to stop funding. Competence Centres are a high-risk investment involving significant operational autonomy, lower TRL research and requiring lengthy times for return on investment, with an average of nine years before the realisation of such tangible benefits in Australia's Cooperative Research Centres. These prioritisation principles formed the basis of Invest NI's decision to withdraw any further funding considerations of the Competence Centre Programme, in 2022, as well as other relevant Invest NI programmes such as Proof of Concept (PoC). The relaunch of the PoC programme, which aims to increase the quality of commercialisation through the provision of funding academia for early stage development activity, highlights the ongoing acceptance of the need and rationale to support R&D activity.

The ongoing need for support for innovative R&D is clear, in light of the increasing need to bridge the 'valley of death', particularly in light of the heightened cost pressures of doing business in the current economic context. This position is supported across literature, previous assessments of the barriers to innovating and its positive impact on business performance and wider regional productivity. How best to deliver such R&D&I support is a difficult judgement call, particularly in light of the overall innovation journey from conception to market; companies will require varying formats of support dependent on their stage in the innovation ladder. This evaluation has illustrated that, whilst the CCP's collaborative R&D&I support objective represents a marked gap in support provisions in Northern Ireland, its operational design, delivery and efficacy is complex and imprecise from the perspective of ensuring value for money and impact. Nonetheless, benchmark analysis and consultation reveal the potential for significant economic impact to be realised, as well as the undeniable successes of several projects during the course of the programme. The evaluators conclude that there is an ongoing need to support innovative R&D collaborations but it is less clear that the CCP is the optimal model for delivering that support.

[28] https://midsouthwestregion.org/

4. Agri-Food Quest

4. Agri-Food Quest

4.1 Background to the Agri-Food Quest Competence Centre (AFQCC)

The Agri-food Quest Competence Centre (AFQCC) commenced operations in October 2015, building on the findings of both a Centres of Excellence Evaluation (2007) and the recommendations of the MATRIX panel. It was the fourth centre to be approved under the umbrella of the Competence Centre Programme. The Centre is hosted by QUB, with collaboration and partnership involvement from other institutions including the University of Ulster. It was granted initial funding of £5m for a five-year period from Invest NI.

The key objectives of AFQ was 'to stimulate export growth and improve productivity and international competitiveness in the NI agri-food sector through:

- Increasing the level of R&D activity;
- Developing a culture of partnership, collaboration and knowledge exchange;
- Encouraging the adoption of best practice;
- Developing novel production processes;
- Developing new added value products;
- Improving sustainability, safety and quality.[29]

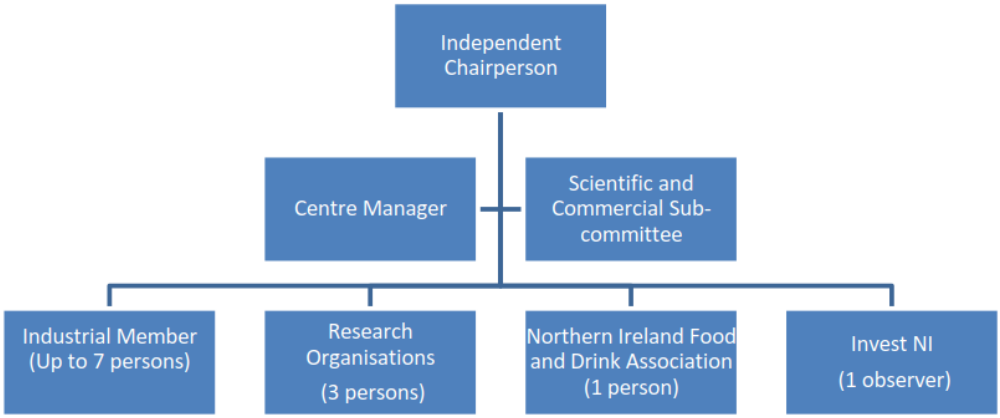
An interim evaluation was conducted, covering operations between 1 Oct 2015 and 30 Sep 2018. The resulting recommendations advised that AFQ should be invited to apply for a further three years of funding under a phase II. This Phase II business plan was prepared, but it was confirmed in May 2022 that Invest NI will not be in a position to consider a further offer of Competence Centre support to Agri-Food Quest (nor any of the remaining centres). AFQCC operations subsequently drew to a close as an Invest NI-funded initiative in March 2023.

This chapter evaluates the performance of AFQCC in Phase I and considers its legacy impact and future potential.

4.2 AFQ delivery and governance

AFQ secured business plan approval for a five-year programme, commencing in October 2015. The below organogram shows the delivery structure for the centre, with Invest NI acting as arm's length funder.

[29] AFQCC Ministerial Submission



Several strengths were highlighted during the consultation phase, as well as in the quarterly and end-of-phase report by AFQ. Firstly, the importance of the chairperson and their independence was stressed, with the continuity experienced of this stressed as having been integral for the centre's operations and in bringing together stakeholders. Indeed the close-out report comments on the *'High attendance for all steering committee meeting and very strong involvement and commitment by each member'.*

Another strength highlighted was the flexibility offered by Invest NI to the AFQ steer co and operations during COVID-19 regarding funding timelines and accommodation of delays from Invest NI has been highlighted as a core strength and support by AFQ management. This culminated in Invest NI providing an extension for AFQ to end March 2023. However, primary engagement revealed a perception of the oversight process and funder-centre relationship being, at times, bureaucratic and causing delays. It was highlighted, for example, that the Centre Manager Guidelines were not received by AFQ until 2018, two-three years following the centre's establishment. Furthermore, given that there were no 'core' research staff, the process to select projects, award funding and source staff was time intensive, with the initial two years being dominated by set up tasks such as this.

The structure of the management/board, involving several stakeholders within NI's agri-food industry, as illustrated above, is another strength. This was another mechanism used to unite industrial, policy and academic stakeholders. In addition, AFQ benefited from being integrated within an existing structure within the Institute for Global Food Security. This accelerated the efficiency and acceptance of AFQ as an influential voice within NI agri-food, rather than starting from an independent structure. It also opened several doors, in terms of making national/international connections and widening AFQ's reach and influence.

4.3 AFQ Activity

4.3.1 KPI attainment

AFQ reported quarterly to Invest NI on the below set of indicators, covering both industrial and research-related activities. In general, KPI attainment was positive. The notable area of underperformance was commercialisation, with no license agreements issued and only one (vs the target of two) spin-offs established. Despite this, it is worth considering AFQ's performance in light of the reviewed commercial KPIs set for Phase II of the centres. Had the target concerned Invention Disclosure Forms (as was applied to CASE phase II, for which the target of three), five of these were secured by AFQ. This indicates a strong pipeline of potential IP creation and is a more realistic target within the initial five-year timespan of AFQ.

The outturn rate of IKCs as a share of total research project costs was lower than projected (16% vs 25%). However, this should be considered in tandem with the attainment of industry cash contributions, with the target almost doubled (193%).

The over performance, in terms of national and international knowledge dissemination and corporate membership, displays the positive impact that AFQ has had in raising the profile of NI as a destination for innovation and critical mass in the agri-food field.

Table 4-1: AFQ performance against KPIs

Performance Indicators	Initial 5-year target	End of phase result	Assessment
Number of persons employed	up to 1.5 people per year	1.5	
Ratio of industry staff costs as % of total in-kind contribution	50%	60%	
Other leveraged funding	£1,800,000	£2,711,961	
Cash contribution from industry	£155,000	£298,550	
Overall Industry in-kind contribution as % of total research project costs	25%	16%	
Issue licence agreements	2	0	
Established spin-offs	2	1 (with an additional spin-off under consideration)	
Activity indicators Indicators	**Initial 5-year target**	**End of phase result**	**Assessment**
Active participations at conferences and seminars	5	46	
Publish academic publications	16	30	
Total companies engaged	20	31	
Total research projects	18 to 28	19	

Source: Invest NI[30]

4.3.2 Budgetary considerations

At the Centre's outset, funding of £5.0m from Invest NI was committed to for the five-year period at a support rate of 75% for core costs and 100% of research costs. Industry would make contribute of 25% to core funding, composed of in-kind contributions (£1.5m) and cash contributions (membership/project fees) of £155,000. Assistance was provided via a revenue grant, paid retrospectively against approved expenditure.

Realised cash-contributions from industry members at project close were 93% higher than target (£299k vs £155k, respectively). Members were also charged an annual fee depending on their size; this ranged from £500 (small), £2,500 (medium) to £5,000 (large). This income stream totalled £298,550 over the eight-year operational period (COVID impacted this for the 2021 year, with receipts totalling only £4,000).

The realised expenditure was roughly in line with the amount projected. The excess industry cash contributions and leveraged funding more than compensated for a marginal shortfall in the grant funding.

[30] 30 AFQ Quarterly Report Jan-Mar 23

Figure 4-2: AFQ participants

Element	Phase (I)
Total grant paid (offered)	£4,943,316 (£4,983,726)
Maximum eligible expenditure incurred (projected) [31]	£5,147,781 (£5,119,313)
Of which:	
Core staff	*£776,071*
Other core costs	*£41,787*
Research staff	*£2,633,262*
Research overheads	*£1,155,111*
Other research costs	*£541,549*
Industry cash contributions (projected)	£298,550 (£155,000)
Invest NI funding	£4,943,316
Core grant paid	*£613,393*
Research grant paid	*£4,329,923*

Source: Invest NI

4.3.3 Research activity

The AFQ research strategy is highlighted below. The initial themes were designed to be wide and, following industry engagement with AFQ's growing membership base, were modified to encompass megatrends sustainability and transparency.

The process for devising and reviewing this strategy was intended to include an annual strategy day, where stakeholders would come together to analyse key trends in the agri-food industry in NI and internationally. Two such workshops occurred, in 2016 and 2017, to strategise the research agenda for the subsequent year, with 5 and 25 companies in attendance, respectively. At these workshops, priority themes were agreed on, upon which the flagship proposals (projects with wider strategic significance for Northern Ireland) were to be based. During the consultation phase, there was consensus regarding the importance of these strategy days in deciding the research areas to focus on and whether they had evolved.

[31] Excludes in-kind contributions. Includes total expenditure, with Invest NI funding representing 25% of 'core' funding and 100% of research funding.

Figure 4-3: AFQ Research Strategy

Source: AFQ Centre Final Report

The evaluation team noted that the graphic depicting the research strategy was the same in the Centre's Final Report (2023) as in its Midterm Report (2019). This is despite the evaluation action plan resulting from the interim evaluation that stressed the importance of refreshing and focussing the research agenda. It is however appropriate to note that as the AFQ budget was fully committed following completion of the 2017 call any change in research strategy would only be reflected if a new budget was allocated. The business plan submitted by Invest NI as part of the phase II application in August 2021 incorporated a research strategy. There was business and academic consultation to inform this research strategy but took the form of online workshops (due to Covid restrictions) rather than the in-person workshops used during earlier strategy discussions.

4.3.4 Marketing and Recruitment

Four open calls for research project submissions took place during 2016 and 2017. This was an iterative process, with edits made to the process in response to feedback. The second call introduced a two-stage process, consisting on an Expression of Interest followed by a full proposal stage. A further addition of a 'flagship' concept was made in 2017, with two calls made in parallel for a standard project and flagship call. The latter was based on putting into action the outputs of a large innovation workshop carried out with all AFQ stakeholders in June 2017.

At the close of AFQ phase I, 19 projects had been completed, involving 31 individual industry partners. Of these, 16 projects (84%) fell inside the target TRL level of 3-7, with the model TRL being 5 and 6.

In all the recruitment/activity-related KPIs, AFQ achieved or exceeded the target level. This was particularly notable in conference and seminar participation outside of NI, thereby increasing the international profile and reputation of NI's Agri-food-related innovations.

Invest NI tracking data reveals that large businesses dominated AFQ, by far the largest representation of any centre, at 60%.

Table 4-1: AFQ activity and recruitment

Participant demographics	Share	CCP total
SMEs	40%	72%
Large companies	60%	28%
Invest NI client companies	69%	43%
Share NI companies	97%	82%
Share non-NI companies	3%	18%

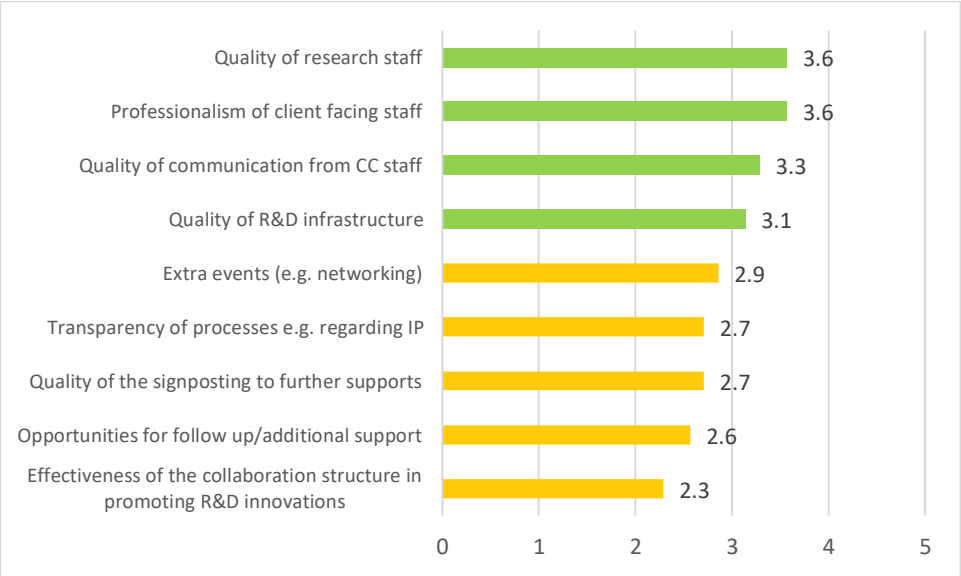
Source: AFQ quarterly tracking data; Invest NI data; Grant Thornton analysis

4.4 Perspectives on AFQ

4.4.1 Satisfaction with the programme elements

There were positive levels of satisfaction with some elements of AFQ among stakeholders. For industrial participants, the benefits centred on the establishment of a forum to connect agri-food companies (where before there had been limited to no forum for this). Testament to this, the top three rated elements, rated by survey respondents, concerned competence centre staff, including the quality of their communications. The commercialisation elements were ranked lower (transparency of IP processes and effectiveness in promoting innovations). The scoring of extra events, as dissatisfied/neutral, reflects the constraints due to limited core funding for such activities.

Figure 4-4: Reported levels of satisfaction with programme elements (average satisfaction levels)



Source: Grant Thornton Analysis (n=7)
Green indicates a score of >3.0 (i.e., satisfaction with the respective element)
Note: The scale used throughout 'opinion questions' is 1= Very Dissatisfied, 2=Dissatisfied, 3=Neutral, 4=Satisfied, 5=Very Satisfied

Regarding whether they would recommend participation in AFQ to other companies, respondents were split; of the eight who answered, four responded 'no', three 'yes, and one was mixed, citing a need for AFQ to be more focussed on generating tangible benefits. Those who would not recommend participation cited the centre being more suited to particular strands of agri-food, an overrepresentation/focus of academic objectives, and bureaucratic delays in processes. Consultations with industry were more positive, particularly regarding the benefits of the stakeholder forum and of participating in the consortium agreement structure.

4.4.2 Outcomes and benefits

Participants reported the medium to long term nature of tangible, monetary returns to the type of innovative R&D being undertaken. Several focussed more on the non-monetary benefits resulting from participation in AFQ, particularly in the resulting awareness and strengthened networking. Benefits reported in the survey and consultation process include:

- Strengthened peer network of likeminded businesses. The connections, networking and knowledge sharing opportunities spanned:
    - Local NI landscape
    - With UK and Ireland partners, e.g. One project part-financed with Enterprise Ireland through a link to the DPTC (Dairy Processing Technology Centre)
    - With international partners: links forged with EIT Food, a pan-European competence Centre; attendance at 46 conferences
- Knowledge transfer between companies, as well as between industry and academia (30 peer-reviewed papers produced)
- Development of new (or enhancement of existing) products and services, the potential of which was expanded by access to R&D&I skills and perspectives from academia and other industry partners
- Benefits from academic perspective/input
- Increased access to talent, including researchers (instances of staff transfer from academia to industry were cited)
- Strengthened peer network of likeminded businesses, opening companies' eyes to collaborative research (vitamin D continued beyond agri-food quest funding)
- Development & testing of prototypes
- Profile and awareness raising of NI potential and critical mass in agri-food. Focus on an emerging cluster area of economic significance to the NI economy, from a base of low investment historically. Strong outreach and dissemination with 30 peer-reviewed papers produced and attendance at 44 conferences (with projects presentation or posters). One particular project (UK Sausage with no added nitrite) reached out through media with 270 articles written and 3 radio interviews.
- Onus on participants: High attendance for all steering committee meeting and very strong involvement and commitment by each member.
- Step change in attitudes towards R&D&I in agri-food companies; elevating awareness of innovation and its potential for their business. Ingraining innovation more in the business processes and day-to-day discussions – one company spoke of their transition from being an innovation 'follower' to leader due largely to their involvement with the innovation landscape in AFQ. Driving the agenda for selection and approval process by the industry has given them the token and incentive to drive further projects. One participant describe the transition from them being a solution taker to a solution provider.
- Participation has given agri-food producers back a level of control in relationships with their buyers. One consultee described the vast majority of agri-food companies as being dependent on one market, these tending to be retailers in the UK and Ireland, for example in the meat production and packaging field. These companies can therefore become dependent on this retailer's requirements/agenda. Consultees spoke of AFQ affording them a level of control in managing these relationships, with innovation advances allowing them to incorporate strategic areas of importance for their buyers into their research and future product/services (e.g. animal welfare advances, supply chain integrity and transparency),

adding value to and securing their position as supplier. It was recognised that this is not a tangible/visible benefit, but is a big part of maintaining their contracts.

Case study of the role of AFQ in raising awareness and international reputation of NI agri-food industry

Project: UK sausages with no added nitrates/nitrites, have a lower risk of colorectal cancer than their EU counterparts

The aim is to demonstrate that mice fed with nitrate/nitrite containing sausages, have a greater risk of developing colorectal cancer, compared to those fed a nitrate/nitrite free sausage. The ultimate goal is to demonstrate the superiority of a 'clean' product to encourage avoidance of nitrates/nitrites in processed meats. The objectives were to compare the number, size/ volume and histopathology of colorectal polyps that develop in mice fed a nitrate/nitrite free sausage, to those fed a highly processed equivalent.

Outcomes/benefits: socioeconomic benefit (drive for a change in definition of processed meat in line with WHO recommendations; international awareness and marketing of NI agri-food - media coverage has provided strong advocacy and messages to differentiate NI and British sausages vs continental counterparts and the connection between the type of recipe used to determine health risk. A total of 270 articles and 3 peer reviewed papers were published, alongside 3 radio interviews.

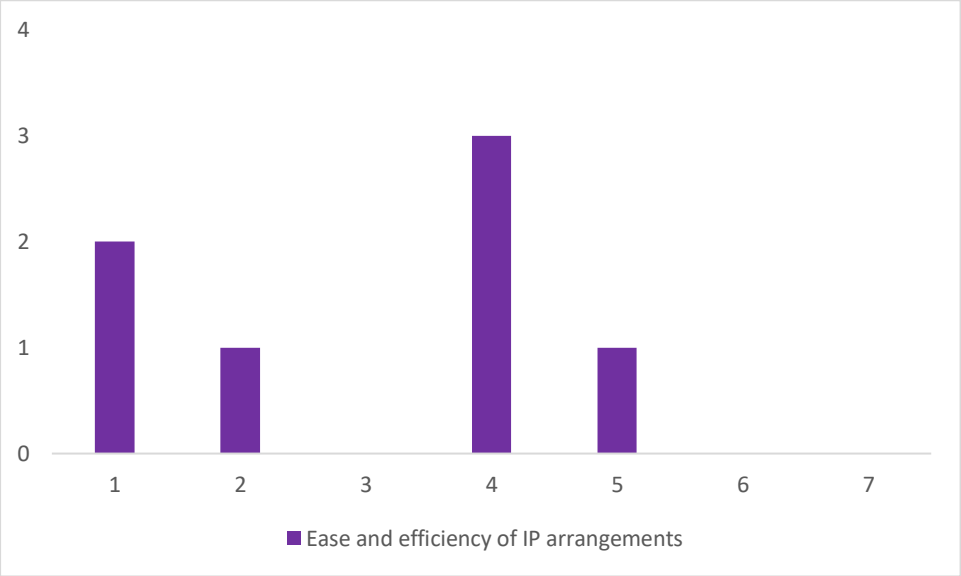
4.4.3 Commercialisation arrangements

The state aid regulations governing the CCP applied in the same with the AFQCC as to the other centres, bringing with it the limitations and frustration for industry. The KPIs relating to commercialisation were felt to be unreasonable; reasons cited included the time frame (albeit a 'reasonable' timeframe was not proposed by respondents) and nature of companies involved, with the participant companies tending to be buyers, rather than suppliers, of many of the products/services.

The modal answer to survey respondents' scoring of IP ownership and licensing arrangements in AFQ was a neutral 4 (neither easy nor difficult). This aligned with the consultation findings that companies did not, on the whole, focus on the IP processes due to their projects either not involving IP, or involving pre-existing IP. It is also possible that the restrictive IP arrangements deterred companies from bringing certain projects to AFQ.

How would you rate the IP ownership and licensing arrangements within the Competence Centre Programme?

1 = very difficult and complicated, 4 = neither easy nor difficult, 7 = very easy and efficient



Source: AFQ respondents, Grant Thornton analysis, n = 7

Case studies do demonstrate the potential for commercialisation within AFQ. One start-up was launched directly from AFQ and since secured £1m of Seed A private equity funding; another is in discussions to purchase a license. A further five Invention Disclosure Forms have been created, pointing to a strong pipeline of potential IP developments. When compared with the performance of other centres in phase I, this level of IP activity/pipeline is not misaligned and is in fact quite positive.

4.4.4 Challenges and lessons learned

Across the primary engagement undertaken, participants felt that several 'lessons learned' could be taken from Phase I of AFQ. They are as follows:

Table 4-2: AFQ activity and recruitment

Consideration	Explanation	Solution
Dominance of larger companies within the forum. Connected to this, duality of project proposer / assessor role possible.	These companies could shape the agenda of the centre. There was also cross-over between stakeholder committee personnel and the companies proposing projects for funding award. In general, the participant company did not get involved; not a rule but more of an understanding.	To some extent, this is reflective of the nature of the agri-food field in Northern Ireland. It is also importance to have representation from key industry members on the steering committee. Possible improvements could involve an independent award committee (e.g. of three personnel including a subject matter expert) to be involved in the project award process and to ensure transparency. This action was proposed and accepted by the centre in the Phase II Business Plan but was yet to be realised. To prioritise participation of entrepreneurs and SMEs in AFQ, higher weighting could be given in the project award process. Outreach visits could also be organised to increase awareness of the benefits of AFQ membership.
Tensions between research and innovation remit; duality and confusion between research and commercial KPIs	The commercial KPIs, in relation to spin-outs and license purchases, were viewed as being unfeasible during the five-year time frame, as well as owing to the nature of projects in the centre.	Review KPIs and develop them in tandem with AFQ stakeholders to ensure suitability and relevance. This should include refinement of commercial KPIs, with the removal of spin-out creation to be considered. The raising of private equity could be a further avenue to monitor (perhaps to merit inclusion as a KPI).
'Virtual' nature of AFQ caused a lack of identity and sense of belonging	There were no core research staff attached to AFQ, nor was the centre a legal entity, but rather a part of QUB.	Conduct a cost-benefit study, prior to any further operational phase, of the merit of funding core researchers / dedicated PhD students. Consider publishing and distributing annual updates to key industry bodies, members and affiliates.
IP arrangements were unclear particularly	Outside of comfort zone	Given state aid considerations, this is difficult to address and is not

Consideration	Explanation	Solution
given the consortium approach		unique to NI Competence Centres. The TRL focussed on may lend itself to post-concept stages, whereby developmental work is being carried out on an existing product and thus is post-patent stage.
Administrative and time burden associated board meetings and quarterly reporting	One respondent detailed the administrative burden of "quarterly meetings and reports for 19 projects with 1.5 people (being) an impossible task."[32] This relates to the burden on core staff as well as on the steering committee.	Consider placing the onus for quarterly reporting directly on participant companies, feeding in to an online database. A data visualisation package could be used to automate this reporting. Consideration should also be given to a rotating membership of the committee, to share out the burden, as well as a review of the core staff budget.
Focus on economic output in KPIs as opposed to research, innovation and policy alignment	One respondent said "Competence Centres should focus on the research that will 'fuel' innovation and thereafter the economic output."[33] It was felt that the current suite of KPIs did not aptly reflect this potential.	This evaluation has attempted to more fully illustrate AFQ's impact by considering the business expenditure on R&D (BERD) leveraged. Moving forward, timely reporting of indicators – particularly relating to BERD but also on elements such as expenditure on staff training and skills development – should be reported to AFQ on a bi-annual basis. If built in to participation clauses, this would provide comprehensive baselines and progress tracking.
No core research staff leading to time delays	Recruitment of staff for projects took between six to nine months according to several consultees, causing further delays to projects commencing.	Consider the merits of core PhD students with pre-approved funding independent on specific assignments. This would also enable strategic projects that align closely with policy to be pursued.
Demographic of company base lead to fewer opportunities to develop and/or commercialise new products and services	It was felt that the demographic of participant company did not lend itself to commercial outputs through R&D&I. The nature of the much of the agri-food sector uses service providers as suppliers, who may not necessarily be seeking to produce new products/services.	Ecosystem management and targeted recruitment of particular cohorts could help to generate more socioeconomic benefit through the collaborative research. This could include service providers, chemical, diagnostic and big data companies operating within the agri-food space. Avenues could include expanding the definition of sector, research strategic (e.g. incorporating AgriTech specifically), word of mouth and organic visits. Collaborations with related centres (e.g. CASE in the area of circular economy) could also progress this area.

[32] AFQ Centre Final Report

[33] AFQ Centre Final Report

Consideration	Explanation	Solution
Lack of direction and oversight regarding delivery and management	AFQ centre manager only received the Centre Manager Guidance handbook in 2018, two-three years into the operational period. This could indicate a lack of direction/oversight in key areas during these first years.	Ensure an open line of communication between centre managers and Invest NI oversight personnel, to accompany a 'live', updated set of guidelines and FAQs relating to delivery and management principles.

4.4.5 Economic Impact Return on Investment & Value for Money (VfM)

The impacts of participation in the AFQ CC are not largely quantifiable in nature, as established through the strong value placed on non-monetary outcomes such as stakeholder engagement with peers and academics by alumni. However, it is also insightful to attempt to quantify, insofar as possible, the impact of the centre on turnover of participant companies, as well as the R&D impact. These cannot be relied on, largely due to the small sample size (20 survey respondents, reducing to 7 for impact/additionality). No consideration is given to future benefits, rather the analysis is undertaken on 'pre' and 'post' programme. Therefore it is anticipated that further benefits will be realised over the longer term, with costs having been fully realised.

The below results demonstrate a potential ROI of -0.4, i.e. a loss of 40p per £1 of Invest NI expenditure in the short term. This is a potential short-term economic impact of £3.2m. No additional BERD contribution was calculated from AFQ phase I. It is, however, worth noting that in the medium to longer term, this economic impact, BERD leveraged and overall ROI on Invest NI expenditure is likely to increase as benefits are realised.

Table 4-3: AFQ economic impact

	AFQ	
Impact variable	Results	
GVA impact		
Additional turnover, net	£	7,356,772
Economic impact (GVA), net	£	3,201,420
BCR		0.6
ROI		-0.4
BERD impact		
BERD activity generated, net	-£	522,483
BERD growth (%)		-0.8%

Source: Invest NI monitoring data, Grant Thornton analysis, NISRA

4.4.6 Equality Considerations

The evaluation team's review of the AFQ CC and its activities indicates that centre participation is available to any Northern Ireland small, medium or large company with appropriate innovation ambitions and relevant proposals. Overseas owned/based companies are also eligible to come participants/members, where it can be demonstrated they will strengthen the consortium and bring technical/economic benefits to Northern Ireland and/or support the internationalisation of the Competence Centre. As such, it is the Evaluation Team's assessment that the AFQ Centre complies with all elements of equality promotion set out in Section 75 of the Northern Ireland Act 1998 and by Invest NI in their Equality Scheme

4.4.7 AFQ's Economy, Efficiency & Effectiveness

Table 4-4: AFQ activity and recruitment

Measure	Analysis
Economy The Economy measure is concerned with measuring the impact of the programme at an appropriate level of input i.e. impacts have been obtained at the best VfM	AFQ was subject to an economic appraisal, business plan and robust internal casework process. It was also subjected to a detailed interim review with an international advisory panel, as well as its flagship projects being the subject of a detailed investigation within that time. These foundations were used by Invest NI to assess best practice and operational efficiency in terms of delivery, as well as helping to understand the potential outcomes being generated and challenges faced. This represents a high level of scrutiny and stakeholder input. The interim evaluation action plan allowed for consideration by AFQ stakeholders regarding how best to maximise impact for the remaining operational years. AFQ used its own internal procurement processes throughout its operational period, given the arms' length nature at which Invest NI operated. The guidelines for this were provided in the Letter of Offer at project outset. AFQ participation required both cash and in-kind contributions from companies. This both reduced Invest NI's outlay, as well as incentivising commitment from companies. These cash contributions exceeded the target set by 93%. The total cost of AFQ was £4,943,316 to Invest NI and £5,147,781 when including industry contributions. • The economic impact that has been calculated suggests a potential ROI of -£0.4 for every £1 of Invest NI funding of AFQ, i.e. a loss of 40% on funds invested. This ROI may increase in future, should products/innovations progress to market and/or achieve strategic benefits. • Based on the sample provided, there was no evidence of increased BERD compared with the baseline expenditure data.
Efficiency The Efficiency measure looks at measuring the impacts relative to the level of inputs i.e. has the maximum level of output been achieved for a reasonable level of input	A total of 29 companies participated in AFQ, carrying out 19 projects during the operational phase. This exceeded target of 20 companies. The cost to Invest NI per business was £170k (or £260k per project). The potential ROI was calculated as being -0.4, indicating a loss on initial Invest NI funds. The centre exceeded target of leveraged funding secured by 51%, totalling £2.7m during phase I (vs target of £1.8m); industry cash contributions exceeded target by 93%.
Effectiveness The Effectiveness measure is concerned with understanding the level of impact the programme has achieved relative to aims, objectives, etc.	The primary engagement undertaken revealed several constraints on impact, both exogenous (e.g. the nature of the agri-food industry and the overrepresentation of large companies) and endogenous (the IP ownership rights remaining with the host institutions rather than the companies, the time delays and burden caused by bureaucratic demands). Despite this, there was significant additionality, with 80% of companies indicating that they would have reduced the scale and/or delayed carrying out similar research in lieu of AFQ assistance.

Source: Invest NI & Grant Thornton Analysis

4.4.8 Considering the future of AFQ

At this time, there is no planned phase II for AFQ in the context of funding constraints and commitments. However, the work conducted to date in AFQ, such as Food Fortress and Food Future, provide strong potential for future R&D leveraged funding, such as Grant for R&D. A growing area of strategic focus that AFQ relates to, spanning multiple sectors and industries, is the Circular Economy. The draft Northern Ireland Circular Economy Strategy and accompanying public consultation was published in 2023 and sets out the potential for implementing its principals, including the circular bioeconomy, which encompasses the agri-food production chain. This is an area that AFQ, perhaps in collaboration with CASE, has and could make further contributions to.

