

Review of the Invest NI Proof of Concept Programme

Final Report to Invest NI

April 2018



SQW

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Approved by: Richard Hindle Date: 18 April 2018
Director

Executive Summary

1. The Invest NI Proof of Concept programme (PoC) was introduced in 2003 with a Pilot phase, to support the pre-commercialisation of leading edge technologies from Northern Ireland's research organisations, and particularly its universities. The first and second Phases followed, and Phase III is now underway. SQW Ltd (SQW) was commissioned by Invest Northern Ireland (Invest NI) in July 2017 to undertake a review of the period from the launch of Phase I of the programme in January 2008 onwards, focusing particularly on the period up to the end of Phase II in April 2015, and assessing the impacts to mid-2017.
2. **We found a continuing strong rationale for intervention in this space.**
 - Ideas and innovation are recognised as one of the 'five foundations of productivity' in the 2017 UK Industrial Strategy; the national (and Europe-wide) weakness in realising rapid growth of high value businesses is also acknowledged. A Government press release published alongside the Strategy¹ cited the importance of boosting Northern Ireland's research and innovation base, the role of the Industrial Strategy flagship sector deals including some of Northern Ireland's most important sectors, the Industrial Strategy Challenge Fund and the Strength in Places Fund to support innovation excellence.
 - The Proof of Concept programme has a recognised position in the innovation ecosystem in Northern Ireland, providing early stage support to drive innovation and commercialisation from the research base. It corresponds to similar programmes elsewhere in its purpose and scale of operation, with funding of around £100k per project to undertake further research, and enable projects to move from Technology Readiness Level 2 to 3 or 4.
 - PoC does not take projects all the way to commercialisation; these projects typically depend on further investment, and potentially public support, to achieve this. Its success cannot therefore be judged primarily in terms of the delivery of monetised economic impacts. This is recognised in the targets and reviews of similar programmes elsewhere. PoC aims to increase innovation, and increase entrepreneurial awareness and behaviour. It is targeted at a specific subgroup which have developed research concepts in the form of business opportunities, some of which may have potential for high growth. These intermediary outcomes may take substantial time to realise, and the timeframes may change as the technical and market parameters become clearer. A key performance test for the programme is its role in the innovation ecosystem, and the links with other components of this system, particularly in developing commercialisation knowledge and expertise, and securing follow-on funding. On these measures, which are the most appropriate measures on which to assess the success of PoC, we found that the programme performs a vital role.
 - Given the long timeframes to impact, it is not surprising that the programme's monetised economic impacts to mid-2017 are modest. The net economic impact

¹ 'New Industrial Strategy to boost NI earning power and innovation' – GOV-UK press release, 27 November 2017

to date for Phase I projects is £3.7m, with a Return on Investment (ROI) of £0.81: £1. The equivalent figures for Phase II are much lower than these, but this also reflects the long and uncertain timeframe for realising monetised economic impacts from this type of intervention, and the fact that neither sets of figures take account of future monetised impacts, which are very difficult to assess. Indeed, the economic appraisal for Phase II suggested that the ROI should ultimately reach £2.47:£1, and the pipeline of potentially realisable projects does not seem to be reducing: Phase II overall performance at the end of funding compares favourably to Phase I at the same stage.

- This affirmative conclusion on the validity of PoC in terms of its role and delivery, is to some degree at odds with a clear and consistent view from stakeholders that the PoC programme could and should be delivering more results, and that the impact in developing business potential from research, may be reducing over time. Most stakeholders accepted the broad case for intervention in this space, but noted that other similar programmes elsewhere had been reviewed and to some degree reconfigured. They asked if more could be done to accelerate positive impacts from intervention.

3. **The headline recommendation of this report is that PoC should continue, but with some changes.** There are only two universities in Northern Ireland, and Queen's University Belfast is considerably more research-intensive than the University of Ulster. The disparity in economic impact, with Queen's considerably outperforming Ulster on most dimensions, may be therefore be unsurprising. However, the result is that the PoC programme is over-dependent on one partner. We recommend that this situation be kept under review, with a view to stimulating supply further, including from any new collaborations.
4. Other recommendations focus on a staged approach, with reviews built into the process to identify the innovative potential of the research propositions as they move forward, reassessing their progress towards commercialisation, and seeking to achieve more impact through embedding the programme more effectively within the wider Northern Ireland ecosystem.
5. **Other complementary measures already exist alongside PoC in Northern Ireland, but drawing on experience from elsewhere, we recommend that consideration be given to some additional initiatives, such as enterprise fellowships, which could help researchers in realising the commercial potential of their ideas.** These should be designed, piloted and tested in terms of their contribution to the development of a culture of entrepreneurship and innovation in Northern Ireland, and their performance judged against identifiable – intermediate – effects in helping to stimulate business development and growth in the longer term.
6. The recommendations for PoC in the future follow three core principles:
 - **a more structured programme, in which there is also more flexibility**, providing support tailored to the specific type and form of innovative research projects, and the nature of the funding gaps;
 - **a programme in which the content at project level is designed to encourage, enable and achieve commercial results**, drawing as and where appropriate on

- commercial expertise and other experience, including linking into other initiatives aiming to support embryonic and early stage enterprises with real growth potential;
- **a programme which is embedded in, and a more visible part of, the universities' missions.**
7. We anticipate that, following further feedback and discussion, a revised model for PoC, with sub-options, would be set out and tested in more detail in a full economic appraisal.

1. Introduction

- 1.1 SQW Ltd (SQW) was commissioned by Invest Northern Ireland (Invest NI) in July 2017 to undertake a review of the Invest NI Proof of Concept programme (PoC).
- 1.2 The review covered the period from the launch of Phase I of the programme in January 2008 onwards, with a particular focus on the period up to the end of Phase II of the programme in April 2015, assessing the impacts for these two phases by mid-2017.

The Proof of Concept programme

- 1.3 The Invest NI PoC programme was introduced, first in pilot form, in 2003, as part of Invest NI's suite of R&D and innovation-focused interventions. The programme comprises grant funding to support the pre-commercialisation of leading edge technologies emerging from Northern Ireland's universities, research institutes and NHS Trusts, and is aimed at moving projects closer to commercialisation, typically to Technology Readiness Levels (TRLs) 3 or 4². PoC funding is specifically for projects with commercialisation potential; it is not expected to be just another source of research funding for projects.
- 1.4 The amount of funding available per project has changed over time. Initial funding for a Phase I project totalled £100k, and for Phase II projects was £106k. The funding encompasses two strands of activity: a technology strand of 18 months' duration with maximum assistance of up to £80k; a commercialisation strand of 24 months' duration with maximum assistance of up to £20k (£26k in Phase II), which is expected to run in parallel with the technology strand. The grant covers up to 100% of eligible project costs. In exceptional circumstances, 'Sequential PoC' and 'PoC Plus' funding is made available for projects that need more time and money to prove their concept (Phase II and Phase III only).

Purpose of the review

- 1.5 The purpose of the review, as set out in the Terms of Reference for the study, was two-fold: a retrospective review of the programme, looking at impacts achieved to mid-2017; a forward-looking consideration of future options and models for intervention in this space. The objectives specified were to:
 - Assess longitudinal value for money review of the economic impacts for Phase I and Phase II of the programme
 - Benchmark the impacts of the programme against national and international translational funding designed to 'bridge the gap' between early stage technology resulting from university research and its commercialisation
 - Provide conclusions on the overall findings of the evaluation