Furthermore, planned public infrastructure investments – as represented by the Belfast Region City Deals – provide further opportunity for the work, innovations and connections forged in areas such as food sustainability and security being built upon and linked with digitisation and big data. One such example is Momentum One Zero Institute at Queen's University; its mission is to deliver *Solutions for Wellbeing in a Digital World*. It has three inter-related goals – Longer Healthier Lives, Secure Sustainable Food and Shared Digital Prosperity.[34]

Other emerging funding streams that partner organisations could seek to avail of (given AFQ is not a legal entity and therefore unable to pursue this type of funding) include the Co-Centre Programme, jointly funded by Science Foundation Ireland (SFI), the Northern Ireland Department of Agriculture, Environment and Rural Affairs (DAERA) and UK Research and Innovation (UKRI), and industry partners. It will connect researchers across Ireland, Great Britain and Northern Ireland through the formation of a Co-Centre. The programme will establish virtual Centres of excellence linking researchers across academia and industry to perform cutting-edge research in areas of mutual benefit.[35] The specific funding call dedicated to Sustainable and Reliant Food Systems aligns with much of AFQ's work to date.[36] On the balance of consideration between Benefit to Cost Ratios, Return on Investment and emerging initiatives, the evaluators do not see a rationale for a CCP programme but do see some rationale for AFQ efforts to sustain through the City and Growth Deals arena.

4.5 Implementation of the interim evaluation

The interim evaluation suggested key changes such as carrying out a review of strategic opportunities for phase II, the use of international experts in the project selection process, participation in international business development/funding bids, reviewing the IP arrangements and creation of an IP register.

The 'Agri-Food Quest Competence Centre Evaluation – 2019 – Action Plan' illustrates the progress that had already been made in many of these areas. The Phase II business plan, submitted in 2021, gave further details the plans for actioning these recommendations, including a refreshed research strategy, strategic alignment and IP register processes. However, given that it was confirmed in May 2022 that Invest NI would not be funding any subsequent phase, many of these actions are yet to be realised, pending the certainty of funding to enable them.

4.6 Recommendations

The primary and secondary research conducted to assess the performance of AFQ has informed several lessons learned. Implementation of the following action points could help to further leverage

[34] Agri-Food Quest Competence Centre – Progress Overview Post Interim Evaluation 2019 and Management Response to Evaluation Recommendations

[35] https://www.sfi.ie/funding/funding-calls/co-centres/

[36] https://www.sfi.ie/__uuid/a4ec82e1-80d7-4560-9007-6ea203b7a3cb/CoCentre-Programme-2022-Call-Doc-Updated-Dec-2022.pdf

the impact of AFQ as the centre transitions away from Invest NI CCP funding, or in consideration of the AFQ-Invest NI relationship moving forward.

- **Ensure a continuum between AFQ and related public investments, particularly the city deals suite of projects:** revise the research strategies and impact areas pursued by AFQ, involving the key stakeholders and lessons learned. This should also assess alignment with current and planned city deals projects, particularly the BRCD innovation pillar, given the progression of this. Such consideration should align closely with 10x and include detailed consultations with stakeholders at DfE, as well as industry stakeholders in emerging areas of potential such as AgriTech. This could align closely with the AMIC project. Where areas of alignment are identified, a log of alignment between AFQ projects, the critical success factors (CSFs) and objectives of these centres should be created, enabling a 'continuum' approach to innovative work commenced in AFQ.
- **AFQ to compile funding and opportunity mapping for members and alumni, actively facilities introductions and networking opportunities:** AFQ core staff should leverage their market knowledge to compile a business development register to map potential and 'live' funding opportunities for member companies, affiliates and alumni. This should include current and prospective R&D grants and schemes relevant to agri-food strategic priorities, with action plans and timelines produced in accordance with rolling calls and applications deadlines.
- **Increasing micro and SME representation:** management should review representation on steering committees, to ensure that micro and SME industry partners are being heard, as well as a balance of representatives for larger companies and both universities. Efforts were made to increase SME participation but without success. In-kind contribution levels of 16% indicate that, in particular, SMEs found it difficult to participate in projects, as such an assessment of the restrictions regarding SME participation should be considered. This could include awarding greater weighting to smaller companies in the funding award process, prioritising 'niche' emerging areas (e.g. of AgriTech) in a revised research strategy, and site visits to micro firms and entrepreneurs to raise awareness of the benefits of AFQ membership.
- **Improved efficiency and transparency of governance and project award processes:** possible improvements to the project award process could involve an independent award committee (e.g. of three personnel including a subject matter expert) to be involved in the project award process and to ensure transparency.
- **Reconsider KPIs in light of non-monetary benefits and lessons learned during Phase I of other centres:** Review KPIs and develop them in tandem with AFQ stakeholders to ensure suitability and relevance.
- **A detailed KPI framework informed by compulsory baseline, progress and post-participation metrics:** consider placing the onus for quarterly reporting directly on participant companies and academic institutes, feeding in to an online database. Assessment of detailed information on project spend will ensure good governance and company data can strengthen the collection of output data. A data visualisation package could be used to automate this reporting. Consideration should also be given to a rotating membership of the committee, to share out the burden, as well as a review of the core staff budget.
- **Timely reporting of indicators:** particularly relating to business expenditure on R&D (BERD) but also on elements such as expenditure on staff training and skills development – should be reported to AFQ on a biannual basis. If built in to participation clauses, this would provide comprehensive baselines and progress tracking. This should be in alignment with mechanisms to relieve the reporting burden, including automation such as a data visualisation package, as well as a rotating membership of the committee (Table 4-2).
- **Review of the researcher structure and place within AFQ:** consider the merits of core PhD students with pre-approved funding independent on specific assignments. This would also enable strategic projects that align closely with policy to be pursued. Conduct a cost-benefit study, prior to any further operational phase, of the merit of funding core

researchers / dedicated PhD students. Consider publishing and distributing annual updates to key industry bodies, members and affiliates.

- **Ecosystem management and marketing efforts to ensure that companies and sectors best placed to benefit from AFQ support are recruited:** ecosystem management and targeted recruitment of particular cohorts could help to generate more socioeconomic benefit through the collaborative research. This could include service providers, chemical, diagnostic and big data companies operating within the agri-food space. Avenues could include expanding the definition of sector, research strategic (e.g. incorporating AgriTech specifically), word of mouth and organic visits. Collaborations with related centres (e.g. CASE in the area of circular economy) could also progress this area.
- **Improved efficiency and transparency of governance and project award processes**: any future funding phase of AFQ should be supported by open line of communication between centre managers and steering board personnel and Invest NI representatives. This should be accompanied by a 'live', updated set of guidelines and FAQs relating to delivery and management principles.

5. The Centre for Advanced Sustainable Energy

5. The Centre for Advanced Sustainable Energy

5.1 Background to CASE

The Centre for Advanced Sustainable Energy (CASE) was established in September 2013, building on the findings of the Matrix (Sustainable Energy Science Advisory Panel) Report which identified Northern Ireland as an ideal test bed for intelligent energy systems. The Centre is hosted by QUB, with collaboration from partners including University of Ulster and the Agri-Food and Biosciences Institute. It was granted initial funding of £5m for a five-year period for Phase I from Invest NI.

Following the largely positive findings of the Interim in April 2017, CASE was invited to subject a business plan for a second phase, subject to formulating an action plan to address the recommendations. This Phase II business plan was subsequently submitted in August 2017, leading to a further £3.6m of funding from Invest NI for the 2018-2021 period. Following COVID-related extensions, Phase II is now due to end in March 2024. The vision, as set out in the Phase II Ministerial Submission, is to 'Position Northern Ireland at the forefront of the global sustainable energy market; by integrating leading research into the local industrial base, for the benefit of the business community and the wider economy'.

This chapter considers the performance of CASE phase I; particular emphasis is then placed on the lessons learned and how this knowledge has shaped phase II and its subsequent performance thus far. Challenges, and applicable recommendations relating to the future of CASE as it transitions away from Invest NI funding, will be discussed.

5.2 CASE delivery and governance

Phase I

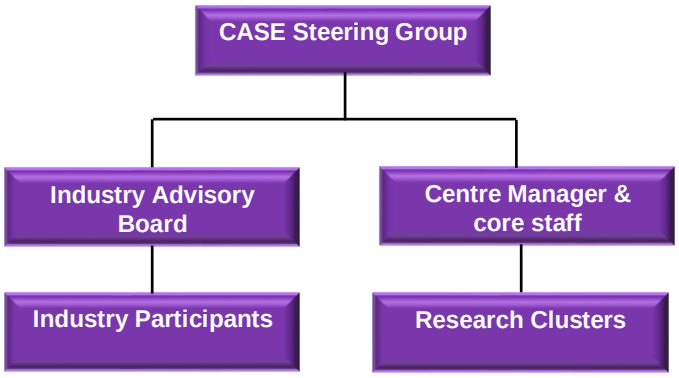
The CASE delivery structure consists of a Steering Group, supported by an Industry Advisory Board and the core staff of the Centre. This is illustrated in Figure 5-1. The main responsibilities they hold are as follows:

- Steering Group:
    - This group informs the strategic direction of CASE, overseeing the development and implementation of CASE themes (including how these translate to projects being realised) and monitoring the centre's performance and KPIs. It reviews the collaborative structure and strategic relevance of proposals, and evaluates and scores them in the funding award process.
    - Has a maximum of 15 members. A minimum of seven members are required to take key decisions.
    - Meets every two months, with additional milestone meetings as required.
- Industry Advisory Board:

- Is composed of one representative from each of the businesses actively involved in CASE. Meetings are set to occur at least once every six months.
- Fulfils an advisory, support role to the Steering Group and conducts an initial shortlisting of project proposals.
- Elects members to the Steering Group.
- Supports the Centre Manager and acts as a sounding board for review and quality assurance, including compliance with the strategic objectives as set out in the Business Plan.

- Centre Manager and staff:
  - The Centre Manager is responsible for the day-to-day operations of the centre, as well as liaison with Invest NI and industrial participants.
  - Coordinates recruitment efforts, including outreach to industry and calls for research proposals, and international business development efforts to connect CASE with international partners
  - Is in charge of financial and KPI reporting, as well as alignment with research objectives and updating of this strategy on an annual basis.
- Research clusters:
  - These were aligned with CASE research priority areas, resulting in Bio-Energy, Integration and Storage, and Turbines clusters
  - These were chaired by an industry participant who also sat on the Steering Group
  - Their aim was to represent their respective research specialism in development of the centre's research strategy and identify priorities within the respective area, as well as encouraging the formation of connections between industry, academia and wider stakeholders in that field.
  - They were also tasked with providing guidance throughout related projects' lifetimes.

Figure 5-1: CASE Governance Structure overview



The mid-term evaluation identified CASE I as being understaffed from a core/administrative standpoint. This resulted in an immediate recruitment (March 2017-June 2018) of a Grade 4 Finance/Admin post within the Phase I operational budget. Stakeholders reported this as having a notable positive impact, concerning claim administration and quarterly reporting requirements.[37]

Phase II

There was a change of centre manager personnel shortly before the start of Phase II, who brought with them several changes. This included outsourcing some of the marketing duties to an external agency. This phase also saw the core centre staffing number expanded, following the mid-term reviews assessment of it being understaffed. This translated to 3.4 FTE core staffing members as follows:

- CASE Director (20% FTE) - sharing the role with Director of the Bryden Centre
- CASE Manager (100%)

[37] CASE Phase 2 Business Plan

- Clerical / finance support officer (100%)
- Commercialisation Manager (100%) focused on leveraged funding, identification and pursuit of IP assets
- CASE Finance coordinator (20%)

This shows an appreciation of the need to become more integrated within the university infrastructure as well as within partner institutions such as AFBI, with some of the roles co-located in respective partner's departments. It also shows an appreciation of the need to focus resources on commercialisation and exploitation of potential IP assets, with the Phase II Business Plan stating: *'Routes to commercialisation for CASE research outputs will now be an integral part of project proposal, evaluation and delivery'.* These additional resources also enabled a focus on longer-term funding and financial sustainability post-Invest NI funding, which has been reflected in the success that Case has secured in this area (such as £4.5m from the Department for the Economy).

Satisfaction levels with centre staffs' professionalism was high (see section 5.4). However, there was a perceived lack of transparency and efficiency in the project award and feedback process. This led to an external review being initiated and conducted, concluding in February 2023. Some of the reasons for this are to some extent, exogenous (budgetary constraints caused by limited financial resourcing for the core funding strand of CASE). However, some elements include streamlining the transparency of the process or avoiding perceived conflicts of interest.

5.3 CASE Activity

5.3.1 KPI attainment

Phase I

CASE performed well in the majority of KPIs it was assigned for Phase I, with the exception of industry cash contributions, license agreements and spin out creation. The latter two were considered, in retrospect, to be unfeasible targets and were subsequently removed/reviewed, with the recruitment of a commercialisation manager in phase II to reflect the importance of IP within CASE.

The underperformance in industry cash contributions (£158k vs the target of £240k) has been magnified due to virements between research and core budgets. The closeout report states *'…This would have been more than sufficient to cover the difference between the total core spend and grant received from Invest NI based on the original budget. However, cash-in fell short of what was required after virements from Research budget and Core budget were required to support the management team as Phase II approvals took longer than anticipated. This shortfall was absorbed by Queen's University, with no expectation that the Centre generates a surplus in Phase II*.' Nonetheless, a simplified charge structure, including the introduction of a membership fee, was introduced in Phase II in recognition of the potential for improvement in this regard.

The leveraged funding exceeded target by 155% during Phase I, with a buoyant participant base and number of funded projects to match. The level of knowledge transfer occurring is demonstrated by on-target IKCs (23.3% broadly in line with the 25% target), with these contributions being majority composed of staff resources (87% vs a target of 50%).

Figure 5-2: CASE Phase I performance against KPIs

Performance Indicators	Initial 5-year target	End of phase result	Assessment
Industry Cash Contribution	£240k	£158.3k	
Overall industry in-kind contribution as % of research project costs	25%	23.30%	
% of in-kind contribution from Industry staff costs	50%	87%	

Performance Indicators	Initial 5-year target	End of phase result	Assessment
Amount of leveraged funding	£3.25m	£8.29m	
Number of people employed by Competence Centre (Admin)	1.5	3	
No. licence agreements issued	7	1	
No. of spin outs	2	0	
Activity indicators	**Initial 5-year target**	**End of phase result**	**Assessment**
No. of MOUs at national or international level	1	1	
Number of academic publications	16	17	
Number of Participating Organisations	Max. 24 per annum	62 (total)	
Number of research projects funded	Minimum 20	23	

Source: CASE Phase I Closeout Report

Phase II

The suite of KPIs reported on for Phase II were cognisant of the lessons learned in Phase I, particularly regarding commercialisation. Some of the key changes that occurred included:

- Transition from tracking the number of projects to tracking funds distributed.
  It was felt that the impact of the research could not be adequately measured simply by number of projects; for example, consultees commented on the potential for one strategically important 'large' project to exert a greater impact than several smaller-scale ones. Therefore, this KPI was reviewed to remove the potential for skewed motivations that do not necessarily correlate with (or even reduce) impact.
- Tracking the number of spin-outs was broadened in Phase II, to determine the number of new businesses created as a results of CASE I & II.
  It was felt that the securing of patents wasn't feasible within the lifetime of CASE, nor reflective of actual activity occurring within the centre. This was replaced in Phase II by invention disclosure forms; if projects identify potential protectable IP, the first stage in this process is submitting an invention disclosure form. This is indicative of the pipeline of IP; the most recent quarterly report shows that 3 such forms had been submitted, which is broadly in line with the target of 4.

Consultees reported positively on the improved relevance of these indicators, particularly regarding commercialisation. It aligned closely with the recruitment of a commercial/prospects management, alongside the enhanced connections with the broader QUB commercialisation team. It also reflected the renewed focus on policy and strategic projects within CASE, which is not reflected in an absolute number of projects being carried out.

Figure 5-3: CASE Phase II performance against KPIs

Performance Indicators	End of year 3 target	End of year 3 result	Assessment
Industry cash contribution (membership income)	£49,500	£48,767 (invoiced) £38,867(paid)	Staff are pursuing unpaid, invoiced payments. CASE is

Performance Indicators	End of year 3 target	End of year 3 result	Assessment
			on track to exceed year 4 target
Industry cash contribution (project income)	£149,250	£129,638 (invoiced) £121,313 (paid)	Staff are pursuing unpaid, invoiced payments. Target based on projections. Consortium and project composition have reduced project contributions; to be offset by increased membership income.
Overall industry in-kind contribution as % of research project costs	25%	18.5%	Delayed reporting of KPIs by participants; increased engagement with them is improving reporting.
Share of in-kind contribution from Industry staff costs	50%	73%	
Amount of leveraged funding	£1.75m	£6.29m	Thus far exceeding target by 260%
Number of REF CASE Studies prepared	1	0	Information was submitted in support of REF return, but was not selected. No impact on operation of centre.
Number of new Invention Disclosure Forms (IDFs)	3	4	
Activity indicators			
Number of academic publications	10	11	
Number of members (of which international)	90 (5)	90 (6)	
INI research funding allocation	£2.87m	Allocation: £2.99m Drawdown: £1.79m	

Source: Q2.13 CASE Centre Report

Additional commercialisation KPIs

CASE Management agreed with Invest NI to gather information in support of the assessment of the Additional Commercialisation KPIs listed in table 5-4. This information to determine the achievement or otherwise of these KPIs was gathered in two different ways (by CASE management):

1. Survey of participating organisations.

2. Engagement with the universities' commercialisation teams.

The results are summarised below and reflect that none of the commercialisation targets were achieved in so far as it was possible to tell from a survey that achieved a response rate of 14%.

Table 5-4: CASE Phase II Commercialisation KPIs

Performance Indicators	Target	Result	Assessment
New businesses created/Companies registered as a results of CASE I & II	3	2	
Companies adapting products/processes	20	8	
Companies developing new products/processes	8	6	
Project participants reporting improved skills transfer (cumulative)	50%	Of Survey respondents: 75% Of Participants: 11%	
New jobs (CASE and Companies) created as a result of CASE I & II	22	4	
Increase in BERD of at least 3.5% by CASE project participants (cumulative)	40%	Of Survey respondents: 42% Of Participants: 6%	
Project participants demonstrating increase in sales (5% local and/or 2% external) (cumulative)	20%	Of Survey respondents: 17% Of Participants: 2%	
IDFs converted to Patents (including Case Phase 1)	3	0	

Source: CASE Additional Commercialisation KPIs report May 2023

5.3.2 Budgetary considerations

Phase I

Both phases of CASE were funded through two separate budgets – a budget for centre management (core funding) and a research budget to support research labour, overheads, consumables and travel (research funding). The allocations and claimed totals are shown in Table 5-4. Industry was to contribute both in-kind and cash contributions, offering at least 25% in cash to core centre running costs and 25% in-kind to total research project costs.

The total grant paid was below that budgeted for, whilst total expenditure was slightly above projections. £63,804 of the grant funds requested from Invest NI were disallowed (due to ineligibility), with most of this relating to the research strand. The shortfall was met by QUB with contributions from CASE over performance in securing leveraged funding.

In Phase I, there was no membership fee but rather only a project participation fee, tied to a percentage fee based on share of participation and project value. Consultees made the following comments relating to industry contributions:

- CASE core staff carried out a significant amount of strategic, business development support for participant companies, such as funding applications and assistance with business plans. This was essentially unpaid work, as there was no membership fee contributed by these companies, nor any consultancy hours charged.
- The project participation fee was based on a complex calculation, which reduced transparency for centre stakeholders, including prospective participant companies.

Table 5-5-1: CASE Phase I budgetary breakdown – Core Funding

	Original Budget	Final Budget after virements	Total Expenditure	Claim totals (@75%)
Salary Costs	£404,811	£554,149	£558,050	
Consumables	£25,000	£17,500	£15,521	
Travel & Accommodation	£37,500	£36,000	£35,400	
Marketing & Promotion	£27,500	£30,000	£22,227	
Consultancy	£46,500	£55,853	£52,383	
Total	**£541,311**	**£693,502**	**£683,580**	**£512,685**
(Cash In)				(£158,379)

Source: Invest NI, CASE Phase I Closeout Report

Table 5-6-2: CASE Phase I budgetary breakdown – Research Funding

	Original Budget	Final Budget after virements	Claim totals
Labour Costs	£2,696,815	£2,391,680	£2,339,609
Overheads	£1,240,535	£1,100,173	£1,017,669
Consumables	£200,000	£396,005	£428,797
Instruments & Equipment	£50,000	£191,004	£196,908
Travel & Accommodation	£50,000	£49,002	£145,915
Subcontracting	£232,667	£230,004	£143,662
IPR	£68,000	£67,003	£0
Consultancy	£56,000	£55,003	£19,170
Total	**£4,594,017**	**£4,479,874**	**£4,291,729**

Source: Invest NI, CASE Phase I Closeout Report

Phase II

The budgetary arrangements for CASE operations were reviewed prior to commencement of Phase II to remedy identified areas for improvement. This included the following changes:

- The introduction of membership and an associated annual fee of £550 was introduced, uniform across all company sizes. This followed a detailed options analysis that

considered a range of options, including a tiered membership fee, as well as a reduced fee to pre-existing participants. A 'mixed model', involving both membership fees and project cash contributions was decided on.

- The project cash contribution structure was simplified and amended to increase transparency.

The evaluator feels that the introduction of an annual membership charge was a positive development; the four-year target for this was set at £66,000 and CASE is on track set to exceed this. It incentivises commitment and participation from companies, who attach a value given the payment made. It also reflects (albeit in a small way) the value of extra-project strategic and business development work undertaken by CASE for companies; in phase I, this time intensive, value-add work had been carried out for free by CASE staff. Thought could be given to an increased fee being levied, or one aligned to number of consultancy hours drawn down by the member. It could also be aligned to company size and location, with increased fees levied on non-NI members.

Another notable difference in the phase II budget from the salary allocation for core staff, which reflects the additional personnel recruited. This total budget increased from £558k to £720k, representing a 29% increase, or 61% if considered on a per-annum basis.[38]

Table 5-7: CASE Phase II budgetary breakdown

Element	Phase (II)
Total grant paid (offered)	£2,248,504 (£3,618,284)
Total expenditure incurred, excl. IKC, at December 2022 (projected) [39]	2,402,617[40]
Of which:	
Core staff	£504,320
Other core costs	£112,133
Research staff	£1,058,355
Research overheads	£486,843
Other research costs	£240,966
Industry cash contributions paid (invoiced)	£160,180 (178,405)
Industry cash contributions (projected)	(£215,250)
Invest NI funding	
Core grant paid	*£462,340*
Research grant paid	*£1,786,164*
Grant disallowed	*xx*

Source: Invest NI

5.3.3 Research activity

Research strategy

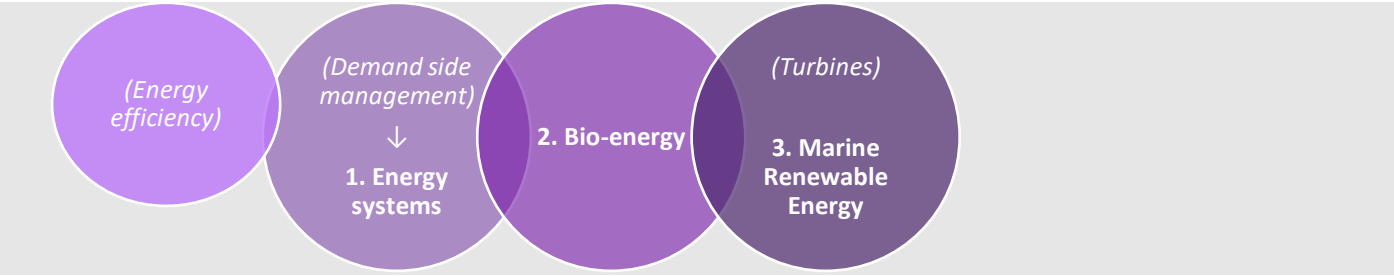
The research prioritisation process for CASE followed several stages during the course of Phase I, as evidenced by steering group meetings, feedback implementation and the Phase II Business Plan. The

[38] Based on Phase I having a five year duration, whilst Phase II achieved business case approval for a four year duration.

[39] Excludes in-kind contributions. Includes total expenditure, with Invest NI funding representing 75% of 'core' funding and 100% of research funding.

[40] Q2.13 Case Centre Report

original business plan for Phase I highlighted four core research areas: energy efficiency; demand side management; bio-energy, and turbines. Following feedback from Invest NI, these four areas were refined to adopt a narrower focus; energy efficiency was removed, with demand side management being narrowed to 'energy systems'. Through a Technologia facilitated workshop, the steering group further refreshed and refined the core research priorities for 2019-2021, with turbines becoming Marine Renewable Energy.



The evaluation team is satisfied that an iterative process was followed, encompassing a range of CASE stakeholders, to ensure that the research priorities were relevant to industry and policy priorities throughout phase I. The assignment of a research cluster, and representation of this cluster in the Steering Group, was a positive action. However, more evidence is required relating to how this translated to project funding prioritisation and whether it contained a balance of academic and research interests.

Evolution to Phase II

The Phase II Business Plan reiterated the 2019-2021 strategic priorities outlined above. It also committed to an annual review of the Research Strategy, to ensure alignment with industry, academic and policy needs, as well as focussing on the areas of most benefit. The evaluators did not see an updated research strategy that difference from the Phase II business plan. That is not to say, however, that it become less relevant during the course of Phase II to date; it is noted that much of CASE's activities inform strategy and policy, rather than vice versa, given its trusted voice role in the marketplace. Therefore, it is informed in real time of emerging areas and policy developments. CASE should also consider seeking, or continue to be cognisant of, feedback from external stakeholders (including international benchmarks and partners) on its strategic priorities.

The consultation and survey process showed that it was not always clear how the Research Strategy and project awards are aligned, despite the governance procedures in place to ensure this (e.g. the representation of research clusters on the Steering Group and the Industry Advisory Board). The consultation process revealed some dissatisfaction with a perceived lack of transparency in the project award process, or lack of feedback to unsuccessful applicants. Stakeholders acknowledged scope for significant improvement in this area, with a formal Process Review Report being conducted in February 2023. This consisted of an external expert conducting a review of CASE governance and processes, with the objective of improving clarity and transparency. CASE arranged this of its own prerogative, which is a positive reflection of its attitude towards constructive feedback, particularly as it rolls off its Invest NI funding phase.

The recommendations from this will be implemented insofar as possible, but funding constraints impact the time available and as such the extent to which they can be actioned, e.g. the depth and turnaround time for individual feedback. Centre management expressed the desire for regular annual reviews and ongoing engagement with stakeholders to achieve this continual improvement.

5.3.4 Marketing and Recruitment

Phase I

CASE attracted a buoyant recruitment base, which was dominated by SMEs (80% vs the programme average of 72%), second only to CHIC. The mix of company demographics in the centre facilitated significant knowledge transfer between consortium partners. There was also a higher than average

representation of non-client companies and non-NI companies. This demonstrates the broad reach of CASE in the sustainable energy space, both in NI and abroad, with economic impact of Invest NI support being successfully transmitted to companies traditionally outside their reach (particularly high potential SMEs).

Table 5-8: CASE phase I activity and recruitment

Participant demographics	Share	CCP total
SMEs	80%	72%
Large companies	20%	28%
Invest NI client companies	26%	43%
Share NI companies	76%	82%
Share non-NI companies	24%	18%

Source: CASE quarterly tracking data; Invest NI data; Grant Thornton analysis

Phase II

When the current Centre Manager initiated participation in Phase II, the need and potential for a refreshed communications strategy was recognised. Subsequently, an external communications company – Lanyon – was hired to assist with social media channels, particularly LinkedIn[41] as well as the dedicated website.[42] The newly created position of commercialisation manager also assisted in these efforts, via strengthening awareness of CASE within the host institution QUB and cross-departmental relationships.

Internally, the connections and expertise of the Steering Group within the respective industrial fields raised significant awareness of, and respect for, CASE in the marketplace. The importance of word of mouth, in-person visits and organic relationship building was stressed, particularly for the recruitment and retention of smaller firms. This reputational value has increased across the ten-year lifespan of CASE to date, with consultees and policy stakeholders feeling that the centre has become a prime 'trusted voice' in areas relating to sustainable energy.

Tracking data shows an additional 7 companies in Phase II of CASE who were not involved prior in Phase I. Of these, none were Invest NI clients, and five were also non-NI, being based in Ireland, England, Switzerland and Netherlands. As none of these are Invest NI clients, no data was available on size or product sector.

This displays the importance of formulating a data collection and KPI strategy from the outset; making this a pre-condition of CCP participation would ensure compliance. This would help to ascertain the impact that Invest NI funds are having, particularly in the context of a large weighting of non-NI companies, to ensure that economic benefit is being obtained for NI public money. This could be via various avenues, such as exporting opportunities, trading relationships and knowledge sharing being secured via the consortium arrangements between NI and non-NI companies. Tracking this should be prioritised by Competence Centre and Invest NI personnel.

5.4 Perspectives on CASE

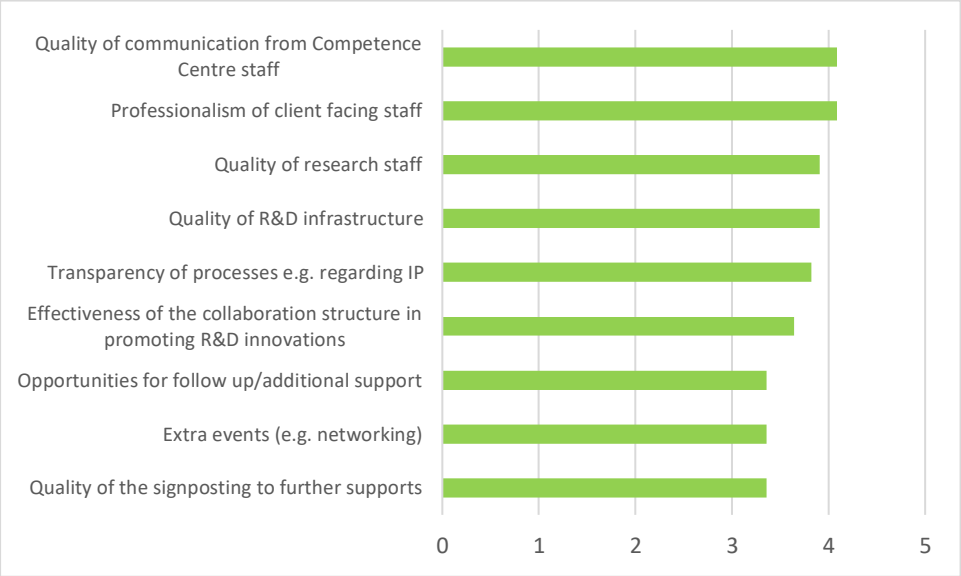
[41] https://www.linkedin.com/company/centre-for-advanced-sustainable-energy-case/

[42] https://www.case-research.net/

5.4.1 Satisfaction with the programme elements

All of the programme elements received a positive (>3.0) satisfaction rating from survey respondents across both phases, with the core and research staff receiving particularly positive reviews. This compares favourably to the other centres being evaluated. This translated to almost all respondents saying they would recommend CASE participation to other companies (with only one saying it was too early to judge)[43], and an average Value for Money (VfM) score of 5 out of 7.

Figure 5-9: Reported levels of satisfaction with programme elements (average satisfaction levels)



Source: Grant Thornton analysis (n=11)
Green indicates a score of >3.0 (i.e., satisfaction with the respective element)
Note: The scale used throughout 'opinion questions' is 1= Very Dissatisfied, 2=Dissatisfied, 3=Neutral, 4=Satisfied, 5=Very Satisfied

Phase II

As detailed, several stakeholders (include those involved in centre management) spoke to the need for increased transparency in the project award and feedback process. This level of self-awareness and preparedness to implement the findings of the February 2023 Process Review is a positive indication of the future potential of CASE in this area.

Industry stakeholders involved in the consultation process reported positively on their experience with CASE involvement, with instances of members being involved in as many as 6+ projects. Much of the work was felt to be of strategic importance not only for the company, but rather for the renewables landscape in NI more broadly. Strong satisfaction was expressed on the connections formed between industry and the forum CASE provided for this, as well as providing access to academia and research acumen. The consensus was that, whilst resources may be available in-house (in the larger members) to fund such research, access to such academic expertise to raise the theoretical quality of this research was not, in lieu of CASE.

[43] Ten responded 'yes', one responded 'too early to judge', whilst others skipped this question in the survey.

5.4.2 Outcomes and benefits

An average time lag of 4.3 years to realise R&D benefits in the sustainable energy field was cited by respondents, with a range of between one and 12 years. Overall, participants spoke positively about the additionality of research undertaken. Key reasons given include:

- The lack of awareness of, and connections with, academia prior to participating in the competence centre
- The low base level of innovation in this field when CASE commenced operations in 2013
- The 'step change' brought about by the strategic work of CASE in sustainable energy has increased the international profile of Northern Ireland in this space. This has increased awareness for domestic entrepreneurs and businesses to undertake sustainable innovations, as well as FDI that would otherwise not have occurred in lieu of CASE's contributions.

The top five most frequently cited benefits among survey respondents were as follows (in increasing frequency), with knowledge transfer being the most common.

- Increased access to talent (33% of respondents)
- Development of new (or enhancement of existing) products and services (33% of respondents)
- Benefits from academic perspective/input (39% of respondents)
- Development & testing of prototypes (39% of respondents)
- Knowledge transfer (50% of respondents)

The interim evaluation reported impact additionality of 68% and activity additionality of 47%, which suggested that a share of the R&D undertaken in the centre would have occurred in lieu of CASE participation. However, activity additionality in this evaluation was assessed as being 68%, which was the highest of the centres, on the basis of survey responses; this finding was further supported by the consultations. This suggests that the reviews actioned both during Phase I following the Action Plan, and prior to embarking on Phase II, refined the impact and efficiency of CASE.

A key benefit of CASE that cannot be understated is its contribution to the policy and strategy landscape for renewables and sustainable energy in NI. Consultees reported that much of the awareness and profile-raising work undertaken by CASE benefitted their business by marketing NI's potential to investors and international partners. CASE regularly responds to consultations and policy work, with stakeholders citing a starting point of a lack of carbon literacy and low awareness of sustainability benefits at all levels in industry. In this way, and owing significantly to its successful Phase I and 'time in the marketplace', CASE has become a 'trusted voice' in its respective field in NI. This has also boosted CASE's recruitment and membership figures, as well as providing a strong basis for funding applications.

Case study of the strategic and profile-raising role of CASE

Testament to the important and growing strategic and networking role of CASE was its hosting of the **inaugural Northern Ireland Energy Summit** in June 2023.

This signalled the congregation of international experts and policy stakeholders in Belfast to discuss key challenges of commercial and socioeconomic relevance in the renewables space, including senior officials from the US government, the head of the NI Civil Service, the Chairman of the European Innovation Council, and Scotland's Director of Energy Climate Change.

The conference served as a forum for reviewing and building on progress towards NI's policy aspirations in the renewables space, with marketing material stating that its objectives were to build *'…an informed consensus on how best to take Northern Ireland forward in meeting its renewable energy targets and net-zero ambitions, whilst driving 10X economic growth across innovation, sustainability and inclusion.'*

This conference also played an important role in generated positive awareness and PR for NI's renewables industry. The CASE Director stated "*The aim of this important event is to showcase the*

Case study of the strategic and profile-raising role of CASE
potential which Northern Ireland has to lead the world in energy transformation, creating economic growth opportunities in net zero technologies, helping to make society healthier and more prosperous."[44]

The strategic significance of CASE's work and its role as a 'trusted voice' for industry was clear to the evaluator throughout the primary engagement process. However, capacity constraints limit the extent to which this work can be carried out. Furthermore, this work is not accounted for in KPIs nor in any quantifiable way currently. This is despite the strategic significance of sustainability and net-zero targets for all sectors in the economy becoming increasingly clear. This wider contribution of CASE and the policy voice it has assumed should be reflected on by policymakers and funding stakeholders. This may lead to the remit of CASE being redefined (for example, additional strategic/policy strands to supplement the current innovative R&D work).

Other key outcomes and benefits of CASE involvement for participants included the centre's role is assisting participants to raise private equity and achieve business development goals; although not able to be independently verified, one member cited having raised £30m in private equity and attributing this to involvement in the centre. Also noteworthy is the role of CASE is making international connections and promoting awareness of NI's potential as a renewables test bed to FDI investors. These, combined with CASE's role in raising public awareness of environmental issues (and solutions) are not accounted for in any formal reporting nor in reports of economic impact, given the difficulty in robustly monetising/attributing them.

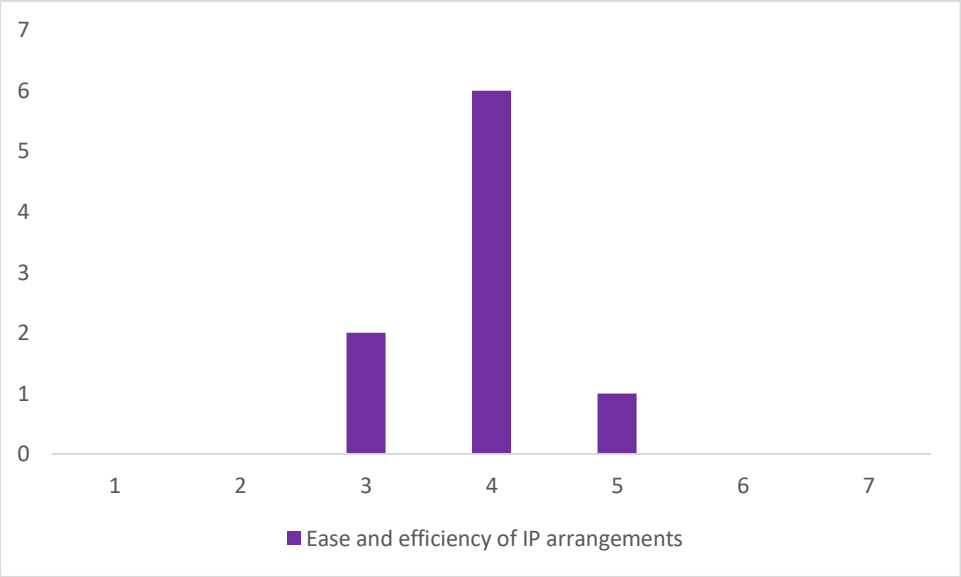
5.4.3 Commercialisation arrangements

On a scale from one to seven, respondents were neutral regarding the ease and efficiency of the commercialisation arrangements. From consultations, an underlying reason for this may be that IP was not actively pursued by, or a key objective of, the majority of participants. Rather, research was undertaken in the spirit of knowledge transfer and shared advancement. Four-fifths of respondents did not licence, or did not intend to licence, IP from CASE; therefore, this neutral response may more reflective of lack of insight/motivation, rather than relatively more efficient IP processes, given that CASE faced the same constraints as the other competence centres.

Suggestions were requested on how to tailor the commercialisation process within CASE to maximise impact. Several respondents felt IP residing with QUB acts as a disincentive for industry partners to pursue commercially beneficial research, with innovative sectors such as IT being highlighted; however, it was also acknowledged that the issue is a difficult one to overcome, given the constraints faced. Another respondent felt that there is too heavy a focus placed on the publication of academic journals (research interests) rather than the production of IP and filing of patents (commercial interests).

[44] https://www.case-research.net/global-experts-to-gather-in-belfast-for-ni-energy-summit/

How would you rate the IP ownership and licensing arrangements within the Competence Centre Programme?
1 = very difficult and complicated, 4 = neither easy nor difficult, 7 = very easy and efficient



Source: CASE respondents, Grant Thornton analysis, n = 9

Evolution to phase II

Respondents who had participated in both phases I and II of CASE were asked to comment on any notable changes had been made to commercialisation arrangements between the two stages. From the small sample of respondents who had exposure to both phases, the majority felt that there had not been any significant changes. This may be owing to the constraints placed on centre managers, staff and member companies by the State Aid rules regarding public funding, meaning that any IP generated rests with the research institute that has undertaken the research (QUB/UU/AFBI). Regarding the potential financial results of commercialisation efforts, two respondents indicated that the commercialisation process is ongoing; one expressed their view that significant income would be generated over the next five to ten years as a result of said license.

The interim evaluation action plan recommended a structured education/training for both staff and participant companies to demystify the IP identification, management and licensing processes. This was addressed in several ways, including the following actions:

- The QUB IP manager ran a commercial awareness training session with the CASE Steering Group
- Reviewed project funding application form to highlight the commercial potential of the proposal. Companies then engaged post-award with representatives from the QUB and UU commercialisation team to raise awareness of the IP processes in the centre and routes to obtaining licencing rights
- Ensuring that this supportive network in place for participating consortium partners, with this monitored on a quarterly basis and relevant introductions made

It is the evaluator's view that CASE operates well within the difficult commercialisation/IP constraints faced by state aid funding rules. However, a tiered membership offer (such as that offered by the Catapult Network) could provide companies with more flexibility regarding IP ownership. Improved awareness among participant companies could also address the attitude expressed by several respondents that companies ought to have the first right of refusal of IP rights; choice regarding tiered membership options, and in particular factoring this into membership agreements, could make companies feel more in control and empowered through this process. Invest NI have clarified that companies that are engaged in a project (and sign the collaboration agreement) are given first right of

refusal to license and resultant IP. If these companies don't utilise that option, it is opened to all CASE industry members. As a final option the research institute may license outside of the CASE membership. That consultations raised a significant misunderstanding in this regard is concerning about the level to which IP was explained/understood.

5.4.4 Key changes

Throughout the primary engagement phase, participants were asked to comment on notable changes between phases I and II of CASE. These are considered here, in addition to preceding comments on how KPI reporting, staffing and commercialisation arrangements differed.

Some observations made included:

- Stronger outreach efforts to both industry and academia
- More rigour and focus on the application vetting and selection process and phase II progressed, with increased focus placed on industry involvement and steer in the process.
- The length of projects was shortened, providing a variety between longer, strategic projects and shorter, postdoctoral-style ones. One respondent reported positive on this enabling industrial partner companies to make decisions on investment and strategy sooner, which it felt was required in light of the fast-paced nature of renewables.
- An increased focus on long-term sustainability of CASE, particularly as it neared the end of its Invest NI funding. This led to diversification and an attempt to raise the profile of CASE via strategic contributions to renewables.
- The Steering Group skillset and breadth was expanded to more adequately cover the bases of research specialisms, particularly when assessing projects.

5.4.5 Challenges and lessons learned

Across the primary engagement undertaken, participants felt that several lessons could be taken from Phases II of CASE to build upon changes that had been made prior to maturing from Phase I, or that hadn't been considered to date. They are as follows:

Table 5-10: Challenges, lessons learned and recommendations, CASE

Element	Explanation	Solution
There is an associated 'time in market' value that increases according to the length of operations and track record of impact.	CASE has become a trusted voice for industry and a representation of NI's sustainable energy industry for international stakeholders. This has increased the reach, impact and influence of CASE. The tangible value of this should be recognised by stakeholders such as Invest NI, with the legacy impact adding to the potential ROI of the centre. This is also applicable to the other centres within the CCP.	Seek to support CASE, its governance and management in retaining and growing the influence it exerts in the marketplace and policy landscape. The contribution CASE has made has been in many ways a product of its established reputation. A stepped approach to setting targets and performance objectives, with the knowledge that impact increases according to time in marketplace, should be retained for future projects and programmes. In hindsight, if this approach had been factored into phase I across the centres, targets relating to e.g. patents would not have been included (given the time required for set up and awareness raising, for example).
The creation and protection of IP has proved difficult across both phases, albeit improved by actions taken in phase II.	The IP arrangements were somewhat unclear in phase I, particularly given the consortium approach. It was also felt that the target TRLs of 4 to 7 were still fairly far	The recruitment of a commercialisation manager and the transition away from Invest NI funding has given CASE more autonomy in its approach to IP generation and commercialisation. For example, it

Element	Explanation	Solution
	from market and as such, didn't tend to translate to commercial outcomes. Overall, the focus on IP translated to a focus tech and monetary outcomes, rather than socioeconomic benefit.	now has the freedom to target TRL 8 and 9. It has also formed links with management schools, creating more focus on cost-benefit analysis and returns to monetisable, non-quantifiable benefits etc in the initial business plans for projects. This approach is reflective of common practice in Green Book appraisals. Were this approach factored into phase I, a more comprehensive assessment of the socioeconomic contribution of CASE activities could have been made.
There was a disproportionate focus on economic output in KPIs as opposed to research, innovation and policy alignment.	This created an under recognition of strategic contribution of CASE work and business development efforts	Key outcomes and benefits of CASE for included the centre's role is assisting participants to raise private equity and achieve business development goals, as well as its role in raising NI's profile in the renewable energy space and attracting FDI investment. These, combined with CASE's role in raising public awareness of environmental issues (and solutions) are not accounted for in any formal reporting nor in reports of economic impact. The formation of a LOGIC model, and in particular an outputs and outcomes register, could monitor CASE performance and contribution in a way that more aptly reflects its contribution to society.
Limited tracking data, particularly relating to non-NI and non-Invest NI clients, made assessment of economic impact very challenging.	Given that non-client and non-NI companies had a particularly high representation in CASE, this lack of data was more acutely felt than for some other centres.	This displays the importance of formulating a data collection and KPI strategy from the outset; monitoring and evaluation requirements should feature in conditions for support. This would help to ascertain the impact that Invest NI funds are having, particularly in the context of a large weighting of non-NI companies, to ensure that economic benefit is being obtained for NI public money. This could be via various avenues, such as exporting opportunities, trading relationships and knowledge sharing being secured via the consortium arrangements between NI and non-NI companies. Tracking this should be prioritised.
Transparency and efficiency of processes, particularly funding awards, could be improved	Consultations revealed a desire for more transparency on who is funded, as well as feedback for unsuccessful applicants to enable them to improve. All stakeholders acknowledged that there was significant scope for improvement in this area. Time and resource constraints were cited as	Ensure the recommendations of the February 2023 Process Review are actioned, with an Implementation Report/Action Log advisable by the end of 2023. Initial recommendations from the evaluator include: • Ensuring that timely feedback and rationale is given for decisions relating to funding awards; in turn this could elevate the quality of business plans received. This could be in a template

Element	Explanation	Solution
	contributing to this issue, with many applications being assessed in the same day/session with limited time for discussion/Q&A.	format accompanied by a 15-30 minute feedback call to reduce time required and to provide a uniform style of feedback that complies with key areas. • Given that implementation of this review may require even more time of board members who tend to be unpaid, consideration should be given to increasing a stipend/grant and/or introducing paid 'consultancy' days to facilitate elements such as provision of feedback • Improving transparency of the process might also improve the relevance and quality of applications • Consider the introduction of external experts operating at arm's length to assess applications. These could include professionals such as lawyers, equity funders, angel investors and economists, who could judge the financial and socioeconomic merits and potential of proposals, as well as better avoiding the potential/perceived conflicts of interest which may result from industry's dual role in applications and assessments of same.
The project by project recruitment of researchers at times led to delays and a misalignment of experience and skills	There was a variance in quality of academics based on the research project being proposed. The host institution being QUB may also have caused an unintentional skew towards the volume of applicants from QUB academics, leading to a lower representation from the University of Ulster and, as such, a small breadth of specialisms.	Renewed consideration of a 'core' researcher basis, or pool of post-doctoral research personnel, rather than project by project recruitment. This would require discussions with QUB personnel regarding navigation of their recruitment processes and cost centre allocations. It is also possible that ad hoc project-by-project recruitment may still be required, should certain skillsets be lacking, depending on project requirements.

Source: Grant Thornton analysis of primary engagement

5.4.6 Economic Impact Return on Investment & Value for Money (VfM)

Much of the benefits of CASE activities are not largely quantifiable in nature, as outlined in sections 5.4.2 and 5.4.5. In addition, a potential economic impact based on Invest NI tracking data was particularly challenging, given the lack of data on non-client companies, which were overrepresented in CASE. No consideration is given to future benefits, rather the analysis is undertaken on 'pre' and 'post' programme. Therefore it is anticipated that further benefits will be realised over the longer term, with costs having been fully realised.

An initial consideration of this impact shows a significant contribution in terms of additional GVA, assessed as being £7.9m across both phases of CASE operations (as of December 2022), with £1.46m in additional BERD having been generated. This translates to an ROI of 0.1 and a BERD

growth from 2017 of 19.0%. Given the strategic contribution of CASE to the emerging renewables landscape in NI, alongside its role as a 'trusted voice' for industry, this impact is likely to grow (with a similarly elevated ROI) over the medium to longer term.

Table 5-11: CASE economic impact

	CASE	
Impact variable	Results	
GVA impact		
Additional turnover, net	£	23,674,132
Economic impact (GVA), net	£	7,920,049
BCR		1.1
ROI		0.1
BERD impact		
BERD activity generated, net	£	1,464,775
BERD growth (%)		19.0%

Source: Invest NI monitoring data, Grant Thornton analysis, NISRA

5.4.7 Equality Considerations

The evaluation team's review of CASE and its activities indicates that centre participation is available to any Northern Ireland small, medium or large company with appropriate innovation ambitions and relevant proposals. Overseas owned/based companies are also eligible to come participants/members, where it can be demonstrated they will strengthen the consortium and bring technical/economic benefits to Northern Ireland and/or support the internationalisation of the Competence Centre. As such, it is the Evaluation Team's assessment that the CASE Centre complies with all elements of equality promotion set out in Section 75 of the Northern Ireland Act 1998 and by Invest NI in their Equality Scheme

5.4.8 CASE Economy, Efficiency & Effectiveness

Phase I

In considering the economy, efficiency and effectiveness of the first phase of CASE, the following points were noted:

Table 5-12: Economy, Efficiency & Effectiveness Analysis (CASE phase I)

Measure	Analysis
Economy The Economy measure is concerned with measuring the impact of the programme at an appropriate level of input i.e. impacts have been obtained at the best VfM	The overall CCP, and CASE individually, was subject to an economic appraisal, business plan and robust internal casework process. It was also subjected to a detailed interim review with an international advisory panel. These foundations were used by Invest NI to assess best practice and operational efficiency in terms of delivery, as well as helping to understand the potential outcomes being generated, challenges faced and how to better bring about impact and therefore VfM for NI. This represents a high level of scrutiny and stakeholder input, whilst allowing for operational autonomy. The interim evaluation action plan helped CASE stakeholders optimise VfM within phase I (allowing for constraints

	of delivery and funding regulations governing this phase), setting in place further changes for phase II (on the basis of which funding was awarded). CASE used its own internal procurement processes throughout its operational period, given the arms' length nature at which Invest NI operated. The guidelines for this were provided in the Letter of Offer at project outset. CASE participation required both cash and in-kind contributions from companies. This both reduced Invest NI's outlay, as well as incentivising commitment from companies. By CASE I close out, company contributions totalled £158k, covering only 65.8% of target. In-kind contributions represented 23.3% of project costs; this was roughly in line with the 25% target set. The economic impact that has been calculated suggests a potential economic return of £0.1 for every £1 of Invest NI funding of CASE I. This represents BCR of 1.1.[45] Furthermore, and reflecting some impact of the significant strategic work undertaken by CASE, the centre generated a potential additional £1.46m of R&D. This represents a 19% increase in BERD from baseline figures.[46]
Efficiency The Efficiency measure looks at measuring the impacts relative to the level of inputs i.e. has the maximum level of output been achieved for a reasonable level of input	A total of 62 companies participated in CASE I, carrying out 23 projects during the operational phase. This compares favourably with the annual target of 24 companies. The cost to Invest NI per business was £80k. The potential ROI was calculated as being 0.1. Though the ROI is marginal, it is still positive and, given the conservative nature of the modelling and data constraints, it is likely that this return will increase over the medium to long term.
Effectiveness The Effectiveness measure is concerned with understanding the level of impact the programme has achieved relative to aims, objectives, etc.	The primary engagement undertaken revealed strong consensus for both commercial and strategic impacts from CASE I. Strategic impact encompassed both policy engagement and demonstration of Northern Ireland's potential for FDI in the areas of renewables. Commercial impact encompassed both outcomes from collaborative projects/research undertaken, as well as commercial/consulting assistance offered to companies. The raised profile of NI as an area of growing potential in this area also played a pivotal role in securing external funding and in making international connections possible. These are not readily monetised in an economic impact assessment based on a limited sample size. Two-thirds of companies surveyed indicated that, in lieu of CASE participation, they would have either ceased, delayed and/or decreased the amount of R&D&I activity undertaken. Substitution, leakage and additionality has been factored into the calculations of return, as detailed above.

Phase II

In considering the economy, efficiency and effectiveness to date of CASE phase II and in light of the limited quantitative data available, the following points were noted. Note that several of the insights detailed in Table 5-9 are also applicable to CASE Phase II.

[45] Note that this potential impact has been calculated on the basis of the 2017-2021 sample data and factors in both phase I and phase II expenditure. It can be interpreted as the cumulative potential impact of the centre to date.
[46] Baseline figures are taken from 2017. It is likely, given that CASE commenced operations in 2013, that the overall increase is materially larger than this.

Table 5-13: Economy, Efficiency & Effectiveness Analysis (CASE phase II)

Measure	Analysis
Economy The Economy measure is concerned with measuring the impact of the programme at an appropriate level of input i.e. impacts have been obtained at the best VfM	CASE phase II was approved on this basis of a detailed business plan, which actioned material recommendations made in the interim evaluation. Key adjustments included the introduction of a membership fee, to better reflect the additional strategic work undertaken by CASE. The interim evaluation action plan, as well as the refreshed delivery and research strategy for phase II, has built on the marginal VfM and significant BERD generation established in CASE I. Individual data was not available to calculate a potential ROI for phase II of CASE specifically. However, the phase I analysis and literature review conducted, demonstrated a positive contribution and VfM, both in terms of GVA and BERD incentivised. CASE's strategic contribution to the NI renewable landscape is non-monetisable, but should be considered when analysis its VfM and market gap. By the end of year 3, cash contributions from companies totalled £198,750 (£49,500 from membership fees and £149,250 from project cash contributions). This fee structure permits shortfalls in project cash contributions (due to consortium composition and the presence of strategic projects) to be offset by higher income from membership fees, a revenue stream that was missing from phase I.
Efficiency The Efficiency measure looks at measuring the impacts relative to the level of inputs i.e. has the maximum level of output been achieved for a reasonable level of input	A total of 40 companies have participated in CASE II to date, including 35 'new' companies who did not participate in phase I. They carried out 14 projects per the most recent data, though this has been removed as a KPI for phase II, being replaced with Invest NI research funding allocation. The allocation of funds by end of Year 3 totalled £2.99m, exceeding the target of £2.87m. This is indicative of a buoyant pipeline of research activity. The cost to Invest NI per business in phase II was £56k to date. The centre has, according to the most recent data, exceeded its target of leveraged funding by 260%, totalling £6.29 by the end of year 3, vs the target of £1.75m. This funding includes £4.5m awarded through DfE's Green Innovation Challenge Fund pilot.
Effectiveness The Effectiveness measure is concerned with understanding the level of impact the programme has achieved relative to aims, objectives, etc.	CASE has since proved its integral part of the sustainable emerging landscape in Northern Ireland, increasingly assuming this 'trusted voice' role in Phase II. The hosting of the inaugural Northern Ireland Energy Summit in June 2023 illustrates this. In addition, several operational changes were made to elevate the established (marginal) return from Phase I, including alignment with industry, improved marketing and communications, and the recruitment of a commercialisation manager.

5.4.9 Considering the future of CASE

Regarding the future of CASE, there is significant optimism regarding its potential, as well as on funding already leveraged, such as through the DfE Green Innovation Challenge Fund, representing £4.5m of funding.[47] Given the growing focus on attainment of net zero targets, and following the establishment of the Net Zero Ministry in the UK, these opportunities look set to increase significantly.

[47] https://www.case-research.net/launch-of-green-innovation-challenge-fund-case-call-for-projects/

Within Northern Ireland, the City Deals initiatives provide local opportunities for CASE to leverage its established reputation and stakeholder base. This includes, but is not limited to, the Belfast Region City Deals, e.g. the AMIC Centre. Other regional city deals present further opportunities, with discussions currently ongoing between CASE and a number of local councils.

Emerging competitive funding opportunities, particularly relating to Island of Ireland based initiatives as well as EU/UK Government funding, are also relevant for CASE[48] and present further avenues for diversified funding and collaboration. These include:

- The Shared island Fund
- The SFI Co-fund: a specific call for applicants under the 'Climate' theme has been made, which presents significant potential for current and new CASE projects, including soil and biodiversity strands.[49] Particular areas of focus within this call are: the role of agriculture, land use, land use change and forestry; sustainable communities, rural and coastal settings; carbon-neutral industries; greenhouse gas removes, and improving water quality
- The continuation of EU horizon funding

CASE also has the potential to leverage funding from private industry, including from FDI investors. NI has an increasing rate of renewables penetration per head within a limited land area; consultees from industry felt that these characteristics make NI an attractive test bed for international companies operating in the sustainable energy space. Current projects with international collaborators include US multinationals. On the balance of consideration between Benefit to Cost Ratios, Return on Investment and emerging initiatives, the evaluators do not see a rationale for a CCP programme but do see a rationale for CASE to evolve through the City and Growth Deals arena.

5.5 Implementation of the interim evaluation action plan

An interim evaluation action plan was provided to Invest NI following the midterm review, with material actions being incorporated into the Phase II Business Plan. Much of this content has been covered in this chapter, for example relating to the expansion of core staffing and increased clarity surrounding the IP process.

See appendix 9-1 for a more detailed consideration of the extent to which these actions were implemented.

5.6 Recommendations

Whilst much positive feedback has been for CASE, there are several lessons learned from delivery to date. Implementation of the following action points could help to further leverage the brand name, impact and efficiency of CASE.

- **Leverage CASE's strategic importance and role in promoting NI's potential in renewables:** Invest NI should seek to support CASE, its governance team and management in retaining and growing the influence it exerts in the marketplace and policy landscape. This includes in relation to its continued efforts to secure private and public funding, as well as attract FDI investors, which could bring significant benefits to NI and aligns closely with Invest NI's skills and remit. Invest NI should consider partnerships and joint trade summits with CASE stakeholders to support this vision, as the centre transitions to a self-sustaining funding model.
- **Evolve the measurement of success towards non-monetary, socioeconomic benefits:** transition towards a focus on cost-benefit analysis and returns to monetisable,

[48] CASE is not a legal entity and cannot bid for these funds but they are relevant funds to which academics linked to CASE could apply.

[49] https://www.sfi.ie/__uuid/a4ec82e1-80d7-4560-9007-6ea203b7a3cb/CoCentre-Programme-2022-Call-Doc-Updated-Dec-2022.pdf

non-quantifiable benefits project business plans, with high weighting given to these in the funding award process. This approach is reflective of common practice in Green Book appraisals. Were this approach factored into phase I, a more comprehensive assessment of the socioeconomic contribution of CASE activities could have been made.

- **Compile, update and report on an Outputs and Outcomes log:** key outcomes and benefits of CASE for included the centre's role is assisting participants to raise private equity and achieve business development goals, as well as its role in raising NI's profile in the renewable energy space and attracting FDI investment. These, combined with CASE's role in raising public awareness of environmental issues (and solutions) are not accounted for in any formal reporting nor in reports of economic impact. The formation of a LOGIC model, and in particular an outputs and outcomes register, could monitor CASE performance and contribution in a way that more aptly reflects its contribution to society.
- **A detailed KPI framework informed by compulsory baseline, progress and post-participation metrics:** a data collection agreement should be a pre-condition of CCP participation. This would help to ascertain the impact that Invest NI funds are having, particularly in the context of a large weighting of non-NI companies, to ensure that economic benefit is being obtained for NI public money. This could be via various avenues, such as exporting opportunities, trading relationships and knowledge sharing being secured via the consortium arrangements between NI and non-NI companies. Tracking this should be prioritised.
- **Improved efficiency and transparency of governance and project award processes:** ensure the recommendations of the February 2023 Process Review are actioned, with an Implementation Report/Action Log advisable by the end of 2023. Initial recommendations from the evaluator include:
  - Ensure that timely feedback and rationale is given for decisions relating to funding awards; in turn this could elevate the quality of business plans received. This could be in a template format accompanied by a 15-30 minute feedback call to reduce time required and to provide a uniform style of feedback that complies with key areas.
  - Given that implementation of this review may require even more time of board members who tend to be unpaid, consideration should be given to increasing a stipend/grant and/or introducing paid 'consultancy' days to facilitate elements such as provision of feedback
  - Consider the introduction of external experts operating at arm's length to assess applications. These could include professionals such as lawyers, equity funders, angel investors and economists, who could judge the financial and socioeconomic merits and potential of proposals, as well as better avoiding the potential/perceived conflicts of interest which may result from industry's dual role in applications and assessments of same.
- **Review of the researcher organisation and place within a self-sustaining CASE:** renewed consideration of a 'core' researcher basis, or pool of post-doctoral research personnel, rather than project by project recruitment. This would require consideration of how this would work within the existing CASE structures operating across three research institutes (QUB, UU, AFBI) but if deemed to be beneficial, different structures should be considered should they prove to be the barrier to implementation. It is also possible that ad hoc project-by-project recruitment may still be required, should certain skillsets be lacking, depending on project requirements. A hybrid model could be considered, including facilitating secondments of research staff from benchmark facilities in other jurisdictions to facilitate knowledge sharing, provide project-specific skills and raise the profile of CASE further still among the international community.
- **Review the membership structure and added-value activities of CASE:** a tiered membership structure, aligned with company size and level of support received, could be considered. This could include a structured package with a pre-determined number of 'consultancy hours', to capture strategic, business development and funding application support work carried out by CASE staff, as well as access to specialists within the wider

QUB/UU/AFBI network. More comprehensive levels of membership could also include preferential IP ownership or licensing options.

6. The Connected Health Innovation Centre

6. The Connected Health Innovation Centre (CHIC)

6.1 Background to CHIC

The Connected Health Innovation Centre (CHIC) commenced operations in June 2013, building on the findings of the Centres of Excellence Evaluation (2007) and the identification by the Matrix Panel of Health and Life Sciences as one of the five priority sectors for NI. Whilst these sectors have evolved since the original 2008 report, Health and Life Sciences has remained a steadfast inclusion in these priority areas.[50] CHIC is hosted at the University of Ulster (UU), with collaboration and partnership involvement from QUB. It was granted initial funding of £5m for a five-year period from Invest NI.