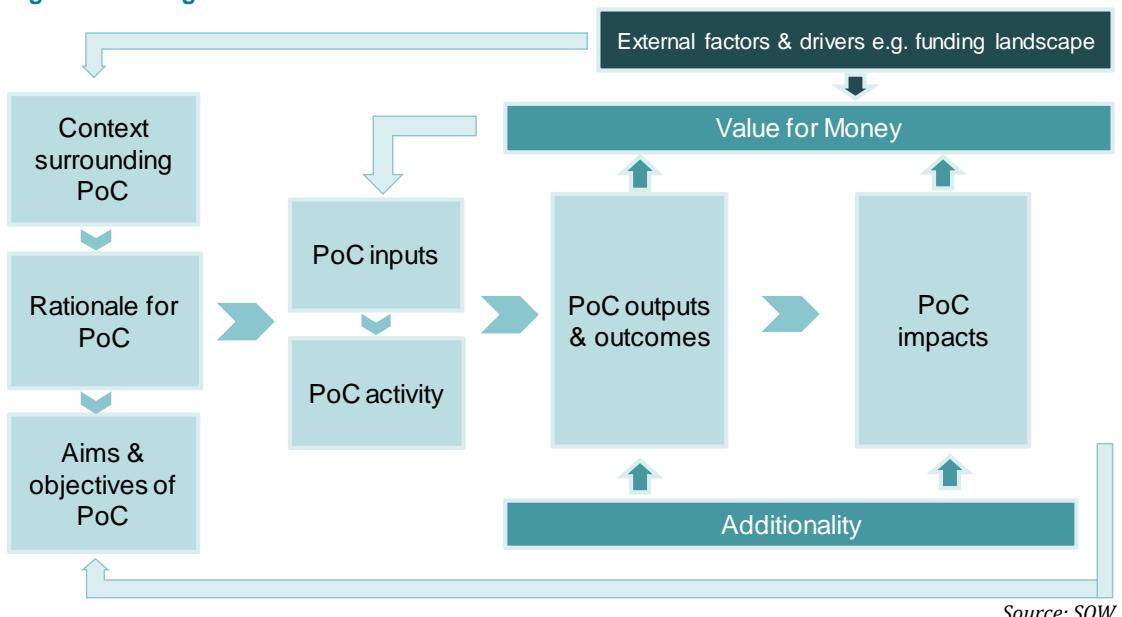
² Technology Readiness Levels (TRL) are a type of measurement system used to assess the maturity level of a particular technology. TRLs 3 to 4 are where concepts have been proven, but at this stage only within a laboratory environment.

- Comment on lessons learned, identify strengths and weaknesses of the current model, and identify areas for improvement
- Explore the potential for new, innovative approaches to improve the commercialisation of research
- Recommend a model for a potential fourth phase of PoC, or a pilot for a radically alternative approach, provided the strategic need for intervention remains.

Approach and method

- 1.6 In order to address the objectives for the retrospective review, the study adopted a logic model approach. This is designed to understand each aspect underpinning the intervention, from the context and rationale for the intervention, through to its impacts and value for money. The key components, and how each feeds into the next, are set out in Figure 1-1.

Figure 1-1: A logic model for PoC



Source: SQW

- 1.7 It is important to recognise that this review does not constitute a comprehensive assessment of past performance of PoC, nor provide detailed analysis of the additionality of the programme. It does not seek to provide 'new' answers with regards to the rationale and objectives for the programme. These are taken as read from previous comprehensive evaluation work. The principal focus was on increasing understanding on the impacts resulting from PoC, specifically how these impacts are realised and what could be done to improve them. The effects of the programme were assessed within the context set by the whole logic model, which informed both the retrospective review and forward-looking element of the study. There were several key elements to this:

- A review of key documents and data** relating to PoC, as well as the wider commercialisation landscape in Northern Ireland
- Consultations with public and private sector stakeholders**
- Consultations with Principal Investigators** of PoC-funded projects

- **Consultations with people involved in proof of concept-type interventions elsewhere**, outside Northern Ireland
 - **Benchmarking against comparator programmes** in Norway, Scotland, Republic of Ireland and Finland, completed through a mix of consultations and desk research.
- 1.8 The review was an opportunity to reflect on **what ‘success’ looks like for this type of intervention**, and whether the impacts currently reported for NI PoC are based on appropriate measures. The retrospective review in this report is necessarily focused on the data recorded to mid-2017 in the monitoring framework, but the stakeholder interviews and analysis of comparator schemes elsewhere enabled a more rounded qualitative assessment of results. The recommendations look towards a realistic definition of success, with appropriate measures for impacts.

Report structure

1.9 The remainder of this report is structured as follows:

- Section 2: Context
- Section 3: Retrospective review
- Section 4: Options for future intervention
- Section 5: Recommendations.

2. Context

- 2.1 This section explores the context to the PoC programme; it considers the commercialisation landscape for the programme and the resulting rationale for, and objectives of intervention in this space.

Section summary

- The crucial role of innovation and commercialisation in supporting economic and productivity growth is increasingly recognised. The UK and continental Europe have promoted innovation through various strategies and initiatives, but they have lagged other developed countries in translating research into commercial activities.
- Compared to the rest of the UK, Northern Ireland performs poorly in terms of both productivity and innovation. Several key barriers to innovation hold back Northern Ireland's innovation potential, even with a supportive strategic and policy environment.
- In this context, market failures are evident in commercialisation, with research organisations failing to reach their commercial potential. The PoC programme was developed, starting in 2003, to increase commercialisation from within Northern Ireland's research organisations, through the provision of funding for early-stage development activity. The study found the rationale for intervention in this space still to be valid.

The commercialisation landscape

- 2.2 The commercialisation of research has been seen for some decades as an important element to supporting economic growth, and the emphasis on this is increasing. The UK economy's future success "*has been linked to the success of translating a world class science base to generate new businesses with the consequent generation of UK jobs and growth*"³: this is just one part of the commercialisation picture.
- 2.3 Yet, according to OECD statistics, there was a general slowdown in the number of patents, licences and companies created at universities in the late 2000s – the average annual growth rate in patent applications by universities fell from 11.8% between 2001 and 2005 to 1.3% between 2006 and 2010⁴. Whilst the number of patent applications is still increasing, the slowdown has raised concern, amongst policy makers and practitioners about the effectiveness of commercialisation policy and technology transfer instruments.
- 2.4 Against this backdrop, and recognition of the uncertainties and lengthy timescales involved in realising commercialisation based on innovation, the policy landscape continues to evolve. Highlighted below are some key policy interventions currently operating in this space.

Europe

- 2.5 Europe has historically lagged behind much of the rest of the developed world, including USA, Japan, Singapore and South Korea, in developing new products, processes and services. A comparison of R&D-to-GDP ratios show European countries spend much less on R&D

³ See [Bridging the valley of death: improving the commercialisation of research, House of Commons Science and Technology Committee, 2013](#).

⁴ See [OECD \(2013\). Commercialising Public Research: New Trends and Strategies](#).

compared to these countries. Major obstacles to innovation in Europe include expensive patenting, market fragmentation, and skill shortages, which prevent ideas reaching the market quickly, and in doing so, hinder the process of commercialisation⁵.

- 2.6 In this context, in 2010 the European Commission set out Europe 2020, a 10-year growth strategy for the advancement of the EU economy. The primary aim was ‘smart, sustainable, inclusive growth’ with greater coordination of national and European policy. One of seven flagship initiatives under this strategy was the **Innovation Union**, designed to create an “innovation-friendly environment that makes it easier for great ideas to be turned into products and services that will bring our economy growth and jobs”. To tackle issues surrounding innovation in the EU, including those related to commercialisation of research, the Innovation Union was responsible for the implementation of a major financial instrument: ‘Horizon 2020’.
- 2.7 With a budget of around €79 billion for a seven-year period (2014-2020), **Horizon 2020** is Europe’s largest ever fund for research and innovation. The overarching goal of the programme is to secure Europe’s global competitiveness through research and innovation. Through Horizon 2020, both equity and debt finance is provided to individual researchers, research organisations as well as companies. The programme puts specific emphasis on the need to show commercial demand for the end product of any funded research project. This EU funding, which is unprecedented in its scale, is aimed at narrowing the innovation gap, and speeding the process of product commercialisation.

UK

- 2.8 The UK too has struggled with translating academic research into commercial outcomes. Government reviews have highlighted how, despite having an excellent research base, the UK fails to maximise its potential when it comes to translating this into economic benefit; the UK has been historically relatively weak at commercialisation⁶. National UK innovation bodies including Government departments, Innovate UK and the Research Councils have played a leading role in developing strategies and initiatives to overcome issues related to the commercialisation of publicly funded research.
- 2.9 Government has acknowledged the challenges that the UK faces in commercialisation, including through the **Dowling Review** (2015), which highlighted the (over)complex innovation system, and the **Industrial Strategy** (2017), which includes a commitment to increase commercialisation⁷. In this context, the environment for research funding is changing, and becoming more strategic. From early 2018, UK Research and Innovation (UKRI) is set to bring together the seven Research Councils, Innovate UK and a new organisation, Research England, to oversee a combined budget of more than £6 billion. As its name indicates, UKRI will work across the UK as a whole, and Research England will work closely with its partner organisations in the devolved administrations. Importantly, UKRI has been tasked with developing a **Knowledge Exchange Framework** to benchmark how well

⁵ See [Innovation Policy – Fact sheets on the European Union \(2017\)](#)

⁶ See [Engineering: turning ideas into reality, House of Commons Innovation, Universities, Science and Skills Committee \(2009\)](#), [The impact of spending cuts on science and scientific research, House of Commons Science and Technology Committee \(2010\)](#), [Bridging the valley of death: improving the commercialisation of research, House of Commons Science and Technology Committee \(2013\)](#) and [Industrial Strategy Green Paper, HM Government \(2017\)](#)

⁷ See [Industrial Strategy \(2017\)](#)

universities are doing at fostering knowledge sharing and research commercialisation, sitting alongside the Research Excellence Framework and the Teaching Excellence and Student Outcomes Framework.

- 2.10 Some interventions have operated in this space for many years: **Knowledge Transfer Partnerships (KTPs)**⁸ have been supporting UK businesses to access knowledge, technology and skills from the UK's research base for over 40 years. The current Government has launched new initiatives to support its renewed emphasis on supporting commercialisation.
- The **Industrial Strategy Challenge Fund** is a key intervention launched by Government to help achieve the objectives of the Industrial Strategy. The Fund was launched to provide funding for technologies where the UK has the potential to take an industrial lead, with customised support provided at each point in the product development process, from early stage research to commercialisation. Six technology areas have been identified, which will share £1bn of funding over four years: healthcare and medicines; robotics and artificial intelligence; clean and flexible energy; driverless vehicles; manufacturing and materials of the future; satellites and space technology.
 - The **Connecting Capability Fund** was also launched to support the Industrial Strategy and accelerate commercialisation. This £100m fund over four years will provide funding, to English universities only, to collaborate with each other on innovative knowledge exchange projects. The aim is to enhance the effectiveness of the university knowledge base in delivering commercial and business applications and wider applications for the economy and society.

Northern Ireland

- 2.11 Northern Ireland's economy performs poorly compared to the rest of the UK, with lower productivity levels, and key economic challenges to address. This is especially evident in terms of innovation, with Northern Ireland sitting at the bottom of almost all UK league tables for innovation⁹, and with particularly low levels of innovation in business.
- 2.12 The barriers to innovation reflect many of the wider economic challenges Northern Ireland faces, and include a mix of often inter-related factors: lack of knowledge (absorptive capacity, IP), access to capital, incentives (lack of competition or ambition), markets (access, identification of opportunities, regulation), skills (leadership, technological, creative thinking) and culture of innovation (risk aversion, low levels of entrepreneurship, reluctance to collaborate). The limited number of very large companies is also seen as limiting levels of R&D and innovation¹⁰. Northern Ireland's public sector is committed to strengthening the innovation ecosystem and to increasing commercialisation of publicly funded research, as set out in Northern Ireland's draft **Industrial Strategy**.
- 2.13 A complex, and apparently comprehensive, ecosystem of interventions and organisations already exists to support innovation, and entrepreneurship more broadly. The ecosystem has been depicted by Invest NI in the graphic reproduced at Figure 2-1. The Proof of Concept

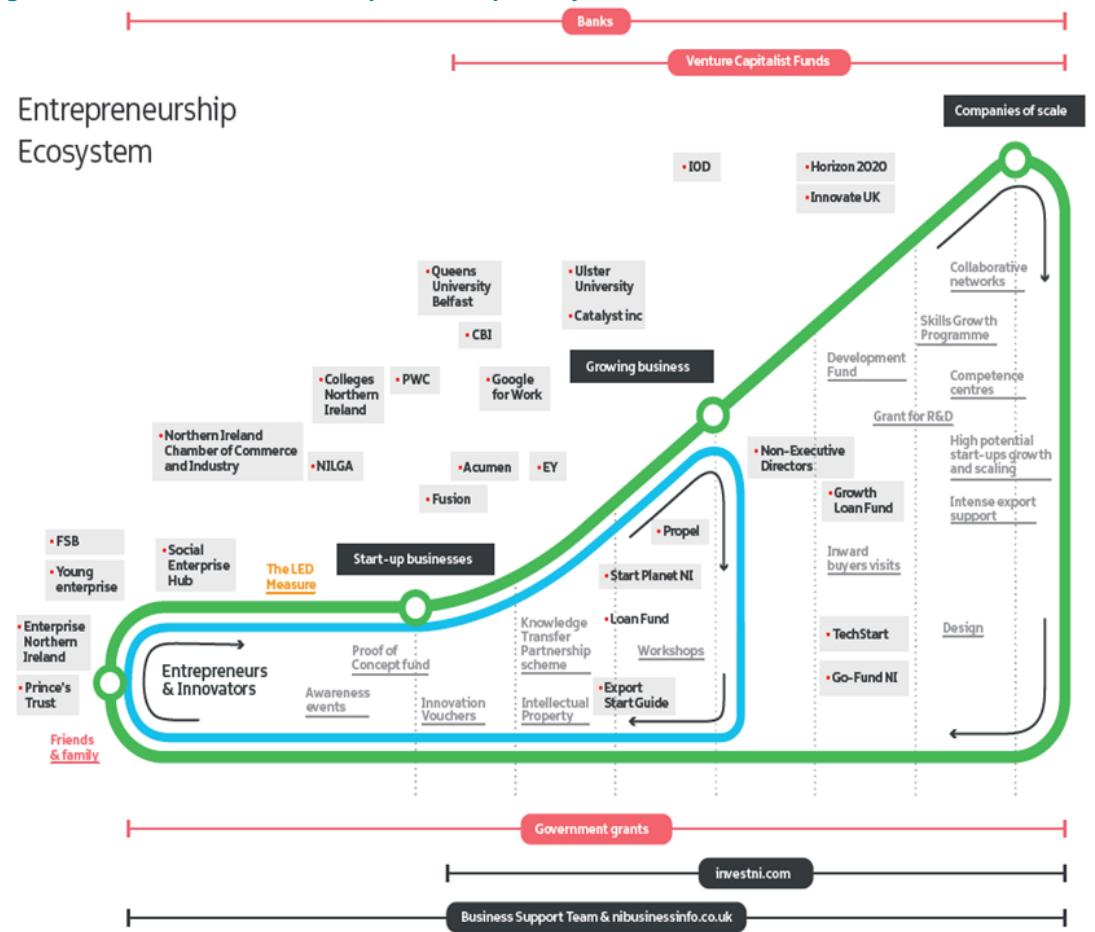
⁸ KTPs replaced the earlier Teaching Company Scheme in 2003

⁹ See [Innovation Strategy for Northern Ireland 2014-2025 \(2014\)](#)

¹⁰ See [Invest Northern Ireland, Corporate Plan 2011-2015 \(2011\)](#)

programme is positioned, as might be expected, as an early stage intervention; it is also shown at the edge of Invest NI's sphere of interest and operation.

Figure 2-1: Northern Ireland Entrepreneurship Ecosystem



Source: Invest NI Business Strategy 2017-2021

2.14 Key interventions in the commercialisation and innovation space in Northern Ireland include the following¹¹:

- **Innovation Vouchers.** Invest NI offers up to £5k to SMEs to 'purchase' specialist knowledge from universities, colleges and other research organisations across the whole of Ireland, which will support the development of new products, processes or services, product and service testing, access to information and expertise on new materials, and tap into research.
- **Collaborative Growth Programme.** This scheme provides up to £25k for industry-led networks requiring facilitation support to scope innovative collaborative projects with the potential to enhance business competitiveness. Applications are particularly welcomed from businesses in Agrifood, Advanced Manufacturing, Digital/ICT, Life and Health Sciences, Materials and Engineering (AMME), and Sustainable Energy.
- **Grant for R&D.** Invest NI offers funding for businesses that are new to R&D to undertake R&D, and provide 'follow-on' funding support for those with some experience of R&D. Support is intended to help with development of R&D projects, as

¹¹ See <https://www.investni.com/support-for-business/do-more-research-and-development/r-and-d-escalator.html>

well as supporting companies to link with colleges or university to collaborate on strategically important projects. Grants for Project Definition are also available, to support businesses to adequately plan and define their R&D project.