The Centre's objective is to conduct commercially relevant research that develops human capital in areas of multi-disciplinary relevance. Some of the goals identified at ministerial submission stage included:

- Improve the long-term collaboration between industry and academia
- Improve transfer of knowledge
- Define new areas of research using a bottom-up approach
- Develop critical mass of research in a priority area for the NI economy
- Use public funding to leverage additional research business expenditure
- Change the research culture and attitudes of both industry and academia

An interim evaluation was published in March 2017, with the centre being subsequently invited to submit a phase II business plan through to year 8 of Invest NI funding, subject to a suite of recommendations being actions. This was approved in 2019 and led to an initial further three year period before being extended to four-years, comprising £3.36m of funding from Invest NI. This has since been extended on a no cost basis due to COVID. Phase II research and administrative activities are now scheduled to draw to a close on 31 March and 31 May 2024, respectively.

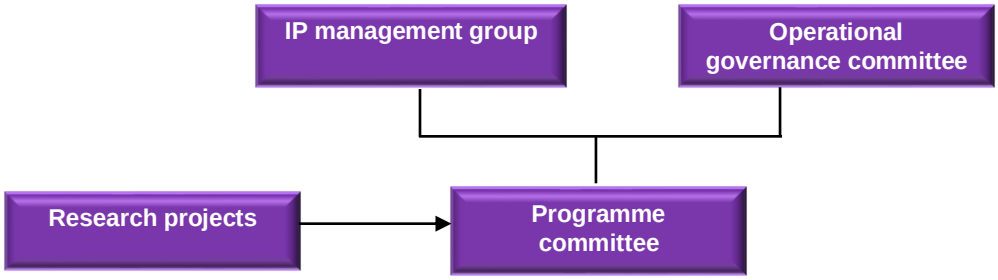
This chapter considers the performance of CHIC phase I; particular emphasis is then placed on the lessons learned and how this knowledge has shaped phase II and its subsequent performance thus far.

6.2 CHIC delivery and governance

CHIC employed a core researcher model, led by two Principal Investigators (PIs), being the only competence centre to do so. This applied throughout both phases, with consultees reporting positively on the impact of continuity of this on research activity, communications, networking and reputational acumen of the centre. Figure 6-1 displays the governance model established for Phase I operations.

[50] https://matrixni.org/sectors/

Figure 6-1: CHIC Governance Structure overview



These structures had the following roles assigned to them:

- **IP management group:**

  Playing a guidance role to the programme committee, this group was responsible for identifying potential IP, implementing safeguarding and promotion of same, and recommending how to maximise commercialisation within CHIC. The interim evaluation cited this group as being more active during the centre's inaugural year to establish protocols etc. However, given the muted IP activity occurring during the remainder of phase I, as well as during phase II, this group played a minimal role during both phases.

- **Operational governance committee**

  This committee was composed of the PIs and the UU Research Office, tasked to monitor and ensure that all CHIC funding was managed in accordance with applicable procedures.

- **Programme committee**

  This committee monitors and managed CHIC's operations, chaired by an independent figure from industry, with meetings at least every quarter. It was tasked with devising and overseeing the implementation of the Research Strategy; monitoring CHIC's performance against the suite of KPIs; overseeing the project selection procedure; formulating the IP policy (within the state aid constraints), and devising the membership fee structure.

- **Centre manager**

  This position was a FTE role tasked with managing the day to day operations of CHIC, including its interactions and communications with the membership based (including recruitment of new members) and liaison with Invest NI in relation to monitoring information and updates as required. This role also encompassed business development activities, such as building and strengthening new and existing relationships between CHIC and NI Health and Social Care stakeholders.

  As in the other centres, this role was found to be key in providing leadership and direction for the centre, and implementing real time feedback from industry and academia in shaping the direction of the Centre.

Phase II

The governance structure for phase II was broadly similar to that in phase I, with actions taken to increase relevance and impact. An International Advisory Group was established during Phase II, to benchmark, leverage and internationalise the impact of CHIC's research activities. The intention was that this would be established in Phase I from the centre's outset, but this did not materialise. However, Covid restricted initiation of this. Consultation with CHIC stakeholders has detailed the progress and difficulties faced in mobilising this board. One face to face meeting has occurred, which influenced the strategic direction, such as through an increased focus on AI. It also provided external validation on the projects CHIC were working on. However, the key benefit cited of this was the international awareness leveraged for the centre through high profile international connections made. Subsequently, CHIC has achieved representation on committees such as the European Health Technology Alliance, as well as exposure to potential future opportunities such as Peace Plus stakeholders.

A further addition to the delivery structure of CHIC in Phase II was the establishment of its PhD programme. This was integrated into the governance structure with a particular focus on earlier stage TRL, strategic projects which were of lower priority to industrialists within CHIC.

The remit of the IP Management Group was also reviewed, being tasked with focussing on lessons learned, reviewing the processes of IP sign up, management and exploitation, and identifying potential IP and exploitation strategies for same.

6.3 CHIC Activity

6.3.1 KPI attainment

Phase I

CHIC performed strongly across the majority of indicators that it reported quarterly on. In particular, leveraged funding, academic publications, member companies and the breadth of projects carried out exceeded the targets set. In addition to the industry collaboration projects, two further strategic projects were carried out, these being larger projects budgeted at £1m over 12 months. The contribution made by these strategic projects is not accounted for directly in KPIs, but is noteworthy as a signal of CHIC's reputation in the local marketplace and socioeconomic contribution.

CHIC underperformed, like all the centres, in the commercialisation IPs, achieving no spin-offs and only one licence agreement. This was recognised as an area requiring greater attention and review prior to embarking on Phase II.

Cash contributions from industry were also below the target set (£155.6k vs £266.5k). This shortfall was mainly compensated for by funding raised through the X-Prize competition (see section 6.3.2 for further explanation).

Table 6-1: KPI's achieved by CHIC I

Performance Indicators	Initial 5-year target	End of phase result	
Number of persons employed	up to 2 people per year	1.5	
Ratio of industry staff costs as % of total in-kind contribution	50%	69.0%	
Other leveraged funding	£3.25m	£5.15m	
Cash contribution from industry	£226.5k	£155.6k	
Overall Industry in-kind contribution as % of total research project costs	25%	13%	
Issue licence agreements	10	1	
Established spin-offs	3	0	
Activity indicators	**Initial 5-year target**	**End of phase result**	
Establish 5 MOU's at a national or international level	5	4	
Academic publications	28	84	
Total member companies	30	28	
Total collaborative projects	25	39	

Source: CHIC Phase I closure report

Phase II

As with the other centres, the KPIs set at programme outset were initial, with refinements in phase II reflecting the lessons learned and impact leveraged. The core KPIs were simplified to five:

- Attainment of the key actions resulting from the Action Plan
- Cash contributions from industry
- IKCs from industry
- Leveraged funding
- Company-related KPIs (spanning a scope of sub-indicators but reported as an umbrella target)

KPIs relating to commercialisation were altered significantly, with the removal of spin-outs. This was replaced by more strategic targets relating to partnerships, both nationally and internationally, with industry, policy and strategic healthcare stakeholders. These in turn incorporate targets of projects having commercialisation plans, identified commercial potential at point of approval, and projects leading to Tech Transfer Agreements. This shows a more strategic treatment of IP by centre stakeholders, specifically how the TRL levels and demographic of company involved with CHIC may lend themselves more to an initial, holistic consideration of IP built into initial business plans.

Table 6-2: KPIs achieved by CHIC II

Performance Indicators	3-year target	Q2 2023 result	
Progress against Key Actions Annex	All key agreed points from interim action plan	All key actions from interim action plan satisfied	
Annual review of Centre progress against agreed benchmarks and Research Centres	*Complete annually commencing in May*	*Benchmarking complete*	
Cash contribution from industry	£147,213	£139,990	
In-kind contributions from industry	Min. 25%	18%	
Leveraged funding	£844,330	£2,044,951	
Company-related KPIs			
Number of Learning and Information opportunities for companies	Min. 2 per year	Complete	
Projects Initiated	5 projects running, with at least 80% FTE utilisation.	Complete	
Early Market Opportunities Introduced	Min. 3 projects annually based on early market opportunities.	Complete	
Partnering Opportunities with health or Government Providers	Min. 1 project annually leads to/is based on partnering opportunities with health/government providers.	Complete	
Health Engagements and Adoption (Includes adoption and addressing barriers)	All projects have an identified market potential at approval. Min. 2 projects annually conclude with commercialisation plan.	Complete	
Completed Projects with Tech Transfer Agreement (including Licence).	Min. 1 project annually completes with Tech Transfer Agreement.	Complete	

Performance Indicators	3-year target	Q2 2023 result	
Academic/Business Joint Publications	Min. 3 joint academic / business publications per year.	Action partially complete / on track	

Source: April-June 23 CHIC2 Quarterly Report

IKCs were below target set. This may relate to the dominance of micro and small firms in CHIC's membership, which is the highest of all centres. These firms are likely to have more constrained resources, including on staff time, compared with larger counterparts. Invest NI should consider tailoring the IKC target to this variable, with the target positively related to the size of company.

Whilst the quarterly reports note that year-end figures may vary as increased contributions are recognised in the months following year end, year 3 was particularly low at reporting stage (18%). Given that a key channel for the transmission of benefits and knowledge sharing are these IKCs and the learning by osmosis that occurs between consortium partners, increasing this contribution to target (or close to target) level should be a priority for centre management.

Limited information is given in the quarterly reports for phase II in relation to KPI attainment. The seven company-related KPIs are attributed a RAG status rather than any explanatory information being given as to why attainment may be below target (e.g. concerning academic/business joint publications). Full details are presented to CHIC Programme Committee on company KPIs on an annual basis. Invest NI receives all papers and participates in CHIC Programme Committee.

6.3.2 Budgetary considerations

Phase I

CHIC employed a tiered membership fee structure, with arrangement, with this annual cost being between £500 and £5,000 depending on the size of company. Health care providers were exempt from this membership fee. This fee permitted the company to access CHIC resources, expertise and informal advice and consultancy.

As the other centres, CHIC was funded by two strands: core funding (at 75% Invest NI, 25% industry) and research funding (100% Invest NI funded). In phase I, attainment of both industry cash contributions and IKCs was below the target set. Whilst the average share of IKCs as a percentage of total project costs across the 5 years was 20%, the cumulative figure was 13%.

Regarding the under attainment of industry cash contributions, the role of strategic projects played a role in this. This strand represented significant funding (totalling £1.6m) but did not have the industry investment in kind that other, more commercially focussed ones did. Therefore, they did not generate the same income as shorter, commercial ones did. This highlights the need to reconsider KPIs and industry requirements being uniform across projects, given that the interim evaluation recommended continuing pursuit of this type of strategic project. In the final close out budget, virements between core and research budgets resulted in a final core funding budget of £655,000 (from £694,600), meaning that industry cash contributions of £155,625 represented 23.8% of core spend (vs the target of 25%). However, if this virement had not occurred, industry cash contributions would have fallen to 22.4%. Shortfalls to this income were met in part with prize money from the X-Prize competition.[51]

Table 6-3: CHIC Phase I budgetary breakdown

Element	Phase (I)
Total grant paid (offered)	£4,948,508 (£4,999,833)
Maximum expenditure incurred (projected) [52]	£5,112,292 (£5,155,983)

[51] CHIC1 Closure Report

[52] Excludes in-kind contributions. Includes total expenditure, with Invest NI funding representing 25% of 'core' funding and 100% of research funding.

Element	Phase (I)
Of which:	
Core staff	*£572,600*
Other core costs	*£82,400*
Research staff	*£2,754,466*
Research overheads	*£1,267,054*
Other research costs	*£439,862*
Industry cash contributions (projected)	£155,625 (£226,500)
Invest NI funding	
Core grant paid	*£491,351*
Research grant paid	*£4,457,157*
Grant disallowed	

Source: Invest NI, CHIC I Closure Report

Phase II

The transition to phase II included a focus on paving the way for a self-sustaining CHIC operating model. A 15% budget was approved by the CHIC Programme committee and Invest NI to focus on work related to such funding opportunities. The Phase II budget also focussed on continuing what worked well from Phase I. The interim evaluation recommended building researcher capacity and career development. The 15% budget was therefore increased to 20% to enable the business development, non-chargeable activities of the researchers. The core research spend remains the largest element of CHIC's budget, reflective of the growing body of dedicated staff and PIs.

The total grand paid by Q2 2023 was c.£330k below that projected. CHIC was able to secure a no cost extension to its existing timeline of June 2022 out to October 2022 (now May 2024), due to a research budget underspend, which has been primarily attributed to the impact of COVID on identifying and commencing appropriate project opportunities.

As occurred in Phase II, industry cash contributions were below that projected (this was exacerbated by the impact of COVID which prevents on the ground research occurring, leading to several members not renewing during this time). The implementation of a 5% cash contribution from projects during Phase II has, however, enhanced the cash position of CHIC and continues to help supplement the CHIC membership fees.[53]

Stakeholders noted the impact that the knowledge amongst industry that CHIC was approaching the end of its funding cycle has had, noting a reduced momentum, number of members and interest from prospective members.

Table 6-4: CHIC Phase II budgetary breakdown

Element	Phase (II)
Total grant paid, Q2 2023 (offered, phase II)	£3,029,971 (£3,359,236)
Total expenditure incurred, excl. IKC, by Q2 2023 (total expenditure projected) [54]	£3,182,506 (£3,520,038)
Of which:	

[53] CHIC 2 Annual Report 2021-22

[54] Excludes in-kind contributions. Includes total expenditure, with Invest NI funding representing 25% of 'core' funding and 100% of research funding.

Element	Phase (II)
Core spend	*£610,142*
Research spend (incl. PhD Student grant)	*£2,572,364*
Industry cash contributions paid	*£100,108*[55]
Industry cash contributions (3-year target)	*£147,213*
Invest NI funding[56]	
Core grant paid	*£457,607*
Research grant paid	*£2,572,364*

Source: Invest NI; CHIC II April-June 2023 Quarterly Report; CHIC II 2022 Annual Report; Grant Thornton analysis

6.3.3 Research activity

CHIC's initial research strategy was submitted to Invest NI in November 2012. Three research themes were identified within this strategy, these being:

- Integrated care and assisted living,
- Point of care (POC) diagnostics, and
- Vital signs sensing development): this was subsequently expanded to include a fourth theme (Healthcare Analytics).

These research areas were underpinning and enabled by six core capabilities:

- Embedded software and pattern recognition for Healthcare Sensor Systems;
- Microfluidics and sensor fabrication engineering;
- Wireless communications;
- Ambient assisted living/integrated care;
- Clinical integration; and
- Economic assessment of trials and early adoption.

Consultees reported participating in strategy days to decide what research areas to focus on, with a focus on prioritising up to five areas. The consensus was that this worked well and helped to ensure alignment between industry and academia. CHIC management took an active role in monitoring alignment between project activity and the research strategy, submitting an updated strategy report in 2014. This reported on market drivers, opportunities and focus areas to monitor the direction and commercial potential for each strand, as well as reporting on project-by-project alignment. There were also strand-specific events and awareness sessions hosted for participant companies.

Despite the clear alignment between strategy and industry priorities with CHIC's research areas, the realisation of this caused some frustration among industry members and underperformance in commercialisation and IP during phase I.

Evolution to Phase II

Moving to phase II, a focus was placed on 'internationalising' the scope and relevance of CHIC's research, as well the commercialisation of this, following the recommendations of the interim evaluation. However, these two aims were divergent, given industry's need for a rapid turnaround on research with clearly commercial applications, whereas the former goal was more strategic in nature.

As part of the phase II business plan CHIC's research strategy and market positioning was considered by reference to domestic (particularly internal company research activity) and international providers competing in the same space. It was concluded that the elements differentiating CHIC's offer, to be focussed on during phase II, were:

[55] Increased industry cash contribution proportionate to project spend was approved at May 2020 PC meeting. This commenced for new projects from 1 June 2020. Figure for Y1 = £30,375, Y2=£38,248

[56] Combined figures from December 2022 Annual Report and Q2 2023 Quarterly Report to present an illustration of the approximate Invest NI grant allocated by end of Q2 2023.

- Deep domain-specific skills
- Collaboration
- Utilising the 'Triple Helix' of Academia, Business and Government.
- Business leadership in the research

Member companies were consulted for feedback on CHIC's research strategy entering this phase. Adoption of new healthcare technologies, i.e. translation of innovative discoveries from the lab to healthcare settings, was identified as a key challenge. Accelerated adoption was therefore introduced to each strand of the research strategy.

Strategic research areas were decided in tandem with health service stakeholders, councils and Innovate UK, with the potential to benefit the industry as a whole. Heart Failure and Smart Long Term Care were decided on as longer-term focus areas with the likelihood of increased publications to accelerate knowledge dissemination and awareness. This aligned with the interim action plan recommendation of focussing on areas with the potential for the highest Impact Factor journal publications, in order to accelerate CHIC's international reputation and standing.

The final research strategy for Phase II encompassed the following strands. They were to be realised by research calls, a continuous focus on strategic projects throughout the phase, and by the new CHIC-specific PhD research programme, with topics selected by the programme committee.

- Smart living
- Medical sensors and diagnostics
- Healthcare analytics, IoT devices and the Living Lab.

This attempted to achieve a balance with more commercial relevance and aligned with the shorter timescales demanded, which was clear from the consultation process (i.e. rapid testing of prototypes) and longer-term, strategically important projects with significant potential socioeconomic benefit. The Business Plan for Phase II noted '*The PhDs will also provide an opportunity to address higher impact factor research papers which is not a core requirement of companies*.'

6.3.4 Marketing and Recruitment

Research staffing model

CHIC employed a core researcher model, rather than project-by-project recruitment of academics, across both phases I and II. It has been the only competence centre to do so. Overall, there were between 10 and 12 researchers on staff, each tending to work across several projects. Consultees expressed the benefits of this as primarily being the breadth of skills available for each project (drawing on several specialisms if required), as well as the time and cost efficiency of having staff on hand to match with project proposals, rather than conducting a separate recruitment call for each. This avoided situations whereby companies could potentially lose interest in projects due to time lags, particularly where time sensitive research was requested. The use of Principal Investigators created a definitive identity for CHIC in the local marketplace, as well as leveraged each of their networks at home and abroad within their respective fields.

The drawbacks of this included the potential for downtime between projects, as with any full-time position. This time became dedicated to leveraged funding proposals and strategic projects, which was more intently focussed on as a formal part of CHIC's research strategy in phase II. Whilst some of the other centres did not employ this core researcher model due to the potential for a lack of suitable skills among the research staff for niche projects that may arise, CHIC stakeholders felt that this was not an issue due to the ability to use other researchers from the university on an ad-hoc basis through available budget.

On balance, the evaluator believes that this research staffing model was regarded more positively by consultees relative to models used in other competence centres.

Outreach and recruitment efforts

The number of member companies averaged 28 over the duration of CHIC I and was consistently above yearly target. This was in many ways the result of a personable, stepped approach to recruitment, particularly relating to SMEs in the inaugural years of CHIC operations. Consultees told of the programme of networking events hosted, involving case study presentations from members on

current innovations made within CHIC. One such event involved 120 representatives from the NI healthcare industry.

The profile of member companies in case was skewed towards SMEs (88% compared with the programme average of 72%). The shares of non-Invest NI client and non-NI based companies were broadly in line with the programme averages. The presentation of SMEs within CHIC is reflective of the nature of the healthcare technology industry (with a few notable exceptions), of CHIC's 'trusted voice' place in the industry thanks in part to its successful track record and tenure of operations, as well as the aforementioned outreach efforts.

Table 6-5: CHIC activity and recruitment

Participant demographics	Share	CCP total
SMEs	88%	72%
Large companies	12%	28%
Invest NI client companies	46%	43%
Share NI companies	81%	82%
Share non-NI companies	19%	18%

Source: CHIC quarterly tracking data; Invest NI data; Grant Thornton analysis

Review of CHIC strategic planning and activities shows that the differences between the demographics of companies within NI's Life Sciences industry were increasingly analysed and embraced as the centre transitioned to phase II. Management were cognisant of the fact that larger companies were likely to have in-house R&D teams and budgets. However, the Business Plan notes CHIC's Unique Selling Point (USP) or market gap as being:

1. Budgetary constraints can impact the risk appetite of these companies; as such riskier exploratory work may not be undertaken. Higher TRLs will be focussed on in these companies
2. At times a lack of technical skills even within larger teams
3. The clinical links can also be missing as the procurement barriers can mean that health trusts can be reluctant to work with companies

CHIC also considered their particular barriers to engagement with the centre including the IP rights resting with the university. Cognisant of these market gaps and USPs, outreach efforts by CHIC stakeholders to these large was to focus on the potential for carrying out riskier, further from market research, and offering skill sets not available to the organisation internally.

6.4 Perspectives on CHIC

6.4.1 Satisfaction with the programme elements

Respondents expressed positive levels of satisfaction (>3) across all elements in the survey, with client facing and research staff ranked highest among these. In addition, respondents were satisfied with the quality of R&D infrastructure in CHIC; given the dominance of SMEs, these are assets not often available in-house. A positive value for money score of 5 (out of 7) was reported, with several participants commenting on the affordable nature of membership and significant benefits that it entailed.

Moving into Phase II, the expansion of core staff, addition of the commercialisation manager and continuation of the core researcher model was reflected in reported satisfaction with staff quality and communications. CHIC maintains frequent communication with members, including via business development, fund raising and awareness materials.

Figure 6-2: Reported levels of satisfaction with programme elements (average values)

Source: Grant Thornton analysis (n=6)
Green indicates a score of >3.0 (i.e., satisfaction with the respective element)
Note: The scale used throughout 'opinion questions' is 1= Very Dissatisfied, 2=Dissatisfied, 3=Neutral, 4=Satisfied, 5=Very Satisfied

6.4.2 Outcomes and benefits

Phase I

Overall, respondents spoke positively about the benefits they experienced from CHIC membership. One respondent highlighted how the practice of making in-kind contributions was particularly beneficial for smaller companies, rather than costlier cash contributions. They also highlighted the dual benefit for the University of honing the commercial relevance and reach of its research, which was echoed by academic stakeholders in consultations:

"The ability to make in-kind contributions is an important one. COVID impacts, inflation etc. have put additional pressures on businesses and the CHIC model allows companies to get world-class R&D underway without additional pressure on cash flow. This represents a truly valuable return for the company on in-kind contributions. Regarding the return and value of the investment in the programme from public funds, I believe it's a win-win, since it helps the University retain expert researchers while enhancing its profile alongside valuable engagement to industry, in tandem with helping create IPR and growth opportunities for local companies."

Analysis of survey responses shows the most frequently cited benefits as being:

- Increased access to talent (43% of respondents)
- Strengthened peer network of likeminded businesses (43% of respondents)
- Heightened commercial relevance of product/service (43% of respondents)
- Development & testing of prototypes (43% of respondents)
- Knowledge transfer (57% of respondents)
- Development of new (or enhancement of existing) products and services (57% of respondents)
- Benefits from academic perspective/input (57% of respondents)

Phase II

The featuring of 'Development and testing of prototypes' among the most commonly cited benefits of CHIC participation is reflective of the efforts to increase the commercial relevance of CHIC activities.

This was communicated by stakeholders during consultations as a key transition in CHIC's approach to industry collaboration in Phase II.

Strategic and business development efforts were refreshed and increased in Phase II, leading to increased awareness of CHIC, and by extension the research and commercial acumen of its members, both in NI and abroad. This includes attendance at conferences and workshops with NI stakeholders to present on the contribution and impact of CHIC.

An example of CHIC's international business development efforts is its attendance at the Boston MedTech Conference in October 2022 as part of the Sector Trade Mission.[57] This afforded CHIC with the opportunity to learn about the latest advances in MedTech, as well as networking and identifying possible FDIs for NI.

CHIC has also played an increasingly important role in advancing the University of Ulster brand, impact and ranking. Two REF cycles have occurred during CHIC's operation lifetime, in 2014 and 2021. In 2014, four out of the five REF case studies presented were from CHIC, whilst in 2021 three out of six were included. Consultees expressed the significant positive impact this has had on the University of Ulster's ranking in the UK and the funding they have leveraged during this period.

Finally, whilst the traditional commercial benefits of increased turnover, cost savings from innovation, accessing new markets and developing new products/services are applicable, the socioeconomic benefit and improved quality of life resulting from healthcare research is particularly applicable to CHIC. This socioeconomic contribution cannot be understated as a benefit, though it is often an overlooked aspect due to the difficulty in quantifying it. This is explored more in section 6.4.6.

Benchmark studies estimate the socioeconomic return on investment of healthcare research as being as high as 14.3:1.[58] Whilst this study adopts a much more conservative approach (a 25% socioeconomic ROI per year), it is worth noting that this is a lower end estimate. Stakeholders testified to CHIC's close integration within healthcare settings, with instances of staff being directly located in hospital settings and working closely alongside medical professionals. This could, in a further cost-benefit analysis, be reflected in the modelling of these health benefits.[59]

Case study of the socioeconomic benefits of CHIC projects: Leckey Connect

Research facilitated by CHIC into the development and evaluation of self-management technologies, specifically processing for sensor data for behavioural insights and the development of health apps has led directly to the creation of new products for SME James Leckey Design called Leckey Connect. Leckey Connect consists of a connected sensor that quantifies movement and a mobile app that contains elements of goal setting and gamification to encourage participation in physical activity.

It is estimated that over 100 children have already positively benefited from using the product. In one case a child's parents and care team has highlighted the impact this technology has on their quality of life. Physios have reported improvements in standing time from 20 to 48 seconds in 8 weeks. Classroom assistants have reported that *"Eli is now able to stand up much straighter and needs less help in and out of his wheelchair than before"*[60]

6.4.3 Commercialisation arrangements

Phase I

CHIC operated within the IP constraints of the wider Competence Centre Programme in the context of state aid rules. Stakeholders acknowledge the 'hard sell' to companies from the centre's outset of participating in R&D projects, for which any resultant IP rights would rest with the University of Ulster.

[57] https://themedtechconference.com
[58] https://jech.bmj.com/content/71/8/827

[59] The modelling of QUALY improvements (Quality Adjusted Life Years) is standard practice in health economics, where monetary outcomes are not readily available or reflective of the true value of research advances to society.

[60] CHIC1 Closure Report

This was further complicated by the consortium design of three companies collaborating, with unease regarding who would have the first rights of refusal regarding licenses etc.

IP activity was below the target set for phase I. Only one licence agreement was entered into over the course of CHIC I compared to a target of 10. The ongoing activities around project review include an element of asset identification which it is hope will translate into licencing. At close out, there were two invention disclosures and three processes concerning the processing of existing IP. There were no spinouts, compared with the target of three. Further compounding the difficulties faced in reaching commercialisation targets is the long time lag associated with the highly regulated healthcare industry.

Phase II

The growing focus on strategic research in Phase II (and introduction of dedicated PhD researchers to realise these projects) presented more potential for industry-wide/socioeconomic benefit, which is difficult to quantify, rather than specific commercial outcomes.

While recognising the complexity of IP in triple helix collaborations which are state aid funded, the CHIC team has worked with the University and Invest NI to recommend and clarify a better way forward.

In CHIC's 2021/22 Annual Report, the introduction of a new Commercialisation Project Stream was announced, in addition to the current Project and Pre-projects streams. This had the objective of continuing to progress research projects up to TRL 7, with all resultant IP generated remaining with the University. These projects would be for a shorter period of time of up to a maximum of 3 months, with the focus of propelling high potential projects closer to market. Two such Commercialisation Projects (CPs) were noted the most recent Project Outcome Tracker made available to the evaluator. One of these, in relation to Diabetic Foot Disease, had attained an Invention Disclosure Form in October 2020. This is a positive development that signals the embedding of a commercial approach within project direction and management.

CHIC now also maintains an IP asset register and progress log that is reported to Invest NI on a quarterly basis. The most recent quarterly report (Q2 2023) details the following assets:

- License agreements: 3
- Invention disclosures: 6
- Sharing & development of existing IP/know-how: 3

6.4.4 Lessons learned

Across the primary engagement undertaken, participants felt that several 'lessons learned' could be taken from Phase II of CHIC, building upon or furthering the actions taken/committed to as part of the phase II Business Plan. They are as follows:

Figure 6-6: CHIC Phase II areas for increased impact and efficacy

Support	Explanation	Solution/lesson
Outreach efforts via word of mouth, networking events and organic relationships to recruit companies	CHIC has performed well in attracting SMEs, particularly via organic outreach efforts.	Entrepreneurs and micro enterprises should be prioritised in outreach efforts, with consideration given to flexibility on the level of contributions or allowing them to join on a pilot basis.
Role of local and international networking with healthcare stakeholders and benchmarks; recognition	This wealth of contacts and reputational acumen should be carried through to related initiatives such as the City Deals Centre for Digital Healthcare Technology and I-	Ensure that CHIC stakeholders, members and alumni are fully involved in and consulted during the establishment and operations of related projects.

Support	Explanation	Solution/lesson
of CHIC's established market position	REACH (Institute for Research Excellence in Advanced Clinical Healthcare).	
Finding the 'unique selling point' of CHIC, acknowledging the varying requirements and objectives of small, medium and large companies	CHIC acknowledged that, whilst larger companies were able to fund in-house research, it was often closer to market (due to risk aversion) and lacking in the specific skills available in the universities.	Given state aid considerations, this is difficult to address and is not unique to NI Competence Centres. The TRL focussed on may lend itself to post-concept stages, whereby developmental work is being carried out on an existing product and thus is post-patent stage.
Focus on economic output in KPIs as opposed to research, innovation and policy alignment	*"Competence Centres should focus on the research that will 'fuel' innovation and thereafter the economic output."* The growing focus on strategic research in Phase II (and introduction of dedicated PhD researchers to realise these projects) presented more potential for industry-wide/socioeconomic benefit, which is more difficult to quantify than traditional commercial outcomes such as turnover and jobs.	It should be noted that socioeconomic cost-benefit analysis is common place (and recommended) in the business case process, in line with HMT Green Book and NI Better Business Case Guidance. The usual approach is to quantify the QUALY (Quality Adjusted Life Years) improvement resulting from healthcare research. This approach should be adopted to not only CHIC's operations, impacts and VfM, but also the individual projects within the funding award process. CHIC should provide training to an appropriate individual within the centre management team / wider QUB team.
The growth in focus on, and revenue spent on, strategic projects, has caused apparent underperformance in some KPIs, such as industry cash contributions.	Regarding the under attainment of industry cash contributions, particularly in phase II, the role of strategic projects played a role in this. This strand represented significant funding (totalling £1.6m) but did not have the industry investment in kind that other, more commercially focussed ones did. Therefore, they did not generate the same income as shorter, commercial ones did.	This highlights the need to reconsider KPIs and industry requirements being uniform across projects, given that the interim evaluation recommended continuing pursuit of this type of strategic project. Separate KPIs for strategic projects, reported separately from the core projects and centre operations.
IKCs were below target in both phases, but particularly in Phase II.	Some years reported as low as 8% share of research project costs coming from IKCs. This limits the benefits from learning by osmosis and knowledge transfer. Invest NI implemented an escalation procedure to address under-performance, in November 2020, which has positively impacted in-kind contributions. Further	Increasing this contribution to target (or close to target) level should be a priority for centre management.Centre management should leverage their relationships with industry to monitor in real time, project-by-project, these contributions, with catch ups scheduled as needed with consortium members. A consultation should be carried out with members regarding IKCs and consideration

Support	Explanation	Solution/lesson
	increasing this contribution to target (or close to target) level should be a priority.	given to applying a tiered contribution requirement, depending on project type, company size and resources.