- **Proof of Concept programme.** As set out in Section 1, PoC provides around £100k for pre-commercialisation projects within Northern Ireland's research organisations, to undertake technology development activities to a point where a working prototype or demonstrator is produced, to prove the initial concept and clarify a route to commercialisation.
- **techstart^{NI}.** This includes a Proof of Concept Grant Fund, SME Equity Fund, Queen's University Belfast Equity Fund and Ulster University Equity Fund. The Proof of Concept Grant Fund provides entrepreneurs with grants to explore the viability and commercial potential of an innovative concept, with funding in the form of a "Concept" Grant (of up to £10k) and a "Concept Plus" Grant (of up to £25k); the other interventions comprise a suite of investment funds providing up to £250k of seed and early stage investment to firms with high growth potential.
- **Competence Centres.** These are designed to promote economic growth by bringing together universities, research institutes and innovative businesses to carry out strategic collaborative research in areas with a direct industrial focus. The Centres aim to develop new products, processes and services and bring them to the global market more quickly.
- **Higher and Further Education Collaboration Fund – 'Connected'.** The Connected programme enables Northern Ireland's two universities and the six further education colleges to come together to provide a "one-stop-shop" for companies wishing to access the technology and knowledge capital within the local research base, taking them right through the whole process from problem definition through to solution identification and implementation. The annual budget for the programme is £1.15m, split across the eight institutions.
- **Knowledge Transfer Partnerships.** This UK-wide scheme offers the opportunity for businesses to benefit from better use of knowledge, technology and skills that exist in universities and colleges. It does so by creating a three-way partnership between a business, an academic institution such as a university or college and a qualified graduate who helps deliver the project. Invest NI co-funds some of these specifically within Northern Ireland.
- Other UK-wide initiatives, some currently led or supported by the EU, include the **Small Business Research Initiative, various Innovate UK funding streams, and Horizon 2020**. In some instances, Northern Ireland has underperformed in securing these funds, when compared with the rest of the UK. For instance, only around 1% of Innovate UK spend on collaborative R&D, feasibility, smart and innovation voucher grants between 2004 and 2017 was in Northern Ireland, which accounts for 3% of the UK's population.

- 2.15 As a business-led panel **MATRIX** also provides an important role in bringing together Northern Ireland's science and technology community, advising Government, industry and academic on the commercial exploitation of R&D in Northern Ireland.
- 2.16 In addition to these ongoing interventions, Northern Ireland's **Innovation Strategy** (2014) identifies 16 actions to combat the low level of innovation, including a focus on open innovation, prioritising investment in those areas that are identified as potential growth areas for Northern Ireland, and investing in collaborative activities. The strategy commits the Northern Ireland Executive to work more closely with the technology transfer offices in Queen's University Belfast (Queen's) and Ulster University (Ulster) to accelerate the translation of research, and maximise potential commercial impact.

Northern Ireland's research organisations

- 2.17 Northern Ireland has just two universities: these are recognised as the key contributors to Northern Ireland's research base and both recognise that they have a key role to play in the commercialisation of research, although this is only one of their priorities.
- 2.18 Queen's Corporate Plan 2016 – 2021 outlines 18 aims for the University. One aim is to further translate research into practice and accelerate the development of new ideas for products and services and support the scale-up of high-potential innovative businesses. Specific actions Queen's will undertake to achieve this aim include:
- Engagement with national networks and Competence Centres, to support development of SME capabilities
 - **Increase commercialisation-specific activities**, through new spin-out and licensing ventures and develop an expert advice network for our entrepreneurs
 - Continue to develop large-scale business-led research partnerships
 - **Diversify sources of funding**, to support early stage ventures through innovative new approaches, such as the Crowd and bring greater, international support and exposure for new ventures.
- 2.19 Ulster's Research and Impact Strategy 2017 – 2022 states that the University will "*pro-actively target businesses which align with our strategic research themes matching research expertise to address industry problems*", and that the University is "*dedicated to driving innovation across industry, supporting businesses to access the knowledge that will help them to develop their global competitiveness*"; Ulster aims to increase the number of research partnerships with business by 25% by 2022, although it is unclear whether this is from a high or low base. Ulster University also operates a Proof of Principle programme, in the form of a small funding pot for early stage pre-commercialisation. Some of these projects have been taken forward ultimately to PoC, but not all Ulster PoC projects have had a Proof of Principle award.
- 2.20 Each university has a subsidiary organisation tasked with commercialisation activities, including spin-out and spin-in businesses – Innovation Ulster Limited and QUBIS Limited. Notable successes in commercialisation include the companies Kainos and Andor (both spin-outs from Queen's), which taken together employ around 1,000 people in Northern Ireland.

Both are long-established spin-outs; there has been no recent replication of these successes at the same scale.

Rationale and objectives

Rationale for intervention – in the innovation space and for Proof of Concept

- 2.21 The interventions to support innovation and commercialisation listed above have been designed, individually and collectively, in response to a recognised market failure.
- From the private sector perspective, innovation can be unattractive due to its high risk nature, with uncertainty as to commercial returns, high costs, and long timeframes before results are realised. For the economy as a whole, this is less of an issue at the early research stage, as relatively high levels of funding are available for research through research councils and charitable foundations. However, beyond this, there is a so-called '**valley of death**', where substantial investment is still required but where research councils and charities are less likely to be involved, and where the private sector is usually unwilling to finance based on perceived uncertainty and risk.
 - For universities and other research organisations, commercialisation is often a fairly low priority. Higher priority is usually given to securing research income, to teaching (in the case of universities), and to healthcare provision (in the case of the NHS). All such bodies face competing claims on resources, but financial pressures on Northern Ireland's universities are exacerbated by the cap on fees.
- 2.22 There is therefore both a generic and a specific case for intervention to help realise the potential of innovation, and contribute to economic development in Northern Ireland through support for commercialisation. This provides a **clear continued rationale for intervention in this space**.
- 2.23 Almost all the interventions to tackle this market failure in Northern Ireland focus on direct assistance to businesses to help resolve the challenges inherent in commercialising innovation. The Proof of Concept programme is the only intervention designed to support research commercialisation, which operates directly through Northern Ireland's research organisations.

Objectives for the Proof of Concept programme

- 2.24 The core strategic objective of PoC is to increase the level and quality of commercialisation from within Northern Ireland's research organisations, through the provision of funding for early-stage development activity.
- 2.25 Operational objectives are also defined for the programme, with the funded projects expected to deliver: improved scientific project management and direction; local retention of benefits, skills and IP; accelerated business creation; cultural acceptance and confidence; increasing business skills and entrepreneurial development within the universities, research institutes and health trusts.

- 2.26 These strategic and operational objectives are intended to help redress the structural issues which result in a low level of innovation in Northern Ireland, and to realise economic potential through commercialisation, where appropriate, of Northern Ireland's research base.
- 2.27 Key performance indicators (KPIs) to achieve these objectives are reported as: establishment of new commercial ventures such as spin out companies and joint ventures; achievement of licence agreements; leveraging of seed investment (e.g. Angel or Venture Capital); leveraging of additional Research Council funding; leveraging of additional commercial funding; leveraging of additional commercial funding not directly related to the project but gained as a result of commercial contacts made during the project; creation of new commercially exploitable Intellectual Property; production of a prototype or working demonstrator of the technology; evidence that the technology is capable of scale-up to commercially viable levels; and identification of potential commercial partners.

3. Review of evidence on performance

3.1 This section comprises the retrospective review of the PoC programme, specifically consideration of its inputs, activities, outputs/outcomes and impacts. It also includes benchmarking against comparator schemes elsewhere.