Source: Grant Thornton analysis of primary engagement; CHIC II Business Plan

6.4.5 Economic Impact Return on Investment & Value for Money (VfM)

Much of the benefits of CHIC activities are not largely quantifiable in nature. Whilst this has been said of the Competence Centre Programme and R&D&I investments in general, it is perhaps most applicable to healthcare research. This is despite the pronounced socioeconomic returns to healthcare research, as established by a wide body of literature. Invest NI tracking data, combined with additionality information from the survey, has been used to formulate an initial assessment of CHIC's potential economic performance. However, it was felt by the evaluators that a socioeconomic assessment of CHIC would provide a more comprehensive assessment of its benefit. No consideration is given to future benefits, rather the analysis is undertaken on 'pre' and 'post' programme. Therefore it is anticipated that further benefits will be realised over the longer term, with costs having been fully realised.

This socioeconomic return was the subject of a 2018 journal article in the British Medical Journal, entitled 'Economic returns to medical research funding'[61]. The authors model the non-monetary benefits of health gains arising from such medial research, concluding that the total return of this funding is around 25% (composed of 10% for the health gains plus circa 15% for the GDP gain). '*This means that for every £1 spent on medical research in the UK, we get back benefits, in GDP gains and health gains, equivalent to 25 pence per year'*. When modelled over a five-year time frame post-available tracking data (i.e. by 2026), this suggests a medium additional return of £1.25 for every 25p invested.[62]

Employing this socioeconomic approach gives a potential economic impact of CHIC of £13.4m by 2026, giving an ROI of 0.7 and a BCR of 1.7 on Invest NI monies spent. In lieu of this socioeconomic return and cognisant of the longer time lags associated with returns to healthcare innovation funding, a conservative assessment of CHIC's ROI is -0.2, representing a marginal loss in the short term.

Regarding additional BERD generated, there has been a potential additional £2.0m of expenditure to date owing to CHIC participation. This presents a 21.0% increase from 2017 baseline figures; this is independent of the socioeconomic adjustments and is likely to be significantly larger over the medium to longer term.

[61] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6144334/#:~:text=By%20combining%20the%20estimated%20elasticity,between%2015%25%20and%2018%25.

[62] It should be noted that socioeconomic cost-benefit analysis is common place (and recommended) in the business case process, in line with HMT Green Book and NI Better Business Case Guidance. The usual approach is to quantify the QUALY (Quality Adjusted Life Years) improvement resulting from healthcare research.

Table 6-7: CHIC economic impact

	CHIC	
Impact variable	Results	
GVA impact		
Additional turnover, net	£	8,512,998
Economic impact (GVA), net	£	5,956,915
BCR		0.8
ROI		-0.2
Socioeconomic returns to healthcare		
Additional turnover, net	£	19,154,244
Economic impact (GVA), net	£	13,403,058
BCR, 2026		*1.7*
ROI, 2026		*0.7*
BERD impact		
BERD activity generated, net	£	2,003,005
BERD growth (%)		21.0%

Source: Invest NI monitoring data, Grant Thornton analysis, NISRA

6.4.6 Equality Considerations

The Evaluation Team's review of CHIC and its activities indicates that centre participation is available to any Northern Ireland small, medium or large company with appropriate innovation ambitions and relevant proposals. Overseas owned/based companies are also eligible to come participants/members, where it can be demonstrated they will strengthen the consortium and bring technical/economic benefits to Northern Ireland and/or support the internationalisation of the Competence Centre. As such, it is the Evaluation Team's assessment that CHIC complies with all elements of equality promotion set out in Section 75 of the Northern Ireland Act 1998 and by Invest NI in their Equality Scheme.

6.4.7 CHIC Economy, Efficiency & Effectiveness

Phase I

In considering the economy, efficiency and effectiveness of the first phase of CHIC, the following points were noted:

Table 6-8: Economy, Efficiency & Effectiveness Analysis (CHIC I)

Measure	Analysis
Economy The Economy measure is concerned with measuring the impact of the programme at an appropriate level of input i.e. impacts have been obtained at the best VfM	The overall CCP, and CHIC individually, was subject to an economic appraisal, business plan and robust internal casework process. It was also subjected to a detailed interim review with an international advisory panel. These foundations were used by Invest NI to assess best practice and operational efficiency in terms of delivery, as well as helping to understand the potential outcomes being generated and challenges faced. This represents a high level of scrutiny and stakeholder input, whilst allowing for the operational autonomy of CHIC. The interim evaluation action plan also allowed for optimisation of VfM within phase I (allowing for constraints of delivery and funding regulations governing this phase). CHIC used its own internal procurement processes throughout its operational period, given the arms' length nature at which Invest NI operated. The guidelines for this were provided in the Letter of Offer at project outset. CHIC participation required both cash and in-kind contributions from companies. This both reduced Invest NI's outlay, as well as incentivising commitment from companies. By CHIC I close out, company contributions totalled £155.6k, which was considerably lower than the target of £266.5k. After virements, this was £9,000 lower than target; this shortfall was part-funded via leveraged funding secured (£5.15m secured vs target of £3.25m). In-kind contributions represented 13% of project costs, which was lower than the target set of 25%. The economic impact that has been calculated suggests a potential loss of 20% for every £1 of Invest NI funding of CHIC I (ROI of -0.2 / BCR of 0.8). However, there is both a higher time lag associated with benefits to healthcare R&D investments, as well as a socioeconomic dividend resulting from such expenditure. Using benchmark studies on socioeconomic impacts by 5 years post-phase I close out, CHIC could have led to a potential ROI of 0.7 and BCR of 1.7. This suggests that, for every £1 of Invest NI monies invested, there would be a socioeconomic return of an additional 70p. A potential additional £2m of BERD was incentivised by overall CHIC activities to date, representing an increase of 21% on 2017 figures.
Efficiency The Efficiency measure looks at measuring the impacts relative to the level of inputs i.e. has the maximum level of output been achieved for a reasonable level of input	A total of 33 companies participated in CHIC I, carrying out 26 projects during the operational phase. This exceeded target of 11 companies. The cost to Invest NI per business was £150k. The potential ROI was calculated as being -0.2, rising to 0.7 inclusive of socioeconomic returns to healthcare research. The centre exceeded target of leveraged funding secured, totalling £5.15m during phase I (vs target of £3.25m).
Effectiveness	The primary engagement undertaken revealed several constraints on impact, both exogenous (e.g. the time delay associated with returns to

The Effectiveness measure is concerned with understanding the level of impact the programme has achieved relative to aims, objectives, etc.	healthcare R&D) and endogenous (the IP ownership rights remaining with the host institutions rather than the companies). The majority (80%) of companies surveyed indicated that, in lieu of CHIC support, they would have either ceased, delayed and/or decreased the amount of R&D&I activity undertaken. Substitution, leakage and additionality has been factored into the calculations of return, as detailed above.

Source: Invest NI & Grant Thornton Analysis

Phase II

In considering the economy, efficiency and effectiveness to date of CHIC phase II and in light of the limited quantitative data available, the following points were noted:

Table 6-9: Economy, Efficiency & Effectiveness Analysis (CHIC II)

Measure	Analysis
Economy The Economy measure is concerned with measuring the impact of the programme at an appropriate level of input i.e. impacts have been obtained at the best VfM	CHIC phase II was approved on this basis of a detailed business plan, which actioned material recommendations made in the interim evaluation. Key elements included that of incorporating an international advisory panel and benchmarking process. CHIC has since proved its integral part of the healthcare technology landscape in Northern Ireland, with its role in advancing the City Deals CDHT project being a key example of this. The interim evaluation action plan, as well as the refreshed delivery and research strategy for phase II, has built on the VfM established in CHIC I. Individual data was not available to calculate a potential ROI for phase II of CHIC specifically. However, the phase I analysis and literature review conducted, demonstrated a heightened socioeconomic contribution of healthcare research, particularly over the medium to longer term. Current cash contributions from companies totalled £100,108k, representing a shortfall against the 3-year target of £147k. In-kind contributions have also lagged behind target (18% realised vs target of 25%). Elevating the IKCs and cash contributions from companies by the end of phase II will help to ensure an appropriate industry matching of Invest NI funds and of knowledge transfer between companies in consortiums.
Efficiency The Efficiency measure looks at measuring the impacts relative to the level of inputs i.e. has the maximum level of output been achieved for a reasonable level of input	A total of 29 companies participated in CHIC II, including 21 ‘new’ companies who did not participate in Phase I. They carried out 34 projects per the most recent data. The cost to Invest NI per business was £95.3k to date. The potential ROI overall was calculated as being -0.2, rising to 0.7 when inclusive of socioeconomic returns in the medium term. The centre has, according to the most recent data, exceeded its target of leveraged funding, totalling £2m by end of year 3 (vs target of £844k).
Effectiveness The Effectiveness measure is concerned with understanding the level of impact the programme has achieved relative to aims, objectives, etc.	Major constraints, such as benefit realisation time lags and governance variables such as IP ownership, were not within CHIC’s control to vary moving into phase II. However, several changes were made to elevate the established impact, including alignment with industry, focus on fast-paced prototype testing and inclusion of international benchmarking. This, coupled with the alignment with (and major contribution to) other healthcare developments such as CDHT and i-REACH within the BRCD, makes it likely that the Phase I impact has been sustained and elevated by Phase II activities.

Source: Invest NI & Grant Thornton Analysis

6.4.8 Considering the future of CHIC

As CHIC evolves post-Invest-NI funding and seeks to obtain alternative funding streams, there is a clear and growing breadth of opportunity within the Life Sciences field. A notable opportunity and natural progression route for CHIC, which appeared throughout primary engagement and desk-based research, was that of the City Deals projects. Across the NI councils these are at various stages of the Business Case process.

CHIC has been involved to date in the consultation and planning process for i-REACH and CDHT within the Belfast Region City Deals Projects.

- I-REACH received OBC approval in December 2021, with the contract for funding signed in March 2023. In FY 2023/24, publication of the Contract Notice and the Pre-Qualification Questionnaire is planned.[63]
- The project lead of the Centre for Digital Healthcare Technology (CDHT), Professor Jim McLaughlin, is a Principal Investigator within CHIC, who has played a pivotal role in the centre's activities and impact since its inception.
- There is significant overlap in personnel and research specialisms between these innovation pillar projects and CHIC. The Living Lab, for example, is a key aspect which will encompass and enhance the existing cardiology-based pilot clinical Living Lab at the Royal Victoria Hospital. In the longer term, the expectation is that the scope of the Living Lab will be expanded into new areas including the treatment of respiratory conditions, ophthalmology stroke and diabetes.[64]
- CDHT's Outline Business Case was approved in May 2022, but an iteration of this is being developed, which will allow for early procurement of specialist equipment to support accelerated delivery of the Clinical Living Labs within the Belfast Trust. This is due to be submitted in FY 23/24.

This is only one (albeit significant) area for CHIC's future potential to be direct. Others include the opportunities associated with EU Horizon Funding, SFI Co-Centres and many other competitive funding routes. On the balance of consideration between Benefit to Cost Ratios, Return on Investment and emerging initiatives, the evaluators do not see a rationale for a CCP programme.

6.5 Implementation of the interim evaluation action plan

CHIC phase II Business Plan outlined the key reviews and changes made resulting from the Interim Evaluation. These are outlined in Appendix 9-1. Some key changes are recapped here.

Annually CHIC carries out a benchmarking activity against other similar institutions according to three variables, these being Academic Output, Commercial Relevance, and Health and Clinical Impact. The rationale was this is detailed below. It was noted in CHIC 2 Annual Reporting documentation that up-to-date comparative data for other institutions is difficult to obtain and so the information provided is based on incomplete data. Nonetheless, the June 2022 comparison showed that CHIC is one of the top two institutions for all measures except for "patients impacted per £100m". This corresponds to high performance in both the academic output and industry relevance comparators.

[63] BRCD Annual Report 2022/23
[64] https://www.brcd-innovation.co.uk/projects/cdht

Academic Output Comparator	*This will compare the level of academic outputs such as patents, publications and academic impact.*
Commercial Relevance Comparator	*This will compare the level of engagement, growth of SME's, ability to support new start-ups and engagement with Larger Companies*
Health and Clinical Impact Comparator	*This will compare the relevance to healthcare improvement and the ability to accelerate access to Healthcare for the exploration and adoption of new technologies.*

In addition, an International Advisory Board was established, supplementing the findings of this benchmarking exercise. Given COVID-related disruption, only one in-person meeting has occurred. Nonetheless, this displays the value of international partnerships formed and ad hoc communications, which consultees spoke highly of.

In line with the recommendation to focus on the future sustainability of CHIC operations, a 15% budget was approved by the CHIC Programme committee and Invest NI to focus on identifying and pursuing domestic and international funding opportunities. This was, in light of the role of researchers' strategic and consultancy roles, increased to 20%. The prospects identified during consultations, such as significant value projects occurring in healthcare settings which CHIC is pursuing, demonstrates the value of such work.

6.6 Recommendations

The primary and secondary research phases of this evaluation have led to several lessons learned from delivery of CHIC phases I and II. Implementation of the following action points could help to further leverage the impact of CHIC as the centre transitions away from Invest NI CCP funding.

- **Ensure a continuum between CHIC and related BRCD projects, particularly CDHT and I-REACH:** Leverage alignment between phase II projects, CDHT and I-Reach prospective projects and stakeholders. Incorporate CHIC lessons learned and best practice into the revised Outline Business Case for CDHT, its subsequent Full Business Case, and the Full Business Case for I-REACH. Ensure that any areas for synergies and identified and monetised insofar as possible. Consideration of the use of CHIC research base and brand name in these projects, and the legacy value of this, should be reported on, given the positive impact this is likely to have on ROI for Competence Centre Programme funds. Ensure ongoing communication between CHIC stakeholders and BRCD representatives to leverage the work conducted to date by CHIC.
- **CHIC to compile funding and opportunity mapping for members and alumni, actively facilities introductions and networking opportunities:** CHIC core staff should leverage their market knowledge to compile a business development register to map potential and 'live' funding opportunities for CHIC member companies, affiliates and alumni. This should include a non-member register of 'affiliate' companies and entrepreneurs, who represent future, prospective members and interested parties. This register should consider alignment with UK Catapult stakeholders, the Enterprise Ireland Technology Centres and the Science Foundation Ireland Research Centres as well as Northern Ireland Life and Health Sciences stakeholders. The geographic remit of this should extend to include collaborative research opportunities and partnerships with sister centres in benchmark jurisdictions to secure competitive funding, such as partnering to secure EU Horizon or SFI co-centre funding, for example.
- **A detailed KPI framework informed by compulsory baseline, progress and post-participation metrics:** a data collection agreement should be a pre-condition of CCP participation. This would help to ascertain the impact that Invest NI funds are having, particularly in the context of a large weighting of non-NI companies, to ensure that

economic benefit is being obtained for NI public money. This could be via various avenues, such as exporting opportunities, trading relationships and knowledge sharing being secured via the consortium arrangements between NI and non-NI companies. Tracking this should be prioritised. In addition, CHIC staff should conduct 'follow ups' with alumni to ensure tracking of CHIC impact past the obligatory reporting period, given the long-time lags associated with returns to healthcare innovation funding.

- **Compile, update and report on an Outputs and Outcomes log:** compile and update an outputs and outcomes tracker to monitor progress and benefits, including independent of that mandated by Invest NI/funders. This should be via reference to the LOGIC model approach. This should make use of the established International Advisory Board, leveraging their knowledge of KPIs and outcomes, particularly from centres with a longer trajectory than CHIC.
- **Ensure detailed reporting of agreed KPIs; consider rationalising this if prohibitively time-consuming:** limited information is given in some quarterly reports for phase II in relation to KPI attainment. Under COVID-19 restrictions, in-kind contributions were recorded below 10% for 2 consecutive quarters pausing researcher spend. This has resulted in a large lag in capturing company contribution, along with the non-linear nature of company contribution and lack of CHIC admin. The seven company-related KPIs are attributed a RAG status rather than any explanatory information being given as to why attainment may be below target (e.g. concerning academic/business joint publications). This provides limited oversight to Invest NI and a more comprehensive reporting style should be encouraged.
- **Ecosystem management to ensure representation of microbusinesses and realisation of projects:** entrepreneurs and micro enterprises should continue to be prioritised in outreach efforts, with consideration given to waiving contributions or allowing them to join on a pilot basis. Efforts to tackle absorptive capacity of SMEs should be considered.
- **Evolve the measurement of success towards non-monetary, socioeconomic benefits:** It should be noted that socioeconomic cost-benefit analysis is common place (and recommended) in the business case process, in line with HMT Green Book and NI Better Business Case Guidance. The usual approach is to quantify the QUALY (Quality Adjusted Life Years) improvement resulting from healthcare research. This approach should be adopted to not only CHIC's operations, impacts and VfM, but also the individual projects within the funding award process. CHIC should provide training to an appropriate individual within the centre management team / wider QUB team.
- **Reconsider KPIs in light of non-monetary benefits and prominence of strategic projects:** the prominence of strategic projects in CHIC's activities highlights the need to reconsider KPIs and industry requirements being uniform across projects, given that the interim evaluation recommended continuing pursuit of this type of strategic project. Separate KPIs should be devised strategic projects, reported separately from the core projects and centre operations.
- **Prioritise attainment of in-kind contribution levels:** increasing the level of in-kind contributions to target (or close to target) level should be a priority for centre management. Centre management should leverage their relationships with industry to monitor in real time, project-by-project, these contributions, with catch ups scheduled as needed with consortium members. A consultation should be carried out with members regarding IKCs and consideration given to applying a tiered contribution requirement, depending on project type, company size and resources.

7. Northern Ireland Advanced Engineering Competence Centre

7. Northern Ireland Advanced Engineering Competence Centre

7.1 Background to NIAECC

The Northern Ireland Advanced Engineering Competence Centre (NIAECC) was established in September 2013, building on the findings of the both the Centres of Excellence Evaluation (2007) and the recommendations of the Matrix panel. One opportunity identified by the Matrix panel as an area of growing potential supported by a world class research base in NI was advanced engineering. NIAECC was established as a limited company with a specific focus on composites

The Centre was hosted by the Northern Ireland Advanced Composites and Engineering Centre (NIACE), with collaboration from partners including Queen's University Belfast and the University of Ulster. It was granted initial funding of £5m for a five-year period from Invest NI. This was extended on a one-year no-cost basis until February 2020, when NIAECC operations drew to a close. This chapter evaluates the performance of NIAECC over this period and considers its legacy impact; particular emphasis is placed on the lessons learned from the challenges faced and how this knowledge can inform future endeavours.

NIAECC's four strategic objectives were as follows:

- Develop local businesses
    - Enable NI based companies to increase their exports;
    - Position the Centre so that it is central to local government policy on business
    - development;
    - Support the formation of spin-out companies; and
    - Assist companies to source development funding.
- Develop local skills
    - Position the Centre so that it is central to local government policy on
    - Employment & Learning;
    - Facilitate the teaching of 'hands on' practical skills;
    - Establish regular placement of university students and Research Associates
    - within companies;
    - Provide support for companies to develop Company Professional
    - Development programmes;
    - Facilitate teaching of strategic/technology road mapping to companies.
- Develop and encourage innovation
    - Position the Centre so that it is central to local government policy on R&D;
    - Increase the number of businesses actively taking part in R&D;
    - Assist companies in getting funding to conduct R&D;
    - Form links with other centres and conduct joint projects;
    - Provide opportunities for companies to receive information about the latest

- Developments in for example new materials, processes etc.

- Achieve national and international recognition
  - Achieve recognition as a centre of excellence in advanced composite and
  - metallic technologies;
  - Generate international links & networks;
  - Support businesses in entering innovation awards.

7.2 NIAECC delivery and governance

NIAECC secured Invest NI Board Casework Committee approval on 12 June 2013 and commenced operations in February 2014.

The guidelines within which the centre manager operated were received from Invest NI in written form in 2018; this was four years into the operational period of the centre. Prior to this, a lessons learned log was kept and updated on an ad hoc basis by Invest NI. Timelier receipt of formal guidelines could have streamlined processes and increased transparency.

Consultations did, however, reveal in interactive, engaged Centre governance structure and procedures. The centre was governed by a steering committee and board, with membership from a variety of academic and industrial backgrounds.

NIAECC governance was composed of a Board, Centre Manager and Technical Committee. **The Board** were to meet every quarter. Members included an independent chairperson, one Director from each member company, a representative from each university, an observer from Invest NI and the Centre Manager (the latter two were non-voting)**.** Their role was to:

- Identify research themes and review these annually (note that the evaluators saw only two research strategies composed of the initial 2013 strategy and 2015 update, the latter of which was not found to differ in substantive ways);
- Allocate funding to projects in line with this strategy through the funding offer letter;
- Monitor progress and budget;
- Provide relevant advice and guidance to the Centre manager;
- Use influence and authority to assist NIAECC in achieving its targets;
- Identify potential conflicts of interest and make recommendations in respect; and
- Appoint an Independent Chairperson to the satisfaction of Invest NI.

The Centre Manager was a focal point of contact for NIAECC member companies, as well as the liaison point with Invest NI. Their responsibilities included:

- Recruiting new members, including marketing and PR coordination
- The point of contact with Invest NI
- Co-ordinating and developing research programme themes with industry
- Co-ordinating project applications for collaborative research projects, as well as leveraged (external) funding signposting and applications
- Project management and linking academia and industry
- Facilitating network opportunities
- Preparing budgets and quarterly reports
- Pricing research commercialisation (in conjunction with NIAECC Board)

The Technical Committee reported to the NIAECC Board. Meetings were set to occur at least every six months, but by 2016 had been occurring at least quarterly[65]**.** Key tasks that the Technical Committee performed included:

[65] NIAECC Centre Report for International Experts 050816

- Reviewing and prioritising research project proposals to the Board for funding
- Reviewing and proposing the research strategy to the Board, including any emerging areas of potential
- Monitoring and reporting of project progress to the Board

7.2.1 A note on NIAECC and NIACE

Both internal and external governance and industry stakeholders were confused about the separation and overlap of NIACE and NIAECC. This relationship merits an explanation, given that it was a material factor in the activity underperformance of NIAECC phase I and the failure to progress to a phase II Business Plan.

NIAECC was co-located at NIACE, adjacent to Bombardier (now known as Spirit Aero). NIACE pre-dated NIAECC and was jointly owned and operated by QUB and UU, having been awarded £6m of funding by Invest NI, the Department of Business, Innovation and Skills (DBIS) and Bombardier. The Invest NI casework approval for NIAECC (June 2013) cites only capital funding being provided for NIACE, with its long-term sustainability and impact being dependent upon the projects that would occur in NIAECC (i.e., an operational stream). It was anticipated that the Competence Centre would represent only one such operational stream in NIACE (accounting for no more than 5%-10% of the total value of R&D conducted).

Whilst accounts of NIACE were not made available, nor considered to be essential for this evaluation, it is likely that NIAECC ended up playing a much more significant role in the operations of NIACE than anticipated (and vice versa). Consultees described NIAECC as being seen as a centre within a centre and as simply a funding stream for it. The similarity of acronyms was also indicative of the confusion and lack of individual identity. Companies paid an annual subscription fee to NIACE, which then permitted them to become members of NIAECC also; in this way, all NIAECC member companies were also members of NIACE. The key industrial stakeholders were also dually represented in both boards.

Despite the significant overlap, NIACE and NIAECC operated two separate management boards, each with their own administrative burdens such as quarterly KPI reporting. This increased bureaucracy was a significant issue for companies and participants of the centres' co-location, serving to increase operating costs without any corresponding rise in impact. For example, the Centre Manager reporting to two separate boards, and several members having to attend two sets of meetings and file two sets of paperwork. This was both time and resource intensive, causing disillusionment among representatives.

7.3 NIAECC Activity

7.3.1 KPI attainment

NIAECC reported quarterly to Invest NI on a pre-determined set of indicators, covering both industrial and research-related activities. In general, KPI attainment was positive, with commercialisation attainment being an exception (as occurred across the competence centres). It is worth noting the large demographic of companies engaged with NIAECC; these firms are less likely to carry out research resulting in novel discoveries in the centre, given the resulting IP would rest with the host institution (QUB). Therefore, the benefits are more likely to result from knowledge sharing, industry-wide innovation advances and the 'learning by osmosis' that SMEs undergo from working alongside these larger counterparts (and new business and supplier relationships connected to this).

NIAECC also experienced notable underperformance some aspects of activity, which was the only occurrence of this within the Competence Centre Programme. Whilst the total collaborative research projects carried out was within target (24 vs target of 20-30), the number of members was half that of the intended target (10 out of a potential target of 20).

The outturn rate of IKCs as a share of total research project costs was only marginally lower than projected (22% vs 25%). This compares favourably with other centres and aligns with the benefit reported in consultations of companies learning from consortium partners, particularly from the larger, multinational companies who were present.

Table 7-1: NIAECC performance against KPIs

Performance Indicators	Initial 5-year target	End of phase result	
Number of persons employed	1.75	1.34	
Ratio of industry staff costs as % of total in-kind contribution	50%	79%	
External (National/EU) Leveraged Funding	£3.375m	£5.277m	
Industry funding + others - cash contribution from industry	£149,000	£155,820	
Overall Industry in-kind contribution as % of total research project costs	25%	22%	
Issue licence agreements	7	0	
Established spin-offs	2	0	
Activity indicators			
Active participations at national/ international conferences and seminars	NOT TRACKED		
Publish academic publications	16	25	
Total companies engaged	Up to 20	10	
Total research projects	20 to 30	24	

Source: NIAECC KPIs Y1-6

Following recommendations from the mid-term evaluation, international conferences and memorandums of understanding did not feature as a target within the final KPI report (including year 6, the one year no cost extension). Given the small membership size of the centre (considerably smaller than the others in the programme) and the concentration of activity in fewer enterprises, this is potentially an appropriate exclusion from the KPIs.

Following analysis of both the monitoring data and takeaways from the consultations, it is clear that NIAECC featured significant representation of large firms (250+ employees). This is both reflective of market share in the advanced engineering field in NI, as well as influenced by the centre's delivery structure and relationship with NIACE.

Given the heightened benefits of R&D&I support for micro and smaller firms, any future intervention should field SME representation within the KPIs and measure of what success looks like. For example, a KPI could have been to reach out to smaller firms and engage micro and SMEs in NIAECC activities, with a target of e.g. five new micro firms becoming members per annum. Consideration should also be given to assess financial barriers such as high membership fees, to encourage engagement. It could also be included in the membership agreement/commitment for large firms that they must engage in consortium agreements only with other SMEs, or employ a consortium 'mix' approach, whereby at least one firm must be micro.

7.3.2 Budgetary considerations

Aligned with other centres, the projected budget for NIAECC was composed of two strands: core expenditure, with 75% grant funding from Invest NI, and research expenditure, with 100% Invest NI grand funding.

- Core funding covered the daily operations of NIAECC, including the Centre Manager's salary, alongside any other administrative staffing expenditure. This strand was projected to total

£596,227 (Invest NI contribution of £447,170). The shortfall was intended to be met via industry cash contributions and membership fees.

- Research funding relates to the university-affiliated costs for conducting research. Industry contributions to this strand were via in-kind contributions of staff time and/or equipment usage. The university elements of the projects were supported at 100% by Invest NI; the figure forecasted for this was £4.55m.

Budgetary analysis by the close of NIAECC operations, in February 2020, shows significant underspend, with 56% of grant expenditure, and 58% of total expenditure, being drawn down.

While one element of the primary engagement process suggested a lack of awareness regarding this underspend, and why it was not used for a reviewed/interim continuation of NIAECC operations (particularly given the interconnectedness of NIAECC operations, stakeholders and partnerships with the Belfast Region City Deals AMIC project), Invest NI have noted that the NIAECC board was aware that further extensions could not be considered given the lack of progress on the implementation of the recommendations of the interim evaluation. For the purposes of this evaluation, document review shows that budgetary spend was in line with the project proportions, but that an acute underspend restricted the reach of NIAECC operations and impact.

Table 7-2: NIAECC budgetary performance

Element	Phase (I)
Total grant paid (offered)	£2,800,853[66] (£5,000,000)
Maximum expenditure incurred (projected) [67]	£2,982,571[68] (£5,149,057)
Of which[69]:	
Core staff	*£543,066.01*
Other core costs	*£142,473.79*
Research staff	*£1,344,068.49*
Research overheads	*£614,648.44*
Other research costs	*£338,314.27*
Industry cash contributions (projected)	£161,040 (£149,000)
Invest NI funding	
Core grant paid	*£503,821.32*
Research grant paid	*£2,297,031.20*

Source: Invest NI, Grant Thornton analysis

7.3.3 Research strategy

The evaluators received two documents in relation to NIAECC's research strategy: the original 2013 strategy implemented when the centre was established, and a 2015 update that accounted for the evolving objectives of NIAECC's growing membership base.

The core focus areas were the same across both strategies, confirming the relevance of the themes at centre outset, upon which the business plan was based. A process of connecting each core focus area to corresponding 'continuing focus (sub)areas' and associated business product and service

[66] Terms of reference

[67] Excludes in-kind contributions. Includes total expenditure, with Invest NI funding representing 25% of 'core' funding and 100% of research funding.

[68] Terms of Reference

[69] There was a shortfall of the budgetary figures reported in the May 2020 quarterly report (the most recent one made available to the evaluators) and the final expenditure figure presented in the TOR, published 2023, which has been assumed to be correct. This shortfall has led to a scaling up figure of 117% being applied to all costs.

outcomes ('areas (that) can generate results which could be potentially implemented into industrial processes within the shortest amount of time and contribute to key business governing factors') was featured. The four core focus areas were as follows:

1. Large Composite Components
    a. Bonding of composites and other materials
    b. FE Modelling limitations
    c. Manufacture of complex preforms
    d. Inspection/Damage identification
2. Future Smart Systems
    a. Developing analytical and numerical models to predict physical aspects such as damage
    b. Developing models which can calculate potential material and process costs thereby facilitating 'live' trade studies
3. Virtual Materials Design Systems
    a. Formulation and manufacture of new material combinations
    b. Develop areas where knowledge levels are particularly low e.g. Thermal and electrical properties
    c. Utilising empirical information to develop statistical based models to simulate testing
    d. Develop non-linear finite element models of the top 15 ASTM tests covering all the basic properties needed for manufacturing materials.
4. Design for Use – Cradle to Cradle
    a. To develop the tools and processes needed to integrate life-cycle issues with early design models to facilitate design for use and allow value through life to help create design.

Analysis for each core area was carried out relating them to the interests and expertise of the current and prospective member companies. For example, it was noted of 'large composite components' that several member companies had expressed an interest in developing related innovations and processes in this area, but also that other members already had previous experience working within it. '*As such there is the potential to utilise existing knowledge and capabilities within these companies as well as using their knowledge as a reference point for project guidance*.' This shows a collaborative approach to forming a research strategy that prioritised commercial benefit and knowledge transfer.

7.3.4 Marketing and Recruitment

NIAECC's research strategy required academics willing to carry out the research and industry members willing to collaborate on them. As established in the KPI overview, NIAECC membership was around half of the target figure (10 vs 20), thereby limiting the extent to which industry were coming forward with commercial problems that required innovative, researched solutions.