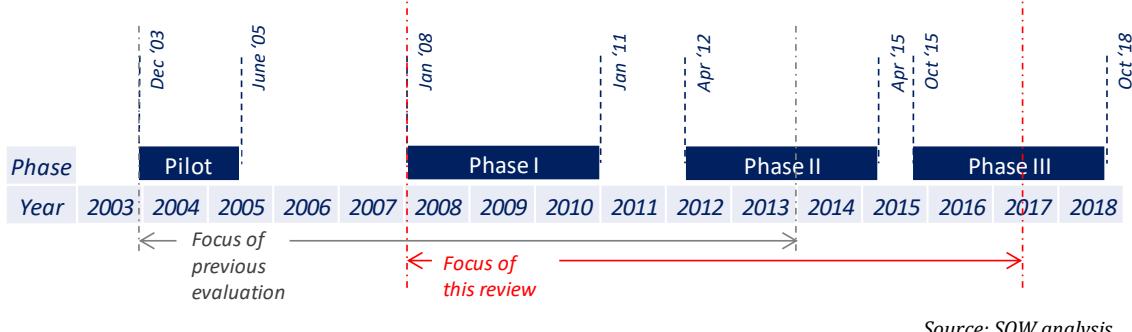
Section summary

- In Phase I and Phase II of the programme, c.£10m was spent on 132 projects. University-led projects account for almost all of the funded projects and are therefore the focus of this review.
- Almost £17m of follow-on funding has been secured to mid-2017 from public sources by Phase I PoC projects, and £14m by Phase II projects. Most of this funding came in the form of research income from UK/EU agencies. In addition, over £7m of income was secured by Phase I projects from commercial partners, with £3m secured by Phase II projects. Sixteen spin-out companies have been formed from Phase I projects, and seven from those in Phase II, with Phase I spin-outs securing around £12m of equity investment to mid-2017. Phase I projects reported a total of c.£0.5m of income generated through licensing, and £3.8m of turnover from spin-outs.
- Several key factors are cited as contributing to projects succeeding and delivering positive commercial outcomes. These include a supportive institutional environment, good mentors, entrepreneurship and business planning abilities, and motivation to genuinely deliver commercialisation activities (i.e. not just using PoC as a form of research income).
- The total gross monetary impact derived from Phase I projects to mid-2017 is £11.7m; the equivalent figure for Phase II projects is £3.3m, which is broadly comparable to Phase I at approximately the same stage in the previous evaluation. Queen's-led projects account for by far the larger part of these impacts, although almost all licensing income is from Ulster-led projects.
- Benchmarking impacts of PoC against comparators is challenging, given a lack of genuinely comparable schemes with recent published evaluations. From the evidence available, the PoC programme performs fairly well against comparators.
- The impact analysis assessed GVA impacts and ROI, as for other interventions. But PoC is an early stage intervention, and in that sense atypical for Invest NI: a more appropriate way to look at its impact may be to take the outcomes that the programme can directly influence 'at face value', with greater consideration given to the effects within the institutions, and to the qualitative results i.e. effects on the research base, that could lead to future economic benefits.

Inputs and activities

3.2 There have been four phases of PoC to date, as set out in Figure 3-1. The Pilot operated from December 2003 to June 2005, Phase I from January 2008 to January 2011, Phase II from April 2012 to April 2015, and Phase III started in October 2015 and is expected to continue to October 2018. In line with the Terms of Reference for this study, this retrospective review focuses on Phase I and Phase II PoC projects and impacts up to mid-2017. **To mid-2017, spend on Phase I and Phase II projects totals £10.4m.** Note that this is spend on projects only; it does not include internal Invest NI costs.

Figure 3-1: PoC phases



- 3.3 In addition to the two universities, PoC funding is available to other public sector organisations in Northern Ireland that undertake research, notably the NHS and the Agri-Food and Biosciences Institute (AFBI). However, as shown in Table 3-1, projects led from the two universities have accounted for the great majority of spend, some £10.1m of the £10.4m spend to mid-2017 on Phase I and Phase II projects. Of the £10.1m spend for the two universities, £4.6m was on Phase I projects and £5.5m on Phase II. Queen's projects account for approximately two-thirds of spend, both in Phase I and Phase II.

Table 3-1: Spend on Phase I and Phase II PoC projects to mid-2017

	Queen's	Ulster	AFBI	Total Spend
Phase I spend (£m)	3.26	1.33	0.18	4.77
Phase II spend (£m)	3.54	1.93	0.18	5.65
Total spend (£m)	6.80	3.27	0.36	10.42

Source: SQW analysis of Invest NI data

- 3.4 As shown in Table 3-2, **132 projects were funded in Phase I (65) and Phase II (67)**. The funding figures include Invest NI funding granted to the projects, but does not include internal Invest NI delivery costs. Given the very small proportions of non-university projects and spend, this review examined only the university-led projects, most of which focused on life sciences or engineering.

Table 3-2: University-led Phase I and Phase II PoC projects

	Queen's	Ulster	AFBI	Total projects
Phase I projects	43	19	3	65
Phase II projects	43	22	2	67
Total projects	86	41	5	132

Source: SQW analysis of Invest NI data

Outcomes

- 3.5 The universities' monitoring data on outcomes has captured income leveraged from other sources following PoC funding being allocated to the project, including from other public sector sources (e.g. research funding from EU/UK agencies, funding from the institution itself, further Invest NI funding), from commercial partners (e.g. Innovate UK, industry-sponsored research, or for consultancy work), from licensing, and equity investment; also data on employees and turnover from resulting spin-outs. The data were provided by the institutions directly, with each institution providing up-to-date data as of mid-2017.

- 3.6 The data provided was for 78 of the 127 Phase I and Phase II projects. Whilst the remaining 49 may have achieved their technical objectives, it was apparent from discussion with the institutions that these projects have delivered no monetised or quantifiable outcomes to mid-2017. As such, although the data cover just 78 of 127 projects, the outcome figures below represent a close to ‘whole population’ view.
- 3.7 However, for these 78 projects, there is likely to have been some undercounting of impacts. This is because of challenges the institutions faced in collating accurate and full information, as a result of the long time-lag for many of the projects since PoC funding was obtained. This is compounded for earlier projects, with these also being the most likely to have secured the greatest benefits (given the longer time over which they have been able to secure benefits). They are also the projects where people are most likely to have moved on, so that the institution can no longer ascertain impact, or where a spin-out was formed and the institution has not been able to access up-to-date relevant data from the firm.

Public funding support leveraged following PoC award

- 3.8 **Around £17m has been secured from public sources to mid-2017 by Phase I projects; slightly less funding has been secured by Phase II projects, around £14m.** The slightly lower amount of funding leveraged to date following Phase II projects is not surprising, as the overall numbers in each Phase are similar, and Phase II projects have had less time for other funding to have been leveraged. The majority of follow-on funding from public sources for both Phase I and Phase II projects is from UK or EU research funders, with much smaller amounts of funding from Northern Ireland-based organisations/funders.
- 3.9 Queen’s accounts for the greater part of the follow-on funding from public sources in Phase I projects (£14.3m of £16.7m), although in Phase II Queen’s and Ulster have each secured around £7m. The Phase II monies for Ulster relate almost entirely to one project, which secured £6m of research funding from the EU.

Table 3-3: Follow-on funding from public sources to mid-2017

	Phase I	Phase II
Follow on UK research income (£m)	9.70	4.51
Follow on EU research income (£m)	3.78	6.91
Other funding from the University (£m)	1.05	0.62
Follow on funds from NI sources (£m)	2.21	1.78
Total follow-on funding from public sources (£m)	16.74	13.82
<i>Queen’s follow-on funding from public sources (£m)</i>	<i>14.28</i>	<i>6.63</i>
<i>Ulster follow-on funding from public sources (£m)</i>	<i>2.46</i>	<i>7.19</i>

Source: SQW analysis of university data

Income from commercial partners

- 3.10 Programme participants also reported commercial income generated e.g. contract research from an industrial partner or from Innovate UK. Although some of this is from parts of the public sector, this is funding focused on money for delivering specific tasks on a commercial basis, rather than funding as a form of support as in the case of the public funding leveraged

set out above. Note also that this does not include equity investment into firms, which is treated separately below.

- 3.11 **In total, around £7.4m of income was generated from commercial partners for Phase I projects, and £3.3m for those in Phase II** (see Table 3-4). The difference between the two Phases is more substantial here than for public funding leveraged. This difference is likely to be explained by a greater time lag from PoC funding to securing commercial income than for leveraging public funding, which is likely to be focused on further research, technology testing and applications development; insufficient time may have passed for some Phase II projects to have secured commercial income. To date, Phase II has secured substantially higher income from commercial partners than Phase I projects had done at a similar stage (£3.3m for Phase II vs. £2.6m over roughly the same timeframe for Phase I).
- 3.12 At the institution level, there is a sharp difference between the two universities in income generated from commercial partners, with Queen's-led projects accounting for £10.2m of the £10.7m generated.

Table 3-4: Income generated from commercial partners to mid-2017

	Phase I	Phase II
Total income from commercial partners (£m)	7.44	3.28
<i>Queen's income from commercial partners (£m)</i>	6.89	3.28
<i>Ulster income from commercial partners (£m)</i>	0.55	-

Source: SQW analysis of university data

Spin-out companies

- 3.13 To mid-2017, **16 Phase I and seven Phase II projects have led to the formation of spin-out companies**. The Phase I economic appraisal suggested that a programme of £6m would deliver 14 spin-outs; this number of spin-outs has been exceeded on a lower spend, although only nine have generated turnover to mid-2017. Phase I spin-outs account for almost all known employment (72 of 73) and turnover (£3.51m out of £3.55m), with one spin-out accounting for 41 FTEs and £1.9m turnover.
- 3.14 The turnover and jobs totals for those spin-outs formed from Phase I projects have risen considerably since the 2014 evaluation, from 16 FTEs to 72 and from £0.69m to £3.76m turnover. As Phase I ended almost seven years ago, this provides some indication of the considerable time-lag before substantial business growth, even in successfully commercialised projects. It is not unreasonable to assume that jobs and turnover will continue to grow in future, especially for Phase II projects where there has been less time to achieve such outcomes to mid-2017; the economic appraisal for Phase II suggested that Phase II projects was expected ultimately to lead to 124 new jobs, considerably higher than the total achieved to mid-2017. Nevertheless, in the previous evaluation there had already been 14 spin-out firms with turnover of £0.69m from Phase I projects within three years after the end of Phase I, compared to 7 spin-outs and £40k turnover from Phase II projects within a similar timeframe after the end of Phase II, suggesting that Phase II could have some catching up to do to achieve the same outcomes in relation to spin-out activity.

Table 3-5: Spin-outs created to mid-2017

	Phase I	Phase II
Number of spin-outs created	16	7
Queen's	9	6
<i>Ulster</i>	7	1
Number of FTE employees	72	1
Queen's	66	-
<i>Ulster</i>	6	1
Number of spin-outs generating turnover	9	1
Queen's	6	1
<i>Ulster</i>	3	-
Spin-out turnover (£m)	3.76	0.04
Queen's turnover (£m)	3.23	0.04
<i>Ulster turnover (£m)</i>	0.53	-

Source: SQW analysis of university data

- 3.15 **Spin-outs also reported equity investment, with Phase I projects securing £10.61m of investment, and Phase II projects £1.25m** (see Table 3-6). Almost all of this equity investment came from venture capital, including one firm securing over £0.5m from Invest NI's Development Funds.

Table 3-6: Follow on funds leveraged from equity investment to mid-2017

	Phase I	Phase II
Development Venture Capital (£m)	10.13	1.20
Other sources (£m)	0.49	0.05
Total equity investment (£m)	10.61	1.25
Queen's equity investment (£m)	8.78	1.20
<i>Ulster equity investment (£m)</i>	1.83	0.05

Source: SQW analysis of university data

Licensing activity

- 3.16 In addition to the above, **four Phase I projects reported income generated through licensing, which in total amounted to £0.47m** (see Table 3-7). Most of this (£397k) came from one PoC project, with the technology licensed to a Northern Ireland-based company. Another licensing agreement has generated £75k, also to a firm that has a site in Northern Ireland, although headquartered elsewhere. To mid-2017, no Phase II projects have secured any income from licensing. Although low at present across the two phases, this income may increase considerably in future years, with new and continuing licences; the licence agreement that has generated £75k to mid-2017 is expected to generate a further £525k, with £200k in the next year. Phase I had achieved licensing income of only £31k at a similar stage to where Phase II is now.

Table 3-7: Income generated from licensing to mid-2017

	Phase I	Phase II
Total licensing income (£k)	474	-
<i>Queen's licensing income (£k)</i>	2	-
<i>Ulster licensing income (£k)</i>	472	-

Source: SQW analysis of university data

Commercialisation journeys and delivering outcomes

- 3.17 No two journeys to commercialisation are the same. Indeed, even the final destination can vary, between licensing technology to other firms or spinning out as a new business. As part of the retrospective review, eight Principal Investigators (PIs), the academics leading PoC projects (not, in most cases, the person undertaking most of the work, who was typically a research associate), were interviewed, to explore what makes for a successful PoC project. The commercialisation journeys of four of these PIs are summarised below.
- 3.18 It is important to note that these are not a representative sample; they were selected to focus on PIs whose PoC projects successfully delivered impacts, and they are disproportionately life-science focused. Typical commercialisation journeys for life science projects, are longer than those set out below, often over 10 years post-PoC. But the summaries highlight the different challenges that have to be overcome in order to achieve success: in the case studies, these included aborted commercial relationships, and a funding gap between the end of PoC and reaching the point where it would be realistically possible to attract private investment. Some PIs were involved in multiple PoC projects, others just one.
- 3.19 Several factors are particularly evident, from these discussions and from the wider stakeholder consultations.
- **Supportive departments and institutions** were important to success. There is often little time to pursue PoC projects, with teaching, publications and research income generation perceived as higher priority. Delivery of commercialisation activities receives little recognition in researchers' appraisals or cases for promotion, with much greater prominence given to other elements of the academic role. Institutions' approaches to IP ownership and their model for commercialisation (explicit or not) can also be either an enabler or barrier to commercialisation.
 - **Good mentors** have provided valuable inputs to the commercialisation process, through their knowledge of and contacts in industry. But PIs' views tended to be polarised; some mentors were described as 'not high quality', and as having provided little help in commercialisation.
 - **Individuals' entrepreneurship and business planning knowledge** were important for achieving success, with interventions such as the Lean LaunchPad and ICURE helping to equip PIs and research associates with the necessary entrepreneurial skills to push the projects towards commercialisation.
 - Successful PoC projects **had highly motivated teams**, able to push past the challenges in commercialisation, even where the key individuals looked to continue their academic careers. From the stakeholder consultations, it appears that some PoC

projects have been led by PIs who did not have a genuine desire to pursue commercialisation, but saw PoC funding as another form of research income. This is reported to have reduced in Phase III, with increased emphasis on commercialisation outcomes, both from Invest NI and the universities' Technology Transfer Offices (TTOs).

- **Early identification of a customer need and products with relatively simple development journeys.** Clearly-identified customers and market, pointing to commercial opportunity which can be realised in the short term, has characterised many of the more successful PoC projects.
- Consultations with stakeholders also emphasised the importance of ensuring that projects that are funded are developed to the point where **PoC support can realistically take them forward to TRLs 3 to 4**. Some stakeholders argued that some projects had received PoC funding too early in their development, when the prospects for commercialisation were almost wholly unknown; they argued that these should not have been brought forward for funding at such an early stage. Even if their potential becomes evident later, there is likely to be an extended time period before impact can be realised, reducing the overall likelihood of commercial outcomes in the medium term.
- **Continuity of funding post-PoC** is important for continuing to move the project forward and maintain momentum. The key factor here is the ability to keep the project team together: the research associates who typically undertake most of the work on PoC projects, often leave the project when PoC funding ends, unless other funding is available. Some sources of finance are available to continue work on commercialisation e.g. PoC Plus or Sequential PoC (for Phase II projects), Confidence in Concept (Medical Research Council), Royal Academy of Engineering Fellowships, Engineering and Physical Sciences Research Council (EPSRC) Impact Acceleration Accounts (Queen's only) and EPSRC Follow-on Fund. However, the pathways through PoC to these other sources of finance vary and do not appear to be signposted as well as they might be; many projects do not go on to secure further support. The TTOs have an important role to play in navigating this complicated funding landscape and in ensuring that credible projects are able to move as seamlessly as possible to the next stage of funding and commercialisation.

Case study 1

- The PoC project was to develop technology to deliver small molecules through the skin, specifically delivery of active pharmaceutical ingredients using microneedle arrays and a novel hydrogel composition.
- PoC funding was reported as key in the success of the project, with almost £5.5m of other funding leveraged to mid-2017 as a result, including £2.7m from UK research funding bodies, and £2.4m from directly contracted work.
- A patent on the microneedle technology filed in 2007, in advance of the PoC project, allowed the academic to pursue publication and academic career prospects at the same time as the commercial potential.
- Some interactions with other businesses have been pursued, with varying success to mid-2017. An exclusive licensing agreement with a manufacturer in Germany was terminated because the pharmaceutical sector did not want an exclusive manufacturer for the product. However, a Memorandum of Understanding exists with this

- manufacturer, enabling QUB clients to have microneedle products co-developed with QUB to be manufactured for clinical trials and, in due course, for the market.
- The team is currently working with two other pharmaceutical firms to develop different products, based on the core technology. Consideration is being given to spinning out the project, to push forward with non-exclusive field-of-use licences.