Due to the operational and delivery structure of NIAECC, where several large firms were involved from the outset, this lack of recruitment/awareness translated to an overrepresentation of large firms (250+ employees in NIAECC). The share of SME members was 55%, compared with the CCP average of 72%. The centre was fully composed of companies with a presence in NI (including multinationals), compared with the programme average of 18% non-NI members. They were also 91% Invest NI client companies, which far exceeded the average of 43%. This shows a lack of outreach to new SMEs and start-ups within advanced engineering, who would not have been aware of the competence centre programme and had no prior engagement with Invest NI / receipt of support. Any R&D&I supports given to this cohort represents enhanced additionality and knowledge transfer, particularly in light of the large size and profile of member companies. The lack of non-NI members may also represent a missed opportunity for dissemination of NIAECC activities and NI's profile in this space, as well as the introduction of new perspectives in consortium projects.

Table 7-3: NIAECC activity and recruitment

Participant demographics	Share	CCP total
SMEs	55%	72%
Large companies	45%	28%
Invest NI client companies	91%	43%
Share NI companies	100%	82%
Share non-NI companies	0%	18%

Source: NIAECC quarterly tracking data; Invest NI data; Grant Thornton analysis

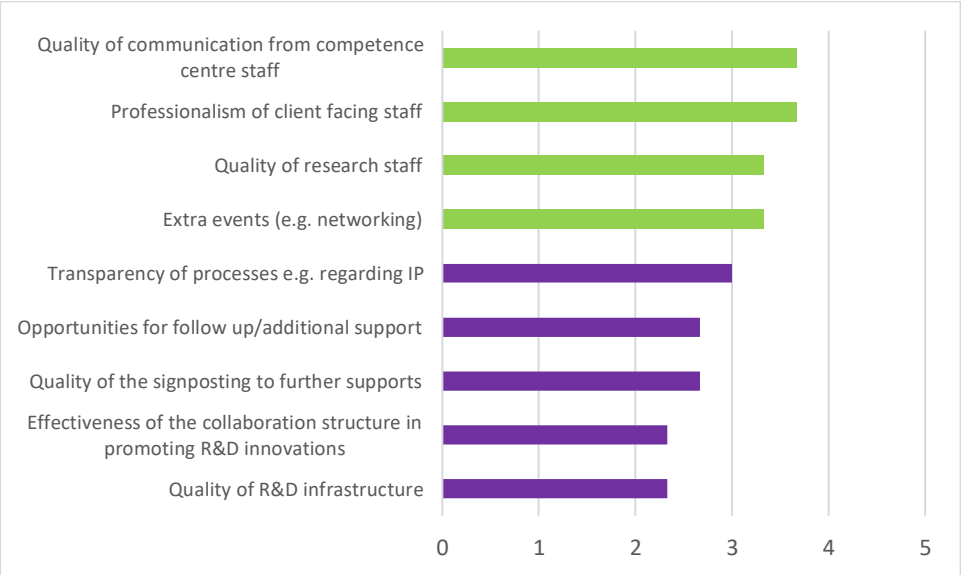
7.4 Perspectives on NIAECC

7.4.1 Satisfaction with the programme elements

When asked to report their satisfaction with various elements of NIAECC, only four of the variables were given a 'positive' rating. These were all related to the research and centre staff, which is testament to their impact and efficiency, and aligns with the stakeholder discussions held. Networking events were also rating positively, showing the close 'learning by osmosis' and appreciation of the importance of connections within the centre membership.

However, the remaining elements – particularly relating to the effectiveness of the infrastructure (which may relate to much of the equipment being owned by NIACE / other member companies via NIACE) and the effectiveness of the centre structure in promoting innovation, were rated poorly. This shows the impact that the lack of clarity in NIAECC delivery and operating structure had on daily activities. Survey respondents echoed the impact of this confusion and inability to fully utilise equipment in the centre.

Figure 7-2: Reported levels of satisfaction with programme elements (average satisfaction levels)



Source: Grant Thornton analysis (n=3)
Green indicates a score of >3.0 (i.e., satisfaction with the respective element)

Note: The scale used throughout 'opinion questions' is 1= Very Dissatisfied, 2=Dissatisfied, 3=Neutral, 4=Satisfied, 5=Very Satisfied

Overall, the average response when asked to react to the statement that NIAECC participation represented value for money (VfM) was 4, this being a neutral 'neutral agree nor disagree' on a scale of one to seven. This does, however, mask extremes of opinion, with one respondent citing 1 whilst another cited 6. This perhaps reflect the varying outcomes based on company size and level of involvement with NIAECC from its inception. Similarly, when asked whether their objectives had been achieved in the centre, conflicting answers were given (from yes to 'not at all'). Ongoing feedback processes ('360 feedback' and real time collection and actioning, if necessary) could act to level the playing field and avoid such extremities of experience and impact.

7.4.2 Outcomes and Benefits

The level of reported activity additionality in the survey was the lowest of the centres, at 25%. This may be owing to various factors already discussed, such as the lack of clarity in the NIAECC-NIACE relationship, this being to some extent outside the control of NIAECC stakeholders once the centre had been established.

However, it may also be owing to the characteristics of the industry, and the demographics of the membership based. It was dominated by large companies, with SME representation lagging behind. One survey respondent pointed to the heightened need that SMEs have for assistance not just with R&D&I, but also with forging connections and becoming involved in business development activities: *'Focus should be on smaller companies; Smaller engineering firms found picking up phone intimidating to ask for help – need INI (Invest NI) to be aware of opportunities to promote and connect larger and smaller firms'*. Some of the benefits that were reported from the primary engagement included:

- Talent benefits, including the upskilling of the current workforce (e.g. through the in-kind contributions), staff retention and increased access to talent
- Knowledge transfer and benefits from academic perspective/input
- Development of new (or enhancement of existing) products and services, including the development and testing of prototypes, process and efficiency improvements, and heightened commercial relevance of these
- Development of a peer cohort grouping of likeminded companies/researchers
- Business development benefits, such as increased markets access and consumer base
- Increased reach of/returns to R&D investments
- Strengthened peer network of likeminded businesses. Informal contact building and networking, through collaborative projects and NIAECC events, was seen as a key benefit to NIAECC membership.
- Companies becoming more active in R&D due to an attitudinal change. Prior to NIAECC, the general consensus had been that getting involved was expensive, costly and difficult to justify financially. The centre made businesses, particularly smaller ones, more aware of R&D being broader.

7.4.3 Commercialisation arrangements

The state aid regulations governing the CCP applied in the same way to NIAECC as to the other centres, meaning that any resulting IP remained with the competence centre. NIAECC's business plan outlined aspirations that the predominant form of IP created would be in the form of patents; none, however, resulted during the centre's lifetime. Subsequent measurement of IP in phase II of other centres (CASE) has taken the form of Invention Disclosure Forms. Conversion of IDFs to patents was also tracked as a longer term performance metric. This illustrates that the attainment of patents was perhaps not feasible.

The business plan also detailed the reasons for ownership of IP remaining with the universities *'…as they have the appropriate policies, procedures and resources available to manage this'.* However, consultation and survey findings reveal that there was a low awareness level among members in relation to such policies and procedures. Any future phase could have benefited from increased focus on refining policies, ensuring feasibility of targets and KPI measurement, and raising awareness of routes to IP rights among members. No spin-offs were established, nor were any licenses granted. Consultees were aware of the constraints caused by state aid regulations.

7.4.4 Lessons learned

Across the primary engagement undertaken, participants felt that several 'lessons learned' could be taken from the operation of NIAECC. These are important to bear in mind for future endeavours related to the advanced manufacturing fields in Northern Ireland, namely the AMIC / Factory of the Future facility. They are as follows:

Table 7-4: NIAECC lessons learned

Challenge	Explanation	Solution
Dominance of larger companies within the forum	The skew towards larger companies led to an overrepresentation or steer towards certain strategic priorities within NIAECC's agenda. Smaller companies benefitted from working alongside large companies such as Bombardier in NIAECC. However, these smaller counterparts– particularly micro and entrepreneurs, were not prioritised in the recruitment / marketing / outreach efforts. As such, they were underrepresented and were largely unable to benefit from NIAECC's activities, representing a one to one, rather than one to many, style of assistance. This limited NIAECC's impact, given that NI is an SME-dependent economy.	Given the heightened benefits of R&D&I support for micro and smaller firms, any future intervention should field SME representation within the KPIs and measure of what success looks like. For example, a KPI could have been to reach out to smaller firms and engage micro and SMEs in NIAECC activities, with a target of e.g. five new micro firms becoming members per annum. It could also be included in the membership agreement/commitment for large firms that they must engage in consortium agreements only with other SMEs, or employ a consortium 'mix' approach, whereby at least one firm must be micro. The scope / absolute impact (net additional GVA generated, 'n' participants involved etc) rather than just ratios (ROI and BCR) is an important consideration for the breadth of economic impact. This is increasingly important in the context of R&D innovations, to raise the critical mass of innovation capacity, as well as awareness in NI and abroad of the capabilities/potential. Detailed stakeholder consultation, demand analysis and sensitivity testing should be carried out as part of the appraisal process prior to approval and release of funding for future projects.
Tensions between participant universities	The tensions between partner institutions, namely the University of Ulster and QUB – introduced challenges and frictions from the outset of	This displays the critical nature of a detailed management case to be conducted, as is prescribed by the HMT Better Business Case guidance. This would consider (and consult via

Challenge	Explanation	Solution
	NIAECC. This was largely due to the pre-existing partnership agreements, which attributed shares of equipment donated to NIACE, which was used in the competence centre. Instances of bids from rival researchers for the same collaborative project were cited, which at times created a competitive environment that worked against the aim of knowledge sharing.	workshops and one-to-one consultations) key stakeholders, and account for the risks of such tensions, attributing a responsible owner for each risk category. The core researcher model is also relevant here, as a way of avoiding the tensions resulting from rival bids being submitted. This could also have fostered a culture of knowledge sharing, with representatives from both universities, which appeared to begin to be implemented at the end of the three year period.
Lack of a core research base to draw on	During some consultations, a view of academia at times being difficult to approach/coordinate for industry projects was expressed. At times it was difficult to locate the specialists required for specific projects, with the quality of academic expertise varying according to the type of project (given that specialisms may have been concentrated in specific fields). Researchers were recruited on a project by project basis, so this matchmaking exercise was required for each collaborative project, was time consuming and with mixed success. A small funding allocation for core researchers was agreed for QUB and UU who would undertake industry engagement, project development and feasibility work. It was felt that further support would help to build specialisms in key areas.	For any future venture, thought should be given to adopting the core body of researchers/PhD fellows, as CHIC has employed. This should feature a career development plan for research staff, to locate and encourage areas of specialism; the centre's research strategy should be cognisant of this and align with identified specialisms and interests of the available research base.
Lack of identity of NIAECC as a unique entity; confusion between NIACE and NIAECC.	NIAECC was seen as a centre within a centre, being co-located at - and dependent on - NIACE. NIAECC was seen as a funding stream for activity within NIACE, rather than a venture within its own right. Companies paid annual subscription. For the majority of members, this permitted them to be members of both NIAECC and NIACE. A confusing situation emerged involved two entitles, two	Given that NIAECC was established post-NIACE being operational and known within the marketplace, but dependent on its physical infrastructure, it was very difficult to find a workable solution for this interdependency after the fact. This ultimately was a key reason for NIAECC being closed at only 60% spend of projected budget. Moving forward for future projects, due diligence conducted as part of the business case should include a detailed management case. This should clearly include an organogram and benefits

Challenge	Explanation	Solution
	governance structures, a largely overlapping membership base, dual requirements to report KPI, but largely one 'identity'. Consultations revealed a great deal of confusion even for those involved in the Centre's operations, but particularly for industry.	realisation plan with responsible owners. Any risks and lack of clarity regarding delivery structures should be given due attention and either mitigated, addressed or amended prior to release of funds, to avoid issues connected to delivery and organisation structure. It is noteworthy that the interdependency with NIACE was not highlighted as a risk in the ministerial submission for NIAECC.
Stakeholder buy in, both in terms of industry and academic parties, is key for the centre's success in terms of impact.	Despite moderate impact estimated by the economic modelling (BCR of 1.2), this is overshadowed by the underspend and, as such, lower breadth and scope of this impact. A failure to reach out to and recruit larger numbers of micro and SMEs is a key factor, with only ten companies benefitting from NIAECC's operations.	The scope / absolute impact (net additional GVA generated, 'n' participants involved etc) rather than just ratios (ROI and BCR) is an important consideration for the breadth of economic impact. This is increasingly important in the context of R&D innovations, to raise the critical mass of innovation capacity, as well as awareness in NI and abroad of the capabilities/potential. Detailed stakeholder consultation, demand analysis and sensitivity testing should be carried out as part of the appraisal process prior to approval and release of funding for future projects.
Ongoing engagement with policy stakeholders is key to driving impact	The connections, partnerships and lessons learned from NIAECC should not be forgotten, given the insights they could afford to developments such as City Deals. To date, industry stakeholders consulted expressed a lack of awareness surrounding the AMIC project. Future boards should ensure appropriate representation of industry. For example, on the board of the National Composites Centres there is one academic appointee, with the remainder coming from industry.	Ensure that the voice of NIAECC alumni and stakeholders is heard. This could be via their incorporate in the Maker's Alliance, an independent industry-led body tasked with driving the strategic development of the Advanced Manufacturing sector in Northern Ireland.[70] This provides a forum for engaging with industry, to keep them ensured, ensure their alignment with the objectives and goals of developments (such as AMIC) and fully tap into the lessons learned from NIAECC.
IP creation was suboptimal, particularly when measured according to the KPIs set (spin offs and licenses)	The KPIs were not feasible when considered in NIAECC's operating context. The evaluation also found a low awareness level among members in relation to IP policies and procedures.	Any future phase could benefit from increased focus on refining policies, ensuring feasibility of targets and KPI measurement, and raising awareness of routes to IP rights among members.

[70] https://www.investni.com/media-centre/news/establishment-new-makers-alliance-announced

Source: Grant Thornton analysis of primary engagement

7.4.5 Economic Impact Return on Investment & Value for Money (VfM)

NIAECC's ministerial submission noted *'As the benefits from Competence Centres accrue over a longer time period, it is not possible to fully quantify/monetise all of the impacts of NIAECC at the outset of the project for inclusion in the Economic Efficiency Test (EET). White the EET is an effective method to quantify the potential economic value of Grant for R&D projects and is the best tool currently available, measuring the full long-term economic benefit of Competence Centre projects is beyond its scope.'* This aligns with the literature studying the impacts of competence centres and benchmark evaluations carried out, particularly given the structure of the NI Competence Centres (such as the limited time frame and the IP rights resting with the centre, as opposed to e.g. the Catapult network). No consideration is given to future benefits, rather the analysis is undertaken on 'pre' and 'post' programme. Therefore it is anticipated that further benefits will be realised over the longer term, with costs having been fully realised.

Nonetheless, a potential economic impact assessment has been carried out for NIAECC, based on sample tracking data provided by Invest NI. This was combined with measurements of additionality. However, given that some of the projects occurred up to nine years ago, the measurement of this impact is imprecise and should not be relied on. A potential £3.34m in economic impact was generated, given an ROI of 0.2, or BCR of 1.2. This compares favourably in the context of the overall programme, but the scale of the impact is lesser due to the limited funding drawdown and number of member companies.

A potential additional £435k in BERD was also generated as a result of NIAECC participation; this represents an 18.3% growth since the 2017 baseline. Given that NIAECC commenced operations in 2014, the total BERD impact is likely to be larger than this.

Table 7-5: NIAECC economic impact

	NIAECC	
Impact variable	Results	
GVA impact		
Additional turnover, net	£	6,572,263
Economic impact (GVA), net	£	3,344,296
BCR		1.2
ROI		0.2
BERD impact		
BERD activity generated, net	£	434,962
BERD growth (%)		18.3%

Source: Invest NI monitoring data, Grant Thornton analysis, NISRA

7.4.6 Equality Considerations

The Evaluation Team's review of NIAECC and its activities indicates that centre participation is available to any Northern Ireland small, medium or large company with appropriate innovation ambitions and relevant proposals. Overseas owned/based companies are also eligible to come participants/members, where it can be demonstrated they will strengthen the consortium and bring technical/economic benefits to Northern Ireland and/or support the internationalisation of the Competence Centre. As such, it is the Evaluation Team's assessment that the NIAECC Centre complied with all elements of equality promotion set out in Section 75 of the Northern Ireland Act 1998 and by Invest NI in their Equality Scheme.

7.4.7 NIAECC Economy, Efficiency & Effectiveness

In considering the economy, efficiency and effectiveness of NIAECC, the following points were noted:

Table 7-6: Economy, Efficiency & Effectiveness Analysis (NIAECC)

Measure	Analysis
Economy The Economy measure is concerned with measuring the impact of the programme at an appropriate level of input i.e. impacts have been obtained at the best VfM	The overall CCP, and NIAECC individually, was subject to an economic appraisal, business plan and robust internal casework process. It was also subjected to a detailed interim review with an international advisory panel. These foundations were used by Invest NI to assess best practice and operational efficiency in terms of delivery, as well as helping to understand the potential outcomes being generated and challenges faced. This represents a high level of scrutiny and stakeholder input, whilst allowing for the operational autonomy of NIAECC. NIAECC used its own internal procurement processes throughout its operational period, given the arms' length nature at which Invest NI operated. The guidelines for this were provided in the Letter of Offer at project outset. NIAECC participation required both cash and in-kind contributions from companies. This both reduced Invest NI's outlay, as well as incentivising commitment from companies. By NIAECC close out, company contributions totalled £426,000, with £161,040 in industry cash contributions and overall in-kind contributions representing 22% of project costs. The economic impact that has been calculated suggests a potential economic return of £0.20 for every £1 of Invest NI funding of NIAECC. This represents a return on investment of 0.2. A potential additional £435k of BERD was incentivised by NIAECC activities, representing an increase of 18.3% from baseline.
Efficiency The Efficiency measure looks at measuring the impacts relative to the level of inputs i.e. has the maximum level of output been achieved for a reasonable level of input	A total of 17 companies participated in NIAECC, carrying out 24 projects during the operational phase. This exceeded target of minimum 10 companies, but only marginally. The cost to Invest NI per business was £255k. It is worth noting that only 56% of the grant approved in the NIAECC business plan was drawn down. Despite this, the potential ROI was calculated as being positive (0.2).
Effectiveness The Effectiveness measure is concerned with understanding the level of impact the programme has achieved relative to aims, objectives, etc.	As established by stakeholder consensus, as well as in the interim evaluation, the delivery structure of NIAECC – in particular, the overlap with NIACE – caused significant confusion. This was a key reason why the centre, despite being impactful, did not reach capacity and achieve higher output results/reach more companies. This was a key constraint in companies achieving their objectives, which were also intertwined with the objectives attached to NIACE membership at outset.

Source: Invest NI & Grant Thornton Analysis

7.4.8 Considering the future of NIAECC

NIAECC's operations drew to a close in February 2020, having faced difficulties in implementing the recommendations of the Interim Evaluation. Subsequently, throughout the survey and consultation process, discussions surrounding the future of NIAECC focussed on the centre's legacy for future initiatives. Chief among these is the Belfast Region City Deals Advanced Manufacturing Innovation Centre (AMIC) Factory of the Future. This project is currently at Full Business Case stage. The facility represents £95m of funding in total, making direct use of the infrastructure and equipment at NIACE and NITC. Given the links between NIACE and NIAECC, the connections and links formed during the lifetime of NIAECC will provide an important basis for AMIC. Incorporating NIAECC centre stakeholders (such as previous managers and board members) into the 'Maker's alliance' (if not already occurring), which is a forum for engaging with industry and consulting them regarding the City Deals progress, would be prudent given their insights and experience. To confirm, the evaluators conclude that Belfast Region City Deal activity removes the rationale for and consideration of NIAECC.

Any future collaborative research activity carried out by NIAECC or its stakeholders should be cognisant of emerging areas of potential. These could include circular and sustainable manufacturing, in light of the newly published draft Circular Economy Strategy for Northern Ireland and the circularity gap report. Partnerships could also be forged with stakeholders in Ireland (such as Enterprise Ireland clusters and SFI Research Centres) as well as the UK (in particular, the High Value Manufacturing Catapults).

Targeting high-impact areas independent of vested interests, closely aligned with wider areas of strategic priority and supported by consultation and planning, could lead to increased socioeconomic benefit. [71] Short to medium term forecasts of areas presenting potential for both returns for society (opportunity) and for impact (additionality) for public intervention in advanced manufacturing competencies were the subject of a consultation process involving key stakeholders in the UK; the most promising areas included:

- Big data management and analytics
- Powder metallurgy
- Laser processing
- Systems modelling and simulation
- Tooling and fixtures.

7.5 Implementation of the interim evaluation

The Interim Evaluation findings for NIAECC were finalised in April 2017. The subsequent recommendations, namely that of NIAECC becoming a regional "node" of the National Composites Centre (NCC), were complex and required stakeholder consideration. An extension of one year (on a no-cost basis) to 4th February 2020 was granted to the NIAECC to allow further time for negotiations. It was not possible to resolve the complex issue of the NIACE/NIAECC structure in the timeline of the project. NIAECC therefore ceased operations on the 4th February 2020. As the project completed without the development of a business plan for further Competence Centre Support, a full management response to the Action Plan Arising from the NIAECC Interim Evaluation Report was not developed and implemented.[72]

[71] https://www.ifm.eng.cam.ac.uk/uploads/Resources/IFM_HVM_REPORT_WEB.pdf

[72] FILENOTE – EVALUATION ACTION PLAN DEVELOPMENT – NIAECC INTERIM EVALUATION

7.6 Recommendations

The primary and secondary research conducted to assess the performance of NIAECC has informed several lessons learned. Implementation of the following action points could help to further leverage the impact of NIAECC, in light of upcoming infrastructure projects and initiatives in NI.

- **Ensure a continuum between NIAECC and related public investments, particularly the city deals suite of projects:** ensure that NIAECC knowledge, legacy and assets (such as stakeholder contacts, partnerships and lessons learned) are fully consulted and accounted for in plans for AMIC. This should take the form of either a separate panel (the NIAECC forum) or an inclusion of key NIAECC stakeholders in the Maker's Alliance, to be consulted at set intervals (e.g. quarterly) or as needed at critical control points in the project.

  Ensure that the voice of NIAECC alumni and stakeholders is heard. This could be via their incorporate in the Maker's Alliance, an independent industry-led body tasked with driving the strategic development of the Advanced Manufacturing sector in Northern Ireland.[73] This provides a forum for engaging with industry, to keep them ensured, ensure their alignment with the objectives and goals of developments (such as AMIC) and fully tap into the lessons learned from NIAECC.

- **Prioritise increasing micro and SME representation:** given the heightened benefits of R&D&I support for micro and smaller firms, any future intervention should feature SME representation within the KPIs and measure of what success looks like. For example, a KPI could have been to reach out to smaller firms and engage micro and SMEs in NIAECC activities, with a target of e.g. five new micro firms becoming members per annum. Consideration should be given to the absorptive capacity of SME's. It could be included in the membership agreement/commitment for large firms that they must engage in consortium agreements only with other SMEs, or employ a consortium 'mix' approach, whereby at least one firm must be micro. The scope / absolute impact (net additional GVA generated, 'n' participants involved etc. rather than just ratios (ROI and BCR) is an important consideration for the breadth of economic impact. This is increasingly important in the context of R&D innovations, to raise the critical mass of innovation capacity, as well as awareness in NI and abroad of the capabilities/potential.

- **Follow a rigorous five-case Business Case process in line with relevant guidance prior to pursuing any further funding initiatives.** In line with funding prioritisation principals, ensure that funding directs programmes and initiatives, not vice versa.

  A detailed management case should be conducted, at both Strategic Outline CASE (SOC) and Outline Business Case (OBC) stage, as is prescribed by the HMT Better Business Case guidance. This would consider (and consult via workshops and one-to-one consultations) key stakeholders and dependencies, and account for the risks of any tensions, attributing a responsible owner for each risk category. Any issues identified at SOC stage should be addressed prior to completion of the OBC stage, or the project would not be approved for funding.

  Also to be included throughout the business case process is detailed stakeholder consultation (via a programme of workshops), demand analysis and sensitivity testing, and consideration of risks, constraints and interdependency (for which NIACE was a significant constraint and interdependency).

- **Review of the researcher organisation, their interaction with industry and inter-institution collaboration:** For any future venture, thought should be given to adopting the core body of researchers/PhD fellows, as CHIC has employed. This could be a way of avoiding the tensions resulting from situations like rival bids being submitted from several universities, or particular institutions having preferential access to equipment. This could also have fostered a culture of knowledge sharing, with representatives from both universities. This should feature a career development plan for research staff, to locate

[73] https://www.investni.com/media-centre/news/establishment-new-makers-alliance-announced

and encourage areas of specialism; the centre's research strategy should be cognisant of this and align with identified specialisms and interests of the available research base.

- **Reconsider KPIs in light of lessons learned in phase I and objectives of NIAECC:** reconsider how aligned the KPIs and targets set are with the strategic objectives. A key example of this is the number of members (11 across phase I). Had this been based on the funding allocation being fully realised, this would have been a relatively expensive per-company cost for participation (accepting that cost per company can be a 'blunt' instrument in assessing programmes). This demonstrates that the absolute impact (net additional GVA generated, 'n' participants involved etc.) rather than just ratios (ROI and BCR) are equally important considerations for the breadth of economic impact. This is increasingly important in the context of R&D innovations, to raise the critical mass of innovation capacity, as well as awareness in NI and abroad of the capabilities/potential.

8. Recommendations

8 Recommendations

8.1 Introduction

Having considered each Competence Centre individually, it is clear that there are some common challenges, critical success factors and lessons learned to be taken from each. These have been compiled to form a set of thematic recommendations, discussed in this chapter. It is also noteworthy that uniform structures and guidance cannot be applied uniformly across the centres, given that they operate in varying sectors with a varying demographic composition (see chapter 3). It is clear that, even in lieu of Invest NI funding for further phases of each centre, they have the potential to make significant contributions to NI's R&D&I landscape, whether as a self-sustaining centre, or as important stakeholders in future endeavours. Strategic alignment is more applicable than ever, given the renewed focus of DfE's Vision on elevating NI's productivity, and the recognition that innovation is the key to unlocking this potential. Market failures also persist, particularly around the barriers to innovation faced by micro and small firms.

Whilst the competence centre programme is, at time of writing, drawing to a close of phase II funding, the centres will have a legacy and continued operations should they pursue this. This legacy will be dependent on several factors, both within and outside control of centres. Hewitt-Dundas and Roper (2011)[74] write:

"Longer-term, the likelihood of positive outputs becoming positive outcomes in terms of sustained increases in regional R&D activity or growth depends strongly on other contingent factors… Organisational approaches to IP management, for example, might shape the extent to which knowledge generated by the PRCs is either regarded as proprietary or widely diffused (Young et al., 2008). Similarly, host organisations' ability or attitude to sustaining activity within a PRC beyond the funding period will be important in the longer term. Equally important perhaps are the characteristics of the wider business environment in the region which may either enhance or restrict the transition from positive outputs to outcomes"

8.1.1 Summary on Value for Money

Table 8.1 presents the economic impact summary for each CCP. Accepting that an economic impact calculation is only one part of the picture in assessing CCPs, and that the return on the innovation effort takes a considerable time, it is evident from these figures that the Benefit to Cost Ratios and Return on Investment figures are low.

[74] Hewitt-Dundas, N., and Roper, S., 2011. 'Creating advantage in peripheral regions: The role of publicly funded R&D centres' *Research Policy*, 40 (2011) pp. 832-841.

	AFQ	CASE	CHIC	NIAECC
Impact variable	Results	Results	Results	Results
GVA impact				
Additional turnover, net	£ 7,356,772	£ 23,674,132	£ 8,512,998	£ 6,572,263
Economic impact (GVA), net	£ 3,201,420	£ 7,920,049	£ 5,956,915	£ 3,344,296
BCR	0.6	1.1	0.8	1.2
ROI	-0.4	0.1	-0.2	0.2
BERD impact				
BERD activity generated, net	-£ 522,483	£ 1,464,775	£ 2,003,005	£ 434,962
BERD growth (%)	-0.8%	19.0%	21.0%	18.3%

Collaboration is required, from past funders (Invest NI), industry stakeholders and centre management, in order to protect and secure the competence centres' legacy and impact. While the evaluators do not see a clear rationale for continuing a competence centres programme, the evaluators see a role for Invest NI to continue engaging with CCP stakeholders to leverage and refine the legacy impact of the programme. Further, City and Growth Deal innovation projects also offer an opportunity to continue the work that CCPs have undertaken. On that basis, proposing a series of recommendations remains a valid exercise. The thematic-level and centre-specific recommendations propose the form that such refinement could take.

8.2 Thematic level recommendations

The evaluation process, particularly the stakeholder engagement phase, has enabled the compilation of thematic recommendations. This has been further supported by the benchmark review process undertaken in Chapter 3 of this report, particularly following the September 2023 Catapult Review.[75] **The evaluators also recommend that this evaluation can serve as a 'final' evaluation given there is no continuation of funding beyond this evaluation.**

Table 8-1 Thematic level recommendations

Recommendation	Rationale
1. Prioritise alignment with confirmed and prospective public investments in NI, particular the city deals suite of projects.	Revise the research strategies and impact areas, involving the key stakeholders and lessons learned in current and future engagement related to the innovation pillar of the Belfast Region City Deals, as well as other emerging deals in other council areas. This should align closely with 10x and include detailed consultations with stakeholders at DfE, as well as industry stakeholders in emerging areas of potential. Working groups should involve key stakeholders from the centres to ensure that lessons learned and contextualised recommendations are considered. Any further activities in the Competence Centres should encompass strategic priority areas for local and national strategies (including the 10x cluster areas), as well as the confirmed city deal projects (creating a critical mass in these areas). Linkages with the wider innovation ecosystem, particularly city deals, Innovate UK and the Catapult network, should be prioritised and expanded on.