Case study 2

- This PI has received funding for three life-science related PoC projects to mid-2017: one each in Phase I, Phase II and Phase III. The Phase I and Phase II projects were focused on the development of new coatings, one for infection-resistant contact lenses and the other for catheters.
- The first was successful in generating high levels of follow-on research income (£463k) as well as consultancy income (£624k) from three companies including two US headquartered businesses.
- Two companies currently have evaluation licences in relation to the project, one for 12 months, the other for 24 months.
- The second project was aided by the first, through the networks developed in delivering the project, which led to greater understanding of the possible applications of technology.
- A patent application was submitted for the technology for this second project c.6-9 months into the project – this was not submitted earlier in order to try to secure commercial partners before incurring high patent costs
- The team worked with a US-based firm on commercialisation for 12 months, and were close to agreeing a licensing agreement when that firm pulled out. The team is now working with another potential partner.
- Licensing looks likely to be the route to commercialise these technologies.

Case study 3

- This PI has been involved in three Phase I and Phase II projects. The first was funded in 2008, and was focused on developing diagnostic strip tests for respiratory diseases. This project was successful, and has leveraged over £3.5m of further funding to mid-2017, including over £900k of funding from EU and UK research funding bodies and over £200k from commercial partners.
- There was commercial interest in the technology, with talks undertaken with several companies over three years, but none led to licensing. As such, the PI decided to go down the spin-out route, starting the business in 2013, after the PI won a business plan competition. The spin-out secured £2m of equity and follow-on investment, with a majority stake taken by other parties. Several CE-marked products developed out of the PoC project are now commercially available.
- The PI remained the CEO of the spin-out until the end of 2015; this was facilitated by the PI securing a Research Enterprise Fellowship to pay for a post-doctoral researcher to fulfil their teaching duties for a year. The Research Enterprise Fellowship was reported to be a rare opportunity.
- Another PoC project followed in 2012, to investigate another class of enzyme for tests, but proved more technically challenging and so has not led to any commercial outcomes. This second PoC project, which was to look at the development of tests for two other enzymes for a different disease class, was achieved technically and these are in the company pipeline for future commercial development.
- This PI has also secured another, Phase III, PoC project, with the aim of developing a pharmaceutical to license to the pharmaceutical industry.

Case study 4

- This PI was involved in two PoC projects in Phase I and Phase II of the programme. The first was to develop digital image steganography in 'hidden' images for use in identification and authentication, i.e. for counterfeiting deterrence, copyright protection

etc. The PoC project application was submitted following a business competition within which the PI won the high-tech sector award (£25k competition). The PoC project has leveraged around £100k of further funding, some of which came from commercial partners.

- A spin-out was developed following the PoC project. This was set up by an academic team at the University initially with the PI as CEO. A PhD student was paid to undertake some of the PI's teaching in their absence. The PI was given the opportunity to take an unpaid sabbatical to concentrate on the spin-out, but this was not taken, as this came at a difficult time of redundancies at the University.
- The team paid for commercial expertise in the form of a Chair for the company. It secured £225k of equity investment, and has achieved a cumulative turnover of £80k.
- After four years' operation the spin-out had not grown sufficiently, with increasing small contracts sustaining its operation. The University pulled back the licence from the spin-out, and then looked to sell the IP to another company.
- A second PoC project investigated how to identify people by the way they walk (their gait). This project was successful, with testing being undertaken by the Police Service of Northern Ireland, although no commercial outcomes have resulted from this project.
- The University did not agree at that time to license this IP to the spin-out. Despite this, the spin-out continues to trade, and now has IP assigned to it from the University, for wearable technology.
- The University maintains two patents from the first PoC project, and another patent from the second project.

Impacts

Gross impact

- 3.20 Assessment of the gross economic impact of PoC follows the same methodology used in the 2014 evaluation. That evaluation took the total commercial income, licensing income, and turnover associated with spin-outs as the 'gross monetary impact' of the PoC projects. The suitability of this approach is discussed later in this section, following consideration of the approach taken elsewhere.
- 3.21 **The gross monetary impact to mid-2017 for Phase I projects totals £11.7m (see Table 3-8), with over two-thirds of this in the form of income from commercial partners. Phase II projects have had a gross monetary impact of £3.3m to mid-2017, almost entirely in the form of income from commercial partners.**
- 3.22 Compared to the previous evaluation, the gross monetary impact for Phase I projects has more than tripled: £11.7m compared to £3.3m previously. As noted above, the disparity between Phase I now and Phase I in 2014, and the large disparity between Phase I and Phase II projects, suggests that there may be further impacts in the future, with insufficient time having passed for some projects to have achieved outcomes. A fairer comparison for Phase II is to Phase I at the last evaluation. Comparing the results in the two studies, the impacts for Phase II seem comparable to those for Phase I. Approximately the same impact has been achieved at a slightly earlier stage (this review takes account of impacts up to two and a half years after the end of Phase II, whilst the previous evaluation took account of impacts up to three years after the end of Phase I, as in Figure 3-1); there are slightly more projects in Phase II (65 university-led projects vs. 62 in Phase I), which suggests that performance is broadly similar.

- 3.23 The gross monetary impacts by institution are not proportionate to levels of financial subvention. Queen's-led projects account for 68% of spend to mid-2017 on Phase I and Phase II projects but around 90% of the gross monetary impact.

Table 3-8: Gross monetary impact to mid-2017

	Phase I	Phase II
Income from commercial partners (£m)	7.44	3.28
Turnover from spin-out companies (£m)	3.76	0.04
Licensing income (£m)	0.47	-
Gross monetary impact (£m)	11.68	3.31
<i>Queen's gross monetary impact (£m)</i>	<i>10.12</i>	<i>3.31</i>
<i>Ulster gross monetary impact (£m)</i>	<i>1.55</i>	-

Source: SQW analysis of university data

Net impact

- 3.24 The figures set out above are gross impacts. They do not take account of what would have been delivered anyway, had PoC funding not been awarded i.e. the additionality of the PoC funding. This is an important element in understanding the *net* impact of the programme.
- 3.25 No new assessment of additionality was undertaken for this study, as engagement with the people delivering the projects was limited, and more focus was placed on the forward-looking assessment; additionality for projects undertaken by the PIs consulted for this study appears to be high, but these are not a representative sample. This review therefore uses the additionality adjustments calculated in the previous evaluation: 64% for Phase I project outcomes and 68% for Phase II project outcomes.
- 3.26 Based on these adjustments for additionality, the total **net monetary impact for Phase I projects is £7.47m, and for Phase II totals £2.25m**. For Phase II, this figure is slightly better than for Phase I at roughly the same stage in the previous evaluation (£2.1m), albeit achieved from a slightly higher number of projects.

Table 3-9: Net monetary impacts to mid-2017

	Phase I	Phase II
Gross monetary impact (£m)	11.68	3.31
Additionality adjustment	64%	68%
Net monetary impact (£m)	7.47	2.25
<i>Queen's net monetary impact (£m)</i>	<i>6.48</i>	<i>2.25</i>
<i>Ulster net monetary impact (£m)</i>	<i>0.99</i>	-

Source: SQW analysis of university data

- 3.27 These net monetary impact figures are then converted to a net GVA impact, by applying a turnover to GVA ratio of 50% (as per the economic appraisal for Phase III of the programme) to the net monetary impact. This gives total **net GVA impact to mid-2017 of £3.7m for the Phase I projects and £1.1m for the Phase II projects**.

Table 3-10: Net GVA impacts to mid-2017

	Phase I	Phase II
Net monetary impact (£m)	7.47	2.25
NI average sectoral GVA to turnover ratio	50%	50%
Net GVA impact (£m)	3.74	1.13
Queen's net GVA impact (£m)	3.24	1.13
Ulster net GVA impact (£m)	0.50	-

Source: SQW analysis of university data

Value for Money

- 3.28 Value for Money (VfM) is the ratio between the inputs made and the economic returns secured. The evaluation's Terms of Reference require a longitudinal value-for-money review of the economic impacts for Phase I and Phase II. As reported in the Phase II economic appraisal, it is not possible to undertake a full and accurate assessment of value for money for up to 15 years post-PoC funding; Phase II projects were still being awarded funding in 2015, and Phase I projects up to 2011, the time horizons for realisation of commercial outcomes are too long to allow a full definitive assessment of value for money. Progress to date is, however, assessed on four dimensions:

- **Economy** – the extent to which project activity has been delivered at the minimum cost to the public purse
- **Efficiency** – the cost at which net outputs and outcomes are achieved through an intervention
- **Effectiveness** – the extent to which the stated objectives of an intervention are being achieved through the outputs and outcomes that it is generating
- **Return on investment** from the intervention, comparing net costs against net impacts.

Economy

- 3.29 As noted in section 1, PoC funding includes support both for technical development and commercialisation. These are drawn down concurrently, with eligible spend under different categories for each. The technical strand includes labour costs, overheads, consumables, sub-contracting, equipment, audit fee allowances and 'other' items (e.g. travel). Support for commercialisation includes assessment consultancy fees, travel and subsistence, audit report costs and other miscellaneous costs. Although all project bids submitted have been at or close to the award maximum, some projects do not draw down all the funding. Of £13.0m of funding awarded to university-led PoC projects in Phase I and Phase II, £10.1m has been drawn down to mid-2017. Given that each funding element must be drawn down for specific uses, this helps to keep costs to the public purse at a minimum. In addition, it is possible for Invest NI to claw back monies if a project is not delivering against its objectives. A detailed application and assessment process, helps to ensure that costs are kept to a minimum, and the **Economy of Phase I and Phase II projects is considered to be acceptable**.

Efficiency

- 3.30 In terms of **Efficiency**, the application and appraisal process is designed to ensure that only those projects that are most likely to deliver economic benefits are funded. Stakeholders questioned whether this was done as stringently as possible for Phase I and Phase II projects, with some projects reported to have been funded that were unlikely to deliver benefits: they noted that this had improved for Phase III projects. As noted under 'economy', almost all projects seek, and are awarded, the full funding amount, and there appears to be little pressure to reduce the funding requirement to match project requirements. While, as also noted above, Invest NI can claw back monies if projects do not deliver against their objectives, this does not appear to have been a common occurrence.
- 3.31 Cost per net job created is a common measure of efficiency for economic interventions. But job creation is not the main objective of this programme, and there has been no detailed consideration of future impacts, the form in which job benefits might come through. Efficiency has therefore not been quantified here, although analysis of return on investment is undertaken later in this section. Based on the approach taken to funding projects, a **qualified positive assessment is made for Efficiency**.

Effectiveness

- 3.32 The question of how **Effective** the programme has been in achieving its core objective of increasing the level and quality of commercialisation from within Northern Ireland's research organisations is central to this review. Assessment of progress against the targets set out in the economic appraisals does not give an accurate picture of performance; the original targets for Phase I outcomes were recognised as unrealistic almost from the outset, whilst performance against many of the targets set out in the economic appraisal for Phase II cannot be fully established at this point, when insufficient time has passed to realise outcome targets. PoC has supported a substantial number of projects – 132 across Phase I and Phase II – with some of these leading to commercial outcomes. However, the story of Northern Ireland's commercialisation successes is still dominated by some of its (oft-quoted) earliest successes –Kainos and Andor – there have been few 'blockbusters' since. This has led to concern among stakeholders that the hoped-for major impacts will not be achieved.
- 3.33 The differentiated outcomes to mid-2017 for the different phases, as set out earlier in this section, show that success takes time to achieve, while the case studies show something of the uncertainties attached to these timescales for individual projects. Longer timeframes were set for achieving Phase II target outcomes than for Phase I. There have been some successes from Phase I, and Phase II targets could still be met within the set timescale. The case studies also point to the learning experience around commercialisation developed by key individuals within and across projects. As such, **Effectiveness to mid-2017 is assessed as qualified positive**.

Return on investment

- 3.34 The net GVA impact of the programme is compared to its estimated costs, to arrive at a return on investment (ROI) figure. **The ROI for Phase I projects at the end of the review period was £0.81:£1, and for Phase II projects, it was £0.21:£1. Both these figures are low, but compare favourably to the 2014 evaluation figure for Phase I of £0.14:£1: for Phase I**

this is a considerable uplift from the 2014 evaluation; the figure for Phase II at a similar stage after the end of funding new projects also compares favourably to this figure. These figures can also be expected to improve as future impacts are realised. The economic appraisal for Phase II suggested that the ROI should ultimately reach £2.47:£1.

Table 3-11: Benefit Cost Ratios – return on investment

	Phase I	Phase II
Total spend	4.59	5.47
Net GVA impact	3.74	1.13
Return on investment (ROI)	0.81	0.21
<i>Queen's ROI</i>	0.99	0.32
<i>Ulster ROI</i>	0.37	0.00

Source: SQW analysis of university data

- 3.35 This impact analysis has followed established methodology, but there are some important caveats: not all impacts are captured here. PoC projects have also generated from public sources (£30m across the two phases) and equity investments (£12m): both are excluded. As noted earlier in the section, some significant sums are involved, although most of the money has been generated through a small number of projects. There are also other, qualitative, effects that could lead to economic impact e.g. improved skills in commercialisation and research within research communities. And, as highlighted previously, it takes no account of future impacts, which are very difficult to estimate.
- 3.36 Also, in the context and description of the ecosystem set in in section 2, it is evident that some of the outstanding commercialisation opportunities from the research organisations do not come forward for PoC support, but use other sources of funding, national and NI-specific; PoC is a substantial intervention, but it operates, in some respects, as a funder of last resort.

Performance of the two universities

- 3.37 As set out above, positively, Queen's Phase I projects have an ROI to mid-2017 of almost £1:£1, while Ulster Phase I projects have an ROI of £0.37:£1.. **On this and other impact measures, including follow-on funding secured across Phase I and II projects to mid-2017, Queen's substantially outperforms Ulster, in aggregate and £-for-£ on project spend.**
- 3.38 The potential for achieving substantial commercial outcomes from PoC funding from Queen's research appears higher than it is for Ulster. Both universities have a similar-sized TTO, so this does not appear to be a contributory factor. Ulster's lower research intensity may lead to fewer truly innovative projects, and more limited potential to realise products/services with recognisably high commercial value. Any such conclusion is tentative only, given the uncertainty about final impacts.

Benchmarking

- 3.39 Benchmarking was undertaken to see how the impacts of the PoC programme compared to those of interventions elsewhere; also, to understand what criteria were set for success, and how other programmes have assessed impact.

- 3.40 The key criteria for selecting comparators were programmes with a similar scope, and in a similar context, for which there was evaluation evidence. This was challenging, especially given a dearth of evaluation evidence. Four comparators were identified: TULI (Finland); FORNY2020 (Norway); TIDA (Ireland); the Proof of Concept Fund and its successor the High Growth Spin-Out Programme in Scotland. Table 3-12 provides an overview of each programme, and the type of outcomes and impacts reported in the evaluations.
- 3.41 Several caveats apply in comparing the interventions.
- Whilst every effort has been made to choose similar programmes elsewhere, there are some important differences, both in the context (territorial and demographic scale, level of autonomy, average income levels) and in the programmes themselves (overall size/scale of funding, extent of targeting – sectors or types of embryonic companies – number of projects funded, variation in amounts awarded to each project and scope to vary this). Each of the comparators also works with a larger and more diverse number of partners.
 - None of the comparators had any recent evaluations that cited GVA impacts or return on investment figures. As such, no direct comparison is possible on impact analysis.
 - In the case of Norway and Finland, the evaluations appear to provide a snapshot of spend and outputs within a particular time period. As at least some outputs may be from projects funded prior to this time window, while other results from this spend may only come through later, considerable caution is required in comparing their quantitative results with the PoC programme.
- 3.42 There are, however, some key outcomes where data are available and reasonably direct comparisons can be made.
- In terms of **businesses created**, the PoC programme appears to have performed fairly well. PoC's 23 businesses created from £10m of investment equates to over two firms for every £1m spent, compared to 0.3 firms for every £1m spent by the TIDA programme in Ireland and 1.1 firms for every £1m spent by the Proof of Concept Fund in Scotland. The Finland and Norway comparators create larger numbers of businesses, although it is not possible to compare these figures directly, as the spend to achieve these is unknown.
 - **Jobs** outcomes are reported in the evaluation of Scotland's Proof of Concept programme, with 300 jobs created in business. Although this is four times higher than the 73 jobs created in Northern Ireland, spend on the programme is closer to five times higher. Similar comparisons are not possible with Ireland, Norway or Finland.

Table 3-12: Comparator interventions

Programme	Description	Scale	Outcomes/impacts
TULI and TUTLI, TEKES – Finland	<ul style="list-style-type: none"> • Description: Operating across Finland, the TULI programme provides proof of concept funding for researchers at universities, vocational