[75] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1185134/catapult-network-review-2023-update.pdf

2. Prioritise collaboration between host institution and partner(s) from the outset	A detailed management case should be conducted, at both Strategic Outline CASE (SOC) and Outline Business Case (OBC) stage, as is prescribed by the HMT Better Business Case guidance. This would consider (and consult via workshops and one-to-one consultations) key stakeholders, and account for the risks of such tensions, attributing a responsible owner for each risk category. Any issues identified at SOC stage should be addressed prior to completion of the OBC stage, or the project would not be approved for funding. Also to be included throughout the business case process is detailed stakeholder consultation (via a programme of workshops), demand analysis and sensitivity testing, and consideration of risks, constraints and interdependencies. This will help to safeguard against funding projects which have a strong case for change (strategic alignment), but are difficult to realise due to delivery/market/commercial constraints.
3. Improved data collation, with centre-specific KPIs/reporting requirements, in addition to a core set of KPIs. This should focus on Outputs and Outcomes.	Consideration should be given to placing the onus for quarterly reporting directly on participant companies, feeding in to an online database. A data visualisation package could be used to automate this reporting and extract key insights. To ensure compliance with this (and minimise the burden placed on core staff), a data collection agreement should be a pre-condition of CCP participation. It would require member companies to provide baseline and interim data updates to the centres, as well as an agreed post-participation period (e.g. 12-24 months). Consideration should be given to automation tools that reduce the administrative burden of data reporting, to prevent isolating SME's from participation. This would help to ascertain the impact that Invest NI funds are having, particularly in the context of a large weighting of non-NI companies, to ensure that economic benefit is being obtained for NI public money. This could be via various avenues, such as exporting opportunities, trading relationships and knowledge sharing being secured via the consortium arrangements between NI and non-NI companies. Tracking this should be prioritised. Programme-wide metrics should prioritise the following indicators: • Total private sector funding secured by NI companies • Total public sector funding secured by NI companies • Additional FDI leveraged • Total headcount growth of NI companies • Total turnover growth of NI companies • R&D expenditure leveraged (BERD) • New and existing collaborations (both domestic and international) by member companies • Company expenditure of staff training and development This would be further enhanced by benchmark/data sharing with innovations centres in the UK/Ireland/Scotland (with the appropriate GDPR regulations adhered to).
4. Ecosystem management facilitated by targeted recruitment of particular cohorts and demographics.	Ecosystem management and targeted recruitment of particular cohorts could help to generate more socioeconomic benefit through the collaborative research. This could be informed by an opportunity mapping (based on critical mass and potential

This include prioritisation of micro firms, start-ups and SMEs.	returns) at the outset. For example, within agri-food this may prioritise AgriTech as an emerging area of significant potential. This would be guided by similar exercises carried out in benchmarks, such as in the Catapult Network. Particular demographics of business size should be prioritised across all centres, particularly those identified as having a lower representation of SMEs. Micro firms, SMEs, start-ups and sole entrepreneurs should be prioritised in outreach efforts and potentially attributed a higher weighting in the funding awards process. A review should also be conducted of representation on the steering committee, to ensure that micro and SME industry partners are being heard.
5. Seek to improve the transparency of governance, in particular the project award process	Invest NI oversight personnel should review and maintain a real-time code of practice, with a dedicated liaison point of contact within Invest NI for this to oversee its communication with centre stakeholders and frequent updates of same. These guidelines should be tailored to specific centres' nuances e.g. membership structure, research staff and legal structures. Centres should have a transparent and robust framework in place to address concerns raised by external stakeholders. The transparency and independence of the project award process should also be prioritised in future operations. Possible improvements to this process could include: • Involving an independent award committee (e.g. of three personnel including a subject matter expert) to be involved in the project award process and to ensure transparency. • Ensuring that timely feedback and a supporting rationale is given for decisions relating to funding awards; in turn this could elevate the quality of business plans received. This could be in a template format accompanied by a 15 to 30 minute feedback call to reduce time required and to provide a uniform style of feedback that complies with key areas. • Given that implementation of this review may require even more time of board members who tend to be unpaid, consideration should be given to increasing a stipend/grant and/or introducing paid 'consultancy' days to facilitate elements such as provision of feedback Consider the introduction of external experts operating at arm's length to assess applications. These could include professionals such as lawyers, equity funders, angel investors and economists, who could judge the financial and socioeconomic merits and potential of proposals, as well as better avoiding the potential/perceived conflicts of interest which may result from industry's dual role in applications and assessments of same. It should be noted that an external assessment should be employed supplementary to specialist assessment, who have the expertise to evaluate the technical merit of a research proposition.
6. Expand KPIs to include innovation-specific measures and socioeconomic indicators	The monitoring and assessment of CC performance should encompass a suite of KPIs aligned with socioeconomic benefit. This is reflective of the wider benefit of R&D&I, particularly where health, the circular economy and sustainable energy outcomes are being advanced. The positive externalities associated with

	this research will not be readily reflected in traditional indicators such as job creation and turnover growth. This also reflects a transition towards a focus on cost-benefit analysis and returns to monetisable, non-quantifiable benefits project business plans, with a corresponding high weighting given to these in the funding award process. This approach is reflective of common practice in Green Book appraisals. The suite of KPIs should include, at the company level, monitoring of diversity and quarterly reporting on diversity and inclusion at board meetings.
7. Produce and maintain an outcomes and outputs log	Any future phase of centres, whether via Invest NI funding or otherwise, should be framed from the outset by a logic model, in line with the Innovate UK logic model for Catapults, to increase clarity and accountability of centre targets. The CCs should look to benchmark Catapults to form these models and ensure they are relevant. This would make progress towards the following: • Transparency of tangible outcome targets: these targets will help to define success and provide direction for the overall centre lifecycle. They could be referred to during the project award process and help to prioritise funding, as well as associated transparency (see recommendation 5) • Sector-specific tailoring: recognising that each sector has unique challenges and objectives, the logic model should be tailored accordingly, with realistic outputs and socioeconomically-contextualised outcomes. • Performance tracking: continuous monitoring and tracking are essential to assess performance, ensure relevance of the research strategy, and ensure alignment with set targets.
8. Mapping of relevant supports	Follow-on support to members and alumni of centres is key to leveraging impact, creating lasting connections and bringing the innovations closer to market. Fundamental to this would be the application of a networking group to allow member companies to establish long-term connections, make referrals and share information. Centres have a pivotal role to play in maximising this community and support base. With this in mind, they should conduct a mapping of R&D grants, schemes, partnerships and emerging opportunities/fields relevant to their respective sectors. This approach would maximise both the relationships with participant companies, as well as the ease of follow-on liaison to gauge progress against KPIs post-participation and areas for further support.
9. Focus on commercialisation and IP generation	A reviewed membership structure, with a fee inclusive of a set number of ‘consulting hours’ from core staff (and/or a ‘rate card’ for ad hoc/additional requests), would enable the signposting described in recommendation 8 to be elevated. Higher tiers of membership (e.g. silver and gold) could include core staff providing companies with assistance in realising the commercial ‘product to market’ aspects of their action plans relating to work that was conducted or developed in the centre, applications for signposted supports and meetings with potential investors.

	A tiered membership structure, aligned with company size and contribution to project fees, could also include elevated IP ownership rights residing with the companies. This would be owing to the lower level of public support, thereby no longer falling under state aid legislation. An in-depth consultation with current member/participant companies, as well as a wider stakeholder consultation across relevant companies, should be conducted to gauge the level of interest in this.
10. Inter-centre collaboration	Inter-centre collaboration should play a more prominent role within the CCP, post-Invest NI funding. Areas of emerging socioeconomic benefit, e.g. the circular economy, encompass all of the centres, from the circular bio-economy (AFQ) to the role of sustainable energy in realising these outcomes (CASE). Related centres (e.g. CASE in the area of circular economy) could also progress this area. An inter-centre steering board / forum should share best practice across the CCP supported by relevant stakeholders, including on supporting companies to access finance. This is particularly important in light of recommendation 1, and the potential represented by the number City Deal projects. Post-INI funding, the centres should seek to collaborate on projects of mutual interest. This should form a part of KPI monitoring that centres themselves (and any core/research staff) report on.

8.3 Centre-specific recommendations

For ease of reference, the recommendations made in relation to each programme are re-stated here.

8.3.1 AFQ-specific recommendations

1. **Ensure a continuum between AFQ and related public investments, particularly the city deals suite of projects:** revise the research strategies and impact areas pursued by AFQ, involving the key stakeholders and lessons learned. This should also assess alignment with current and planned city deals projects, particularly the BRCD innovation pillar, given the progression of this. Such consideration should align closely with 10x and include detailed consultations with stakeholders at DfE, as well as industry stakeholders in emerging areas of potential such as AgriTech. This could align closely with the AMIC project. Where areas of alignment are identified, a log of alignment between AFQ projects and the CSFs and objectives of these centres should be created, enabling a 'continuum' approach to innovative work commenced in AFQ.

2. **AFQ to compile funding and opportunity mapping for members and alumni, actively facilities introductions and networking opportunities:** AFQ core staff should leverage their market knowledge to compile a business development register to map potential and 'live' funding opportunities for member companies, affiliates and alumni. This should include current and prospective R&D grants and schemes relevant to agri-food strategic priorities, with action plans and timelines produced in accordance with rolling calls and applications deadlines.

3. **Prioritise increasing micro and SME representation:** management should review representation on steering committee, to ensure that micro and SME industry partners are being heard, as well as a balance of representatives for larger companies and both universities. This could include awarding greater weighting to smaller companies in the funding award process, prioritising 'niche' emerging areas (e.g. of AgriTech) in a revised research strategy, and site visits to micro firms and entrepreneurs to raise awareness of the benefits of AFQ membership.

4. **Improved efficiency and transparency of governance and project award processes:** possible improvements to the project award process could involve an independent award committee (e.g. of three personnel including a subject matter expert) to be involved in the project award process and to ensure transparency.

5. **Reconsider KPIs in light of non-monetary benefits and lessons learned during Phase I of other centres:** Review KPIs and develop them in tandem with AFQ stakeholders to ensure suitability and relevance. This should include refinement of commercial KPIs, with the removal of spin-out creation to be considered. The raising of private equity could be a further avenue to monitor (perhaps to merit inclusion as a KPI).

6. **A detailed KPI framework informed by compulsory baseline, progress and post-participation metrics:** consider placing the onus for quarterly reporting directly on participant companies, feeding in to an online database. A data visualisation package could be used to automate this reporting. Consideration should also be given to a rotating membership of the committee, to share out the burden, as well as a review of the core staff budget.

   Timely reporting of indicators – particularly relating to business expenditure on R&D (BERD) but also on elements such as expenditure on staff training and skills development – should be reported to AFQ on a quarterly basis. If built in to participation clauses, this would provide comprehensive baselines and progress tracking.

7. **Review of the researcher structure and place within AFQ:** consider the merits of core PhD students with pre-approved funding independent on specific assignments. This would also enable strategic projects that align closely with policy to be pursued, and would place AFQ in the position to be a strong applicant for funding avenues such as the

SFI Co-Fund (see 4.4.8). Conduct a cost-benefit study, prior to any further operational phase, of the merit of funding core researchers / dedicated PhD students. Consider publishing and distributing annual updates to key industry bodies, members and affiliates.

8. **Ecosystem management and marketing efforts to ensure that companies and sectors best placed to benefit from AFQ support are recruited:** ecosystem management and targeted recruitment of particular cohorts could help to generate more socioeconomic benefit through the collaborative research. This could include service providers, chemical, diagnostic and big data companies operating within the agri-food space. Avenues could include expanding the definition of sector, research strategic (e.g. incorporating AgriTech specifically), word of mouth and organic visits. Collaborations with related centres (e.g. CASE in the area of circular economy) could also progress this area.

9. **Improved efficiency and transparency of governance and project award processes**: any future funding phase of AFQ should be supported by open line of communication between centre managers and steering board personnel and Invest NI representatives. This should be accompanied by a 'live', updated set of guidelines and FAQs relating to delivery and management principles.

8.3.2 CASE-specific recommendations

10. **Leverage CASE's strategic importance and role in promoting NI's potential in renewables:** Invest NI should seek to support CASE, its governance team and management in retaining and growing the influence it exerts in the marketplace and policy landscape. This includes in relation to its continued efforts to secure private and public funding, as well as attract FDI investors, which could bring significant benefits to NI and aligns closely with Invest NI's skills and remit. Invest NI should consider partnerships and joint trade summits with CASE stakeholders to support this vision, as the centre transitions to a self-sustaining funding model.

11. **Evolve the measurement of success towards non-monetary, socioeconomic benefits:** transition towards a focus on cost-benefit analysis and returns to monetisable, non-quantifiable benefits project business plans, with high weighting given to these in the funding award process. This approach is reflective of common practice in Green Book appraisals. Were this approach factored into phase I, a more comprehensive assessment of the socioeconomic contribution of CASE activities could have been made.

12. **Compile, update and report on an Outputs and Outcomes log:** key outcomes and benefits of CASE for included the centre's role is assisting participants to raise private equity and achieve business development goals, as well as its role in raising NI's profile in the renewable energy space and attracting FDI investment. These, combined with CASE's role in raising public awareness of environmental issues (and solutions) are not accounted for in any formal reporting nor in reports of economic impact. The formation of a LOGIC model, and in particular an outputs and outcomes register, could monitor CASE performance and contribution in a way that more aptly reflects its contribution to society.

13. **A detailed KPI framework informed by compulsory baseline, progress and post-participation metrics:** a data collection agreement should be a pre-condition of CCP participation. This would help to ascertain the impact that Invest NI funds are having, particularly in the context of a large weighting of non-NI companies, to ensure that economic benefit is being obtained for NI public money. This could be via various avenues, such as exporting opportunities, trading relationships and knowledge sharing being secured via the consortium arrangements between NI and non-NI companies. Tracking this should be prioritised.

14. **Improved efficiency and transparency of governance and project award processes:** ensure the recommendations of the February 2023 Process Review are actioned, with an Implementation Report/Action Log advisable by the end of 2023. Initial recommendations from the evaluator include:

a. Ensure that timely feedback and rationale is given for decisions relating to funding awards; in turn this could elevate the quality of business plans received. This could be in a template format accompanied by a 15-30 minute feedback call to reduce time required and to provide a uniform style of feedback that complies with key areas.

b. Given that implementation of this review may require even more time of board members who tend to be unpaid, consideration should be given to increasing a stipend/grant and/or introducing paid 'consultancy' days to facilitate elements such as provision of feedback

c. Consider the introduction of external experts operating at arm's length to assess applications. These could include professionals such as lawyers, equity funders, angel investors and economists, who could judge the financial and socioeconomic merits and potential of proposals, as well as better avoiding the potential/perceived conflicts of interest which may result from industry's dual role in applications and assessments of same.

15. **Review of the researcher organisation and place within a self-sustaining CASE:** renewed consideration of a 'core' researcher basis, or pool of post-doctoral research personnel, rather than project by project recruitment. This would require discussions with QUB personnel regarding navigation of their recruitment processes and cost centre allocations. It is also possible that ad hoc project-by-project recruitment may still be required, should certain skillsets be lacking, depending on project requirements. A hybrid model could be considered, including facilitating secondments of research staff from benchmark facilities in other jurisdictions to facilitate knowledge sharing, provide project-specific skills and raise the profile of CASE further still among the international community.

16. **Review the membership structure and added-value activities of CASE:** a tiered membership structure, aligned with company size and level of support received, could be considered. This could include a structured package with a pre-determined number of 'consultancy hours', to capture strategic, business development and funding application support work carried out by CASE staff, as well as access to specialists within the wider QUB network. More comprehensive levels of membership could also include preferential IP ownership or licensing options.

8.3.3 CHIC-specific recommendations

17. **Ensure a continuum between CHIC and related BRCD projects, particularly CDHT and I-REACH:** Leverage alignment between phase II projects, CDHT and I-Reach prospective projects and stakeholders. Incorporate CHIC lessons learned and best practice into the revised Outline Business Case for CDHT, its subsequent Full Business Case, and the Full Business Case for I-REACH. Ensure that any areas for synergies and identified and monetised insofar as possible. Consideration of the use of CHIC capital equipment, research base and brand name in these projects, and the legacy value of this, should be reported on, given the positive impact this is likely to have on ROI for Competence Centre Programme funds. Ensure ongoing communication between CHIC stakeholders and BRCD representatives to leverage the work conducted to date by CHIC.

18. **CHIC to compile funding and opportunity mapping for members and alumni, actively facilities introductions and networking opportunities:** CHIC core staff should leverage their market knowledge to compile a business development register to map potential and 'live' funding opportunities for CHIC member companies, affiliates and alumni. This should include a non-member register of 'affiliate' companies and entrepreneurs, who represent future, prospective members and interested parties. This register should consider alignment with UK Catapult stakeholders, the Enterprise Ireland Technology Centres and the Science Foundation Ireland Research Centres as well as Northern Ireland Life and Health Sciences stakeholders. The geographic remit of this should extend to include collaborative research opportunities and partnerships with sister

centres in benchmark jurisdictions to secure competitive funding, such as partnering to secure EU Horizon or SFI co-centre funding, for example.

19. **A detailed KPI framework informed by compulsory baseline, progress and post-participation metrics:** a data collection agreement should be a pre-condition of CCP participation. This would help to ascertain the impact that Invest NI funds are having, particularly in the context of a large weighting of non-NI companies, to ensure that economic benefit is being obtained for NI public money. This could be via various avenues, such as exporting opportunities, trading relationships and knowledge sharing being secured via the consortium arrangements between NI and non-NI companies. Tracking this should be prioritised. In addition, CHIC staff should conduct 'follow ups' with alumni to ensure tracking of CHIC impact past the obligatory reporting period, given the long-time lags associated with returns to healthcare innovation funding.

20. **Compile, update and report on an Outputs and Outcomes log:** compile and update an outputs and outcomes tracker to monitor progress and benefits, including independent of that mandated by Invest NI/funders. This should be via reference to the LOGIC model approach. This should make use of the established International Advisory Board, leveraging their knowledge of KPIs and outcomes, particularly from centres with a longer trajectory than CHIC.

21. **Ensure detailed reporting of agreed KPIs; consider rationalising this if prohibitively time-consuming:** limited information is given in the quarterly reports for phase II in relation to KPI attainment. The seven company-related KPIs are attributed a RAG status rather than any explanatory information being given as to why attainment may be below target (e.g. concerning academic/business joint publications). This provides limited oversight to Invest NI and a more comprehensive reporting style should be encouraged.

22. **Ecosystem management to ensure representation of microbusinesses:** entrepreneurs and micro enterprises should continue to be prioritised in outreach efforts, with consideration given to waiving contributions or allowing them to join on a pilot basis.

23. **Evolve the measurement of success towards non-monetary, socioeconomic benefits:** It should be noted that socioeconomic cost-benefit analysis is common place (and recommended) in the business case process, in line with HMT Green Book and NI Better Business Case Guidance. The usual approach is to quantify the QUALY (Quality Adjusted Life Years) improvement resulting from healthcare research. This approach should be adopted to not only CHIC's operations, impacts and VfM, but also the individual projects within the funding award process. CHIC should provide training to an appropriate individual within the centre management team / wider QUB team.

24. **Reconsider KPIs in light of non-monetary benefits and prominence of strategic projects:** the prominence of strategic projects in CHIC's activities highlights the need to reconsider KPIs and industry requirements being uniform across projects, given that the interim evaluation recommended continuing pursuit of this type of strategic project. Separate KPIs should be devised strategic projects, reported separately from the core projects and centre operations.

25. **Prioritise attainment of in-kind contribution levels:** increasing the level of in-kind contributions to target (or close to target) level should be a priority for centre management. Centre management should leverage their relationships with industry to monitor in real time, project-by-project, these contributions, with catch ups scheduled as needed with consortium members. A consultation should be carried out with members regarding IKCs and consideration given to applying a tiered contribution requirement, depending on project type, company size and resources.

8.3.4 NIAECC-specific recommendations

26. **Ensure a continuum between NIAECC and related public investments, particularly the city deals suite of projects:** ensure that NIAECC knowledge, legacy and assets (such as stakeholder contacts, partnerships and lessons learned) are fully consulted and

accounted for in plans for AMIC. This should take the form of either a separate panel (the NIAECC forum) or an inclusion of key NIAECC stakeholders in the Maker's Alliance, to be consulted at set intervals (e.g. quarterly) or as needed at critical control points in the project.

Ensure that the voice of NIAECC alumni and stakeholders is heard. This could be via their incorporate in the Maker's Alliance, an independent industry-led body tasked with driving the strategic development of the Advanced Manufacturing sector in Northern Ireland.[76] This provides a forum for engaging with industry, to keep them ensured, ensure their alignment with the objectives and goals of developments (such as AMIC) and fully tap into the lessons learned from NIAECC.

27. **Prioritise increasing micro and SME representation:** given the heightened benefits of R&D&I support for micro and smaller firms, any future intervention should feature SME representation within the KPIs and measure of what success looks like. For example, a KPI could have been to reach out to smaller firms and engage micro and SMEs in NIAECC activities, with a target of e.g. five new micro firms becoming members per annum. It could also be included in the membership agreement/commitment for large firms that they must engage in consortium agreements only with other SMEs, or employ a consortium 'mix' approach, whereby at least one firm must be micro. The scope / absolute impact (net additional GVA generated, 'n' participants involved etc. rather than just ratios (ROI and BCR) is an important consideration for the breadth of economic impact. This is increasingly important in the context of R&D innovations, to raise the critical mass of innovation capacity, as well as awareness in NI and abroad of the capabilities/potential.

28. **Follow a rigorous five-case Business Case process in line with relevant guidance prior to pursuing any further funding initiatives.** In line with funding prioritisation principals, ensure that funding directs programmes and initiatives, not vice versa.

    A detailed management case should be conducted, at both Strategic Outline CASE (SOC) and Outline Business Case (OBC) stage, as is prescribed by the HMT Better Business Case guidance. This would consider (and consult via workshops and one-to-one consultations) key stakeholders and dependencies, and account for the risks of any tensions, attributing a responsible owner for each risk category. Any issues identified at SOC stage should be addressed prior to completion of the OBC stage, or the project would not be approved for funding.

    Also to be included throughout the business case process is detailed stakeholder consultation (via a programme of workshops), demand analysis and sensitivity testing, and consideration of risks, constraints and interdependency (for which NIACE is a significant constraint and interdependency).

29. **Review of the researcher organisation, their interaction with industry and inter-institution collaboration:** For any future venture, thought should be given to adopting the core body of researchers/PhD fellows, as CHIC has employed. This could be a way of avoiding the tensions resulting from situations like rival bids being submitted from several universities, or particular institutions having preferential access to equipment. This could also have fostered a culture of knowledge sharing, with representatives from both universities. This should feature a career development plan for research staff, to locate and encourage areas of specialism; the centre's research strategy should be cognisant of this and align with identified specialisms and interests of the available research base.

30. **Reconsider KPIs in light of lessons learned in phase I and objectives of NIAECC:** reconsider how aligned the KPIs and targets set are with the strategic objectives. A key example of this is the number of members (11 across phase I). Had this been based on the funding allocation being fully realised, this would have been a relatively expensive per-company cost for participation (rather than the one to many principle followed in some

[76] https://www.investni.com/media-centre/news/establishment-new-makers-alliance-announced

interventions). This demonstrates that the absolute impact (net additional GVA generated, ‘n’ participants involved etc. rather than just ratios (ROI and BCR) are equally important considerations for the breadth of economic impact. This is increasingly important in the context of R&D innovations, to raise the critical mass of innovation capacity, as well as awareness in NI and abroad of the capabilities/potential.

9. Appendices

9. Appendices

Appendix 1: Interim evaluation recommendations

The overall Competence Centre Programme was the subject of a suite of thematic recommendations following the Interim Evaluation. This recognised the impact of the centres, but so too the potential to further leverage and widen the scope of this impact. In particular, this section will highlight the performance of CHIC and CASE during Phase II against the assigned actions plans.

9.1.1 Thematic recommendations

Table 9-1: Interim evaluation thematic recommendations

Recommendation	Actioned (R/A/G)	Comment
Redefining the CCP and centres' aims, objectives and KPIs, to reinforce the focus on creating commercial and economic outcomes through high quality research.		Only actionable for phase II due to business plan constraints, so not applicable to all centres. CHIC and CASE both show evidence of revised KPIs more closely aligned to activity in the centre and realistic objectives.
IP/commercialisation Review IP identification and management processes. Once any relevant additional training is complete, a retrospective review should be undertaken to ensure that all IP has been appropriately identified and registered.		The state aid rules, given significant public funding, are a key constraint faced in both phases of the centres. Consideration of tiered membership allowing for higher cash contributions from industry to bypass this constraint, would be a key consideration moving forward. Efforts have been made to connect the centres to the wider university community and knowledge in the area of IP/commercialisation, but this remains a complex area to understand, track and demonstrate performance in.

Recommendation	Actioned (R/A/G)	Comment
Review IP ownership model, potential mirroring that used by the Catapult Network, whereby higher contributions are made by companies. Communicate better with companies the IP process and raise awareness		
increasing levels of flexibility and adapting aspects of the funding support model and its implementation		The transition to self-sustaining centres will allow for greater flexibility. The CASE review of processes being undertaken is an example of an attempt to increase the transparency, confidence and efficiency of processes.
Develop a knowledge transfer repository/website to link companies with relevant technology and research expertise		No evidence was found of this. The potential benefits of such a development has been reflected in the recommendations of this evaluation, with significant potential to provide follow on support to participants and alumni post-involvement.
Balance strategic and commercial projects to ensure feasible/attractive contribution in kind prospect		Stakeholders acknowledge the contribution of strategic projects. The transition away from 'number of projects' as a KPI illustrates this awareness. Progress could be made in adjusting/tailoring IKC targets based on the project type being considered, or in reporting on strategic and commercial project IKCs separately.
Introduce an element of competition for the introduction of any new Competence Centres		N/A – no new CC has been brought forward.
Provide a longer 'runway', for preparatory work to CCs, prior to commencing core research activities. This will require the initial funding period to be extended from 5 to 5.5/6 years to provide 6-12 months lead time followed by 5 years of core activity.		N/A – this would have led to a significant gap between CASE I and II and CHIC I and II, particularly given the duplicity of some of the members/participants. The longer time frame for funding should be considered in future for any new/similar centres.
Research staff		This cannot be applied uniformly across centres. CHIC has maintained this model, whereas CASE – following consideration – opted to maintain its project-by-project basis as well as PhD

Recommendation	Actioned (R/A/G)	Comment
Implement a core researcher recruitment model, where staff are employed to work across the Centre as opposed to being on short-term contracts linked to individual projects Place greater focus on research staff career development		fellowships. This will be based on available skills, availability, recruitment time lags and stakeholder feedback.
Invest NI should encourage KPs to take a more active role in championing the CC at senior levels, ensuring that they are treated as vital parts of the organisations' operation as opposed to being another competitive funding source.		There is significant evidence of progress towards this objective, given the significant marketing and strategic efforts of both CHIC and CASE. The inaugural NI Energy Summit is indicative of the 'trusted voice' nature of CASE, for example.
As part of their reporting CCs should articulate the: • specific contribution, rather than host-wide • causal link between the Centre's activities and outputs • the need to routinely report on industrial impacts.		Efforts have been made to isolate the specific contribution and impact of the centres, through enhanced quarterly reporting, project by project case studies and performance reports, as well as attribution of leveraged funding via a weighted approach.
Review the model used for the model attributing shares of competitive funding leveraged to the centre. The weighting for direct CC input should be increased from base of 35%.		Analysis of centre quarterly reports shows a significant variance of funding attributed to the CC for each award. Where funding was closely aligned with centres' research strategies and the centre played a pivotal role in securing the funding, the weighting was increased to as high as 66% (CHIC Oct-Dec 22 taken as an example here).
Allow reduction of industrial partners to 2 in exceptional circumstances.		No examples were found of this; perhaps the 'exceptional circumstances' did not occur. The feedback was, on the whole, positive with regards to the number of consortium partners involved in each project.

Source: Cogent Interim Evaluation Reports

9.1.2 CASE specific recommendations

Table 9.2: CASE Interim Evaluation Action Plan

Recommendation	Management response	Evaluator comments	Evaluator's assessment
CASE should be invited to submit a business plan for continued funding through to Year 8. As part of the business plan, the CC should articulate (at a minimum): • Its strategy (the opportunity should be taken to reconsider and revise the strategy), implementing any new strategy from the start of Year 5 at the latest[77]. As part of any new strategy, the Centre should retain the strong focus on building local industry knowhow and capability and articulate how the strategy will position CASE internationally. • How it will create a truly effective mode of collaborative research between its member companies and academic entities to meet the needs of both groups, and establish KPIS which reflect the needs of both groups, and also those of DfE/Invest NI; • Plans relating to industry partners including its intentions to maintain or grow its number of partners (and the strategic rationale for either decision) and participation fee structure; • Plans to commercialise research undertaken to date; • Its successes to date; • Research Strategy. In line with the IEPs recommendation, the Strategy should take cognisance	**Agreed** • Following the interim evaluation, CASE was invited to submit a business plan for 3 further years of funding. • It is already effective – reference International Evaluation Report. The BP continues with the 3 Company to minimum 1 research provider. Revised KPI's proposed and will be ratified at Casework approval due 30th June 2019 latest. • The BP proposes a membership model to increase member numbers and maximise participation fees over the new time period. PPEs are taking place of research	CASE II became operational October 2019	

[77] For the interview presentation the Centre Director addressed the issue of what the future should look like ("Focus on … Strong Delivery – excellent research – legacy") and what the legacy should be (world-wide reputation, impact on creating jobs, new products, services and knowledge, capacity building, etc.). The evaluation team endorses this characterisation and suggests it a good starting point for developing the revised Strategy.

Recommendation	Management response	Evaluator comments	Evaluator's assessment
of other ongoing and emerging international research developments to ensure that CASE's research agenda is at the forefront of the global sustainable energy market/sector, within its identified specialised areas only; and • Anticipated costs for extending its operational activities. In addition, all potential risks that might hinder CASE achieving its vision should be identified and a risk mitigation strategy outlined.	undertaken to date to formulate commercialisation plans**.** • Very long gestation period for commercialisation 10 -15 years. • INI Competence Centres are small scale. Internationally, average membership varies from 5 to circa 20 members. Focusing on absolute membership numbers is not meaningful. However company alignment with CASE strategy is critical. **Agreed**		
Introduce two new structures, one internationally sourced and one locally sourced but both aimed at ensuring the Centre's activities are **truly cutting edge**, as follows: (a) Consideration should be given to the introduction of an International Advisory Board, comprising of no more than 5 leading scientific and business experts in relevant fields, who would be responsible for: • Aiding the selection of research projects in order to identify potential projects of greatest international research standing, mitigate against repeating research already undertaken elsewhere, identify opportunities to lever existing research and identify those research projects that offer the greatest commercial opportunity;	**Agreed** Not clear what is meant by **'truly cutting edge' -** CCs are designed to operate mostly in mid-range TRLs. Other funding sources available for curiosity driven research. Balance between meeting industry needs and primary research needs to be struck. **(a) Agreed**	An IAB was convened.	

Recommendation	Management response	Evaluator comments	Evaluator's assessment
• Providing direction on the Centre's Research Strategy; and • Supporting the internationalisation of the Centre. Typically, the Board would meet face-to-face at the Centre once per year, augmented with a small number of virtual meetings undertaken as and when required. The introduction of the IAB may require a virement of the Centre's funding allocation to support the ongoing costs of the Board (e.g. in relation to any remuneration provided for their time and/or expenses associated with their travel). (b) In line with the IEP.s recommendations, CASE should give consideration to establishing a small (max 6 individuals) internal research management committee consisting of PIs/research leaders drawn from each of the Centre's KPs (with at least one PI/research leader with specialist experience in each of the Centre's research themes). The Committee should be encouraged to meet on a frequent basis (at least once per month) to discuss the progress of the research projects and provide the Centre Director and Steering Committee with detailed guidance on growing the research quality and impact of the Centre. Recognising the potential logistical difficulties in drawing together representatives from each KP on a frequent basis, consideration should be given to (when required) hosting these meetings on a virtual basis.	(b) The BP proposes to augment the current Research Advisory Group (RAG) with panel members from the Bryden centre and hold up to 2 meetings per annum. RAG will be invited to researcher quarterly meetings to scrutinise and report on progress. **Agreed in Principle** – collaboration between the two universities is very limited across all centres.		
CASE should be encouraged to introduce a small number of longer-term, high-impact strategic research projects alongside the "standard" 3 company research projects	**Rejected** Unlike CHIC, the research fields in CASE are too diverse to lend	N/a	

Recommendation	Management response	Evaluator comments	Evaluator's assessment
currently being delivered by the CC[78]. These projects would focus on undertaking more novel research (i.e. at lower TRLs), focused on tackling major industrial challenges. These strategic projects, which may serve to identify additional "standard" projects of interest to be taken forward by participants at a later stage, are likely to be longer in duration, engage a larger number of industry participants (who would likely ramp up their involvement over time) and require a relatively higher research budget allocation. By way of supporting their implementation, CASE's management should be encouraged to articulate the benefits of participation in strategic projects to industry participants. On the basis that CASE's research budget will be fully allocated by December 2017, it is noted that the introduction of these strategic projects will be subject to the CC receiving additional research budget beyond Year 5.	themselves to strategic cross-cutting projects of this size.		
In relation to project selection and design, the Centre should: a. Articulate how it will access and utilise leading-edge industry knowledge and research developments in sustainable energy; b. Articulate how it will assure itself of the value of proposed projects with respect to international best practice (perhaps incorporating Recommendation 2);	**Agreed in Principle –** already in place from initiation. Will review. The centre is reviewing its application forms to capture the commercialisation pathway/ capability of industrial partners. Expressions of interest are due in the first Quarter 2019.	An independent review was undertaken of CASE's governance and project award processes during Phase II. The results of this will be implemented moving forward.	

[78] The Centre might need to negotiate with Invest NI on the best way to manage industry partner contributions to the strategic projects. For example, the contributions might be low for the early phases of the projects but ramp up significantly as a company becomes increasingly involved, maintaining the 25% industry contribution overall, averaged over the length of the project.

Recommendation	Management response	Evaluator comments	Evaluator's assessment
c. Establish clear project selection criteria up front that can be referenced later on when reviewing project performance; d. Capture and/or articulate how any proposed project will build on and add value to existing know-how; e. Seek to transition from a predominant "problem-Solution fit" focus to a "product-market fit" focus e.g. transferring a solution developed for one market into a different market; f. Seek to address the low levels of activity additionality (47%) by ensuring that it has robustly challenged the extent to which the business could take forward a project in the absence of CASE, the extent to which the project is dissimilar to the business' previous research efforts etc and record the findings of this challenge function; and g. Be strategic about deciding which projects to continue, which to continue in a revised form, and which to wind up.			
In relation to project delivery and monitoring (at both the project and Centre level), the Centre should: a. Adopt metrics to track how it is performing compared to other leading international centres in the sustainable energy space; b. (Linked with Recommendation 11) Ensure that the IP plan presented in each application is adhered to with clear and measurable milestones and KPIs established. To help ensure that measurable IP impact is generated, there should be a clear IP management process from genesis through to exploitation. This will require	**Agreed** KPI tracking and project monitoring already in place Day 1 against the Centre's own KPI targets. a. The Competence Centre consultants carried out reviews of CASE against	The KPI reporting process was refined in line with lessons learned in phase I. Collaboration with the QUB commercialisation staff and involvement of a commercialisation manager in CASE	

Recommendation	Management response	Evaluator comments	Evaluator's assessment
education of all stakeholders in the Centre which could be managed by the KPs' technology transfer offices and some external entrepreneurial advisors; c. Enhance procedures relating to tracking, measuring and reporting on KPIs, with a focus on providing insightful information on project progress against expectations. The Centre should review its reporting requirements and ensure that it is measuring against well-structured KPIs and that its projects are resourced sufficiently for appropriate reporting; d. To facilitate evaluation exercises, project reports should be of a consistently high quality, so as to enable independent assessors to determine the quality of the work behind them; and e. Introduce an induction process for academic researchers attached to the Centre and for participant businesses and their employees working on Centre projects. This will help ensure that expectations are clearly set and managed, and to articulate the benefit and impact of working in a Centre.	other centres. Similar centres are difficult to identify but annual reviews will be considered. b. The QUB Commercialisation Office is training academics/ researchers on IP and know/how. c. Projects will report quarterly against KPIs. Reporting templates will be updated to reflect this. d. Quarterly reports will be compiled/ QA by CASE management and reviewed by Invest NI. e. Researcher inductions are/ will be carried out by Centre Director and Chair of post-doc researcher panel.	core staff has improved awareness of IP processes and tracking. Work should continue in this area.	
In relation to internationalisation, the Centre should articulate its: • Plans to promote the centre and its work, retaining the strong focus on building local industry know-how and capability but increasing the international visibility and impact of the Centre; and Plans to internationalise the CC. In line with the IEP's recommendations, this should include identifying actions that will be taken by CASE to promote the Centre to international industry, peer industry-university research	**Agreed** Centres have already built international linkages – mainly through conference papers and collaborative research. Examples - the German MNC Schottel is a member of CASE. The 3 year CASE extension will	CASE has continued and increased its strategic influence during Phase II, completing strategic policy papers and hosting the inaugural energy summit.	

Recommendation	Management response	Evaluator comments	Evaluator's assessment
centres and funding bodies (e.g. Horizon 2020, ARPA-e etc).	include a prospects manager position to promote all aspects of internationalisation. CASE co-ordinated and largely authored CAMBER Interreg application (now Bryden Centre at QUB) for additional new research centre - €9.3m. The CASE Director will maintain close links with Bryden.		
Given the considerable expertise retained within each of the KPs, the CC should be encouraged to explore opportunities for greater levels of KP collaboration in delivering research projects and position institutions outside of QUB to lead bids. In doing so, consideration could be given to individual calls being led by UU or AFBI and/or incentivise joint/collaborative projects through the inclusion of a "collaboration" criterion in the scoring of projects at the IAB evaluation stage. As noted previously, the implementation of this recommendation will be subject to the CC receiving additional research budget beyond Year 5.	**Partially agreed** CASE has proactively engaged with all Knowledge Providers (KP's) during the delivery of centre activity from 2012. Ulster University has led two CASE projects and been involved in a further two and AFBI leading two and involved in a further one project out of the eighteen that have been funded to date. . Some projects have already included more than one KP. Projects are selected and resourced based on merit so the	CASE has sought to collaborate with partners to secure funding as it transitions out of Invest NI funding.	

Recommendation	Management response	Evaluator comments	Evaluator's assessment
	collaboration criteria will not be included in IAB involvement.		
By way of supporting the Centre Director to direct their efforts to focus more on strategy and undertake more value-added project management, strategy and business development activities, Invest NI should work in conjunction with the Centre to address its ongoing resourcing needs. This is likely to require, at a minimum, the employment of an additional administrative resource.	**Agreed** The BP which has been received includes additional administration resource for consideration by INI.	Completed – additional core staff employed in Phase II.	
The need for a Steering Group Executive should be kept under review by CASE and subsequently introduced if required (e.g. following any further expansion in the current size of the Steering Group). In line with the IEP's recommendations, such an Executive should have a remit for more operational decision-making on behalf of the Steering Group and provide detailed guidance to management, leaving the full Steering Group to undertake more strategically important decisions (e.g. final decisions on project round selection) and monitor the Centre's general progress.	This will be reviewed annually but the Steering Group (SG) works well under Chair and other processes need to bed in first e.g. Industrial Advisory Board/ Panel. The SG will ultimately have the decision on the need for an Executive.	n/a	
CASE and the other centres should review their procedures for identifying and managing IP. This is likely to require additional training (potentially from the respective Knowledge Providers' commercialisation offices) to be provided to Centre members/participants, academics and research staff on the methods of identifying, managing, protecting and exploiting IP. Underpinning this, the Centres should develop a culture of IP disclosures, a rapid IP	**Agreed.** CASE has engaged with QUB Commercialisation Office to train researchers re: IP. Two workshops have taken place in September and October 2018.	Collaboration with the QUB commercialisation staff and involvement of a commercialisation manager in CASE core staff has improved awareness of IP processes and tracking. Work should continue in this area.	

Recommendation	Management response	Evaluator comments	Evaluator's assessment
decision-making process (using defined timelines) and ensure that there is a clear license agreement to operate. Once the training is complete, a retrospective review should be undertaken to ensure that all IP has been appropriately identified and registered. It is recommended that such a review is undertaken in conjunction with the KPs' respective commercialisation offices.			
Each of the Competence Centres and the programme in its entirety should review the model(s) of IP ownership that has been employed. Whilst this will require specialist legal advice and a deep working understanding of State Aid regulations, a model that might be considered (as a starting point) is that employed by the Catapult centres. The Catapults offers businesses a variety of options in relation to the ownership of any prospective IP generated. In particular, we note that the Catapult model aligns to some degree with the IEP's suggestion that a more flexible model of IP management/ownership (e.g. businesses contributing in excess of 25% of research project costs to potentially own the IP on completion of the research) should be offered/explored.	**Agreed** Company's feel an entitlement to IP ownership without incurring the full costs. Companies wishing to own IP from start can procure research through contracting with university.	Constraints relating to state aid persist and are outside the remit of CASE management.	
Regardless of the model adopted, there is a need for the CCs to better clarify the model(s) of IP ownership with industry member/participants e.g. through the use of worked examples and case studies.	**Agreed** No licencing has taken place so far but Case Studies will be used when available.	Collaboration with the QUB commercialisation staff and involvement of a commercialisation manager in CASE core staff has improved awareness of IP processes and tracking. Work should continue in this area.	
Whilst strategic projects should be encouraged, the Centres must be mindful of ensuring that businesses can adequately contribute in-kind time to such projects.	Agreed in principle With reference to recommendation 3, strategic projects are not proposed for CASE. However, should this	No further action at this stage	

Recommendation	Management response	Evaluator comments	Evaluator's assessment
	situation change, this recommendation will be implemented.		
Where possible, the 'core researcher' recruitment model (like that implemented by CHIC) – where research staff are employed to work across the Centre as opposed to being on short-term contracts linked to individual research projects - should be encouraged. Such a model offers the potential to: • Facilitate research projects commencing in a more expeditious manner (as researchers would not need to be continually recruited and appointed on an individual research project basis); • Provide greater flexibility in allocating resources; and • Provide greater career flexibility for research staff, thereby potentially supporting the CC to attract the most qualified and experienced staff.	**Partially Agreed** More difficult at CASE as work spans several faculties and unlike CHIC there is no central research facility. A hybrid model is proposed with up to 6 "core researchers" and a number of project specific researchers.	CASE stakeholders have, prudently, analysed this recommendation in light of contextualised factors, such as the variance of skills required by the nature of projects occurring at the centre (and what is likely to emerge). This structure should be reviewed on a rolling basis.	
By way of developing the longer-term research capacity and capability of the centres, each CC should place a greater focus on the career development of its research staff. This should include providing: • Project management and leadership training (e.g. around identifying IP); • Formal recognition of their contributions to undergraduate/Masters/PhD student supervision; • Opportunities for participation in international researcher exchange programmes;	**Agreed** Implemented June 2017. A Researcher forum was established by CASE during the mid-term review process. All CASE researchers meet once a quarter at a meeting chaired by a member of the CASE post-doctoral community who has been voted into this role by their peers.		

Recommendation	Management response	Evaluator comments	Evaluator's assessment
• Encouraging staff exchange between academic and industrial partners of the Centre; and • Supporting industrial PhDs associated with the Centre.	Meetings are scheduled in the period between the end of a financial quarter and the submission of the quarterly report with an agenda dictated by the research team. The meetings usually cover: • Update on CASE activity • Project showcase • Risk review • Training / secondments etc These are adapted to suit the needs of the research team.		
Invest NI should work with the KPs to encourage them to take a more active role in championing the CC at senior levels, ensuring that they are treated as Centres that are vital parts of the organisations' operations as opposed to being another competitive funding source.	**Agreed.** CASE now falls under the QUB Energy Pioneer Research programme – a commitment to allocating resources to developing research in the sector. CASE is also recognised within QUB as a Social Charter Signature Project. This is an elevated status w.r.t. communications, marketing, lobbying and promotion. Senior management	CASE has made significant contributions to the NI renewables landscape at senior levels, becoming a trusted industry voice.	

Recommendation	Management response	Evaluator comments	Evaluator's assessment
	at Invest NI have continued to lobby at VC level in KPs.		
As part of their reporting CCs should articulate the: • Centre's specific role in the activities vis-à-vis the role played by the host or associated organisations; • Causal link between the Centre's activities and realisation of any outputs (e.g. the publication of journal papers etc.) and outcomes; and • The need to routinely report on industrial impacts.	**Agreed.** CASE has continued to provide quarterly reports covering these areas. CASE will work with Invest NI to amend the quarterly report template with respect to any change in these reporting requirements.	Quarterly reporting on leveraged funding and the CASE involvement in securing this; instances of CASE bidding for new funding opportunities on its own as it seeks to become self-sustaining.	

Source: Action Plan Arising from the CASE Interim Evaluation Report; Grant Thornton analysis

9.1.3 CHIC specific recommendations

Table 9.3: CHIC Interim Evaluation Action Plan

Recommendation	Management response	Evaluator comments	Evaluator's assessment (R/A/G)
1. CHIC should be invited to submit a business plan for continued funding through to Year 8. As part of the business plan, the CC should articulate (at a minimum) its: a. Positioning vis-à-vis other similar and/or competing centres [79] (scale of activity, people, funding, industry involvement, management model, etc), its methodology for how it will achieve its vision to be amongst the top 5 on an international basis, and how it will measure its progress towards achieving this vision, whilst maintaining its attractiveness to its industry members, large and small, and which increases their commercial opportunities and capacity from local, to at least in several cases, global impact; b. Plans relating to membership including its intentions to maintain or grow its membership base (and the strategic rationale for either decision) and membership fee structure;	**Agreed** **a. Partially Agreed.** The Invest NI Competence Centre programme (CCp) is tailored to the needs of a small SME dominated Regional Innovation system and cannot and should not try to replicate large dedicated National centres such as Catapult. With a limited budget it is questionable if this aim to be 'amongst the 'Top 5' is realistic not least because it is not clear what 'Top 5' means. However the centre has identified 5 institutes that will form the basis for ongoing benchmarking. Furthermore, the plan includes actions to increase engagement with ECHA, BioBusiness and MATCH and build new relationships in UK EU and USA. While the CCs do not compete with other centres for membership or funding, benchmarking is important and achievable in terms of high level KPIs e.g. economic impacts, patents, funding leveraged etc. **b. Agreed** INI Competence Centres are small scale. Internationally, average membership varies from 5 to circa 20 members. CHIC has worked with 42 NI companies (current membership at any time circa 20 plus) from an estimated total pool of 90 having a potential Connected Health interest. Focusing on absolute membership numbers is not meaningful. However having members fully engaged with CHIC's strategy is	The Business Plan was submitted and accepted, with Phase II of CHIC currently operational.	

[79] International competition should be better defined, and key benchmarks should be named and analysed.

Recommendation	Management response	Evaluator comments	Evaluator's assessment (R/A/G)
c. Plans to promote the centre and its work, retaining the strong focus on building local industry knowhow and capability but increasing the international visibility and impact of the Centre aiming to be a bridge between the Centre members on the one hand and international healthcare companies and funding and investment opportunities on the other. d. Plans to commercialise the research undertaken to date; e. Plans to internationalise the CC (including, for example, attracting postdocs with more varied backgrounds, including those from outside NI and considering the merits of encouraging more businesses and research organisations from outside of NI to become involved with the Centre); f. Research Strategy; g. Anticipated costs for extending its operational activities;	critical. From the plan – 'There continues to be a healthy interest in membership and current ongoing conversations with other company leaders of micro, large and multinational companies. Driven by the review, there has also been an effort to explore relationships with large multinational companies. The BBC, Deloitte Digital, Kainos, Phillips, AVX and First Derivatives would all be examples of ongoing discussions with large companies around membership and research projects. The centre will also undertake Horizon Scanning for New Projects and Partners **c. Agreed** A communications plan is included in the Business Plan incorporating case studies, quarterly newsletter, updated website, bi-monthly articles on the work of the centre, attendance at events and conferences. Centres have already built international linkages – mainly through conference papers and collaborative research. Example - CHIC participated in the International X Prize (placed 5th in this Global competition attracting 300 applicants) and in collaboration with a US Company. CHIC have been in discussions to recruit a major Chinese owned HC company at April 2018. **d. Agreed** Commercialisation plans have been an integral part of project assessment, monitoring and completion from establishment of centre. Plans for revised IPR Agreements including a Model Clinical agreement. Provision for contract research and higher company investment in return for full/partial IP ownership. Plans to support a NIBEC Hatchery generating spin-outs. **e. Partially Agreed**		

Recommendation	Management response	Evaluator comments	Evaluator's assessment (R/A/G)
h. Model of operation including the frequency of meetings, the method by which members can attend meetings (e.g. via video- conferencing). i. In setting all future budgets, the CC should ensure to reflect the need for the recruitment of additional research staff to support the delivery of research projects.	A significant number of research staff are from outside UK. **f. Agreed – detailed in plan** **g. Agreed – detailed in plan** **h. Agreed – detailed in plan** **i. Agreed** UU to fund 4 additional researchers over and above INI funding.		
2. In order to measure CHIC's progress towards its established Vision, the CC should better define and track its international competition (e.g. in terms of research activity, leveraging of funding, industry engagement) and benchmark its performance against those centres. In addition, all potential risks that might hinder CHIC achieving its vision should be identified and a risk mitigation strategy outlined.	**Agreed** **Please see response to recommendation 1a above -** the centre has identified 5 institutes that will form the basis for ongoing benchmarking.	First CHIC Annual Benchmarking was completed June 2020. CHIC Risk Register being maintained and approved by CHIC Programme Committee and reported on quarterly.	
3. CHIC should establish the International Advisory Board (IAB) that was envisaged at the outset to provide international industry	**Agreed**	Update November 2020: the proposed International Advisory Group initial	

Recommendation	Management response	Evaluator comments	Evaluator's assessment (R/A/G)
and/or academic challenge to its operations. This Board should be relatively small (up to 5 members) and comprise leading scientific and business experts in the field. Typically, this Board would meet face-to-face at the Centre once a year, with this meeting augmented by a small number of virtual meetings as needed. Specifically, the IAB should be utilised to: • Provide advice on the CC's Research Strategy; • Assist the selection of research projects (mitigating against duplicating research undertaken elsewhere, identifying opportunities to lever existing research, identifying projects with greatest commercial opportunity etc); and Support the internationalisation of the Centre.	An International Advisory Group is to be established.	meeting was delayed due to COVID-19, and subsequently several members had moved positions (including beyond UK). New members have agreed to join Group. CHIC held one in-person meeting; the onset of COVID-19 made subsequent meetings difficult, but lasting partnerships resulted. Stakeholders reported that the IAB resulted in new international partnership and speaker opportunities for CHIC members.	
4. CHIC should ensure that it is aligned with the emerging NI Life and Health Sciences Strategy and fully utilises, the emerging NI Health Innovation Infrastructure e.g. DARO, CHIP, Int. HAC etc (as and when this is established/becomes operational).	**Agreed** CHIC has developed many strong linkages across the NI Healthcare sector, Clinicians, residential care homes etc. Will continue to support and participate in the action plan working group. Living Lab concept to be launched.	The CDHT OBC is being resubmitted (at time of writing) to reflect the inclusion of the Living Lab.	
5. The CC should develop its communications and branding strategies to build awareness of the Centre, its achievements and its members' capabilities with international industry, research funding bodies and other similarly	**Agreed** This will implemented through: • Shuai China Action plan - to communicate partners and member opportunities as the China action plan emerges.	The CHIC website has been refreshed including capabilities, case studies and partners. Website is being updated regularly.	

Recommendation	Management response	Evaluator comments	Evaluator's assessment (R/A/G)
focused CCs. Linked to this, by way of supporting the ongoing marketing of the Centre and its research, CHIC should ensure that its website is appropriately updated and maintained.	• Boston Partners Symposium and Sister Cities Initiative - *Trade Mission*	Networking events and CHIC speakers attending Life & Health Sciences events, both in NI and internationally, are raising the profile of CHIC.	
6. CHIC should undertake a review of its processes for classifying the TRL of the technologies being developed through its research projects.	**Agreed** TRL levels to be peer reviewed prior to future submission to independent evaluators of CHIC.	TRL being assessed through project review and selection process and in line with Competence centre Managers Guidance issued 28/10/2020. Industry needs and objectives were incorporated into phase II, leading to the inclusion of rapid prototype testing and the faster timelines associated with this.	
7. In relation to individual project management: a. During the scoping of individual research projects, ensure that suitable allowances are made to account for the likely timeframes that might be required to obtain all necessary Ethics Committee approvals; b. Undertake regular "project specification" reviews, so as to ensure that the focus of the research activity continues to be appropriate from a technical and/or market perspective.	**Agreed** Currently operational. Many of the lessons learned illustrated in these actions are part of the operational scoping and specification of today's projects and are subject to frequent review with the programme committee on a quarterly basis. a. Currently operational and will continue to be reviewed with programme committee for lessons learned with areas such as ethics. Recent legal issues around google and health data in London highlight the complexity and lack of clear formula to follow.	7d Complete: A 12 month extension to the CHIC Letter of Offer for phase I facilitated an extension of the Flagship projects and researcher projects by one year. Final term of the flagship projects is 3 years 2 months (projects anticipated to complete May 2019). 7e Ongoing: An update on the strategic projects including opportunities for	

Recommendation	Management response	Evaluator comments	Evaluator's assessment (R/A/G)
c. Continue with the parallel approach of using short-term projects that can tackle shorter term or immediate needs of the industry members, alongside the more strategic projects that can be used to build core expertise, attract international core recruits and to create IP and knowledge in relevant areas. d. Consider extending the term of such flagship projects beyond the current two years, so as to enable key researchers to be retained on more secure contracts. e. Where the newer, longer-term strategic projects format is used, the pathways and opportunities for industry involvement should be clearly articulated.	b. Currently operational with the companies and researcher meetings. c. Currently operational with call 7 projects ongoing and 2 strategic projects. d. Researcher contracts are secure within the terms of the Invest NI funding. The point raised by the action is not relevant to CHIC. No further action required. **e.** Flagship projects will have a limited budget. CC's focus is more KT than primary research. CHIC has and continues to develop links with other centres which have a strong focus on primary research e.g. Precision Medicine, CiTric etc. will be examined. Industry involvement is reported to the programme committee for monitoring on a quarterly basis. Section 1 of BP.	industry involvement are presented to the CHIC Programme Committee (PC) on a quarterly basis. Points a-e are in place for CHIC Phase II and being managed by CHIC Programme Committee in line with Competence Centre model.	
8. Per the IEP's recommendation, CHIC should seek to identify opportunities to increase the scale and scope of its collaborative activities at a national and international level. Specific target markets might include the ROI, US and China (but ultimately should be governed by the commercial needs of CHIC's members, with suitable strategic justification provided for any chosen market). Opportunities to work in collaboration with other organisations and stakeholders (e.g. the Wellcome Trust) should also be explored.	**Agreed -** but subject to funding availability.	"Sustainability and Engagement Manager" in post since November 2019 to explore and implement relevant opportunities on an ongoing basis.	
9. Subject to the retention of the SMART objective relating to the number of member	**Agreed –** but already the case and from Day 1.	NA	

Recommendation	Management response	Evaluator comments	Evaluator's assessment (R/A/G)
companies, and on the basis that CHIC's membership base appears to be broadly reflective of the NI sector, consideration should be given to reducing the target membership contribution to 25% of operating costs for all future years.			
10. By way of supporting the ongoing monitoring of the Centre's progress on a timely basis, the CC's KPs and industry members should provide expenditure (both cash and in-kind contributions) monitoring information in a timelier manner.	**Agreed** Quarterly Reports up to date as of 16th May 2018. Invest NI will continue to press for timely submission of monitoring information. This has and will continue to include withholding grant payments when necessary.	Quarterly reports submitted on time and to the requisite level of detail	
11. Given the Centre's Vision to be a "Top 5" Connected Health Centre in the world, CHIC should be encouraged to place greater emphasis on publishing its research in those journals with highest Impact Factor (IF). Whilst recognising that high IF publications will often require longer projects and additional researcher input which may not always align to the needs of businesses (whose preference may be for shorter projects), if CHIC wants to deliver upon its overarching Vision, there is an onus on the CC maintaining a balanced portfolio of shorter-term and longer projects. In the case of the latter, we note that CHIC has already progressed a number of longer-term "strategic" projects. This will also require the CC to more effectively communicate the merits of engaging in longer-term projects to industry members.	**Agreed** Higher impact factor publications will be considered on a case by case basis in line with commercial interests. However, CCs are designed to operate mostly in mid-range TRLs. Other funding sources are available for curiosity driven research. High IF publications will be the focus of Strategic/Flagship projects and linked to the PhDs. This will reduce the issue of company conflict about time used for high IF publications and also address researcher concern that too few research projects offer sufficient academic challenge to attract high IF publication. Revised KPIs have been approved.	Growing focus on strategic projects and dedicated researchers for this; inclusion in REF case studies for University of Ulster rankings and demonstration of commercial applicability and impact of research.	

Recommendation	Management response	Evaluator comments	Evaluator's assessment (R/A/G)
Linked to this, Invest NI should consider its output target to reflect the nature of the journals in which the research is being published.			
12. CHIC and the other centres should review their procedures for identifying and managing IP. This is likely to require additional training (potentially from the respective Knowledge Providers' commercialisation offices) to be provided to Centre members, academics and research staff on the methods of identifying, managing, protecting and exploiting IP. Underpinning this, the Centres should develop a culture of IP disclosures, a rapid IP decision-making process (using defined timelines) and ensure that there is a clear license agreement to operate. Once the training is complete, a retrospective review should be undertaken to ensure that all IP has been appropriately identified and registered. It is recommended that such a review is undertaken in conjunction with the KPs' respective commercialisation offices.	**Agreed** CHIC has worked with the University and Invest NI to promote a clearer IP policy. This is also being addressed by Ulster IP lead who attends the programme committee. This is wider than a training issue for knowledge providers as it requires specific legal knowledge to balance State Aid rules and operational relationships in ways that are beyond traditional KP experience.	An IP audit of all projects completed since the launch of CHIC completed. Collaboration with University of Ulster IP lead and maintenance of IP asset log. Work to be continued in this area.	
13. Each of the Competence Centres and the programme in its entirety should review the model(s) of IP ownership that has been employed. Whilst this will require specialist legal advice and a deep working understanding of State Aid regulations, a model that might be considered (as a starting point) is that employed by the Catapult centres. The Catapults offers businesses a	**Agreed** As above. Company's feel an entitlement to IP ownership without incurring the full costs. Companies wishing to own IP from start can procure research through contracting with university.	Consider tiered membership model with associated preferential IP rights. Limited scope within the state aid restrictions.	

Recommendation	Management response	Evaluator comments	Evaluator's assessment (R/A/G)
variety of options in relation to the ownership of any prospective IP generated. In particular, we note that the Catapult model aligns to some degree with the IEP's suggestion that a more flexible model of IP management/ownership (e.g. businesses contributing in excess of 25% of research project costs to potentially own the IP on completion of the research) should be offered/explored.			
14. Regardless of the model adopted, there is a need for the CCs to better clarify the model(s) of IP ownership with industry member/participants e.g. through the use of worked examples and case studies.	**Agreed**	Collaboration with University of Ulster IP lead and maintenance of IP asset log.	
15. Whilst strategic projects should be encouraged, the Centres must be mindful of ensuring that businesses can adequately contribute in-kind time to such projects.	**Agreed** This is monitored by the CHIC Programme Committee and Invest NI.	Underperformance regarding IKC target; consider reporting strategic projects and commercial projects' IKCs separately and reviewing this balance.	
16. Where possible, the 'core researcher' recruitment model (like that implemented by CHIC) – where research staff are employed to work across the Centre as opposed to being on short-term contracts linked to individual research projects - should be encouraged. Such a model offers the potential to: • Facilitate research projects commencing in a more expeditious manner (as researchers would not	**Agreed** This has been CHIC operational practice since 2015. UU have agreed to fund 4 research posts.	Generally, the CHIC CORE model has been positively reported on by participants and management, as well as other centres' stakeholders.	

Recommendation	Management response	Evaluator comments	Evaluator's assessment (R/A/G)
need to be continually recruited and appointed on an individual research project basis); • Provide greater flexibility in allocating resources; and • Provide greater career flexibility for research staff, thereby potentially supporting the CC to attract the most qualified and experienced staff.	Recruitment takes 6 months minimum.		
17. By way of developing the longer-term research capacity and capability of the centres, each CC should place a greater focus on the career development of its research staff. This should include providing: • Project management and leadership training (e.g. around identifying IP); • Formal recognition of their contributions to undergraduate/Masters/PhD student supervision[80]; • Opportunities for participation in international researcher exchange programmes; • Encouraging staff exchange between academic and industrial partners of the Centre; and	**Agreed** The CHIC extension plan will address sustainability of centre post INI funding. Up to 20% of research project funding can be devoted to platform work providing management and leadership experience.	Career development plans in place for all researchers and time spent on the relevant career development activities supported by Invest NI.	

[80] We do however note that no PhD students are currently supported through CHIC.

Recommendation	Management response	Evaluator comments	Evaluator's assessment (R/A/G)
Supporting industrial PhDs associated with the Centre.			
18. Invest NI should work with the KPs to encourage them to take a more active role in championing the CC at senior levels, ensuring that they are treated as Centres that are vital parts of the organisations' operations as opposed to being another competitive funding source.	**Agreed** Ulster University's commitment to CHIC is reflected in their decision to fund 4 additional researcher posts. See section 5 Staffing – additional funding beyond grant.	UU funding for 4 additional research staff was a condition of the Phase II funding letter of offer. Complete and monitoring ongoing of same.	
19. As part of their reporting CCs should articulate the: • Centre's specific role in the activities vis-à-vis the role played by the host or associated organisations; • Causal link between the Centre's activities and realisation of any outputs (e.g. the publication of journal papers etc.) and outcomes; and The need to routinely report on industrial impacts.	**Agreed**	A new CHIC manager has commenced October 2018, cognisant of these reporting requirements. Post project evaluation of each research project was undertaken by CHIC to capture actual and anticipated industrial impacts.	

Source: Action Plan Arising from the CASE Interim Evaluation Report; Grant Thornton analysis

Appendix 2: Economic modelling process

Grant Thornton undertook an economic impact assessment and a return on investment analysis for each of the four competence centres. This appendix outlines the approach taken and key modelling assumptions. The aim of the analysis was to establish the 'additional' impact for businesses having been involved in collaborative research projects, and thus the 'additional' impact to the NI economy.

To assess the impact on the NI economy, Grant Thornton established the level of additional turnover generated using data provided by Invest NI. This data spanned the period 2017 to 2021. As this data only contained a sample of Invest NI clients (and given that there was significant involvement of non-clients in the centres), this sample was not wholly reflective of the population. It required a scaling up factor to demonstrate the potential overall impact. As stated within the evaluation, the data is subject to the limitations of self-reported data. Outliers have been removed from the scaling up process, where outliers are defined as companies whose base year sales are more than 2 times greater than the average sales within that year across participants, for each centre.

To account for a base case/counterfactual (i.e. what would have happened in the absence of support) an additionality rate was calculated using survey responses. Additionality was assessed for the activity (would they have done it without Invest NI support) and impact (how much of the impacts were due to the support). With respect to activity additionality, this ranged from 25% to 68%. The impact additionality factor isolated the specific impact of the programme in improving business turnover generation or business expenditure on R&D (BERD), with this factor ranging from 1.4% to 33.3% (T/O) and 2.9% to 31.3% (BERD) depending on the centre. Displacement and substitution were inferred from survey responses, leakage was calculated based on Invest NI CRM data.

Taken together this gave what we believe to be a prudent and conservative estimate of 'additional' turnover and BERD generated to businesses from being engaged in the Competence Centre Programme.

To present the additional GVA impact, Grant Thornton took the NISRA Annual Business Inquiry GVA to Turnover ratio for the applicable primary sector based on survey responses and with reference to the relevant SIC codes. This resulted in conversion rates of between 31.8% and 70%.

Consideration was also given to the established body of literature on the socioeconomic returns to healthcare innovation expenditure. An uplift was applied over a five-year time frame (projecting to 2026 from the 2021 end point of input data) to CHIC's economic impact. These were presented separately in the report to demonstrate a short and medium term impact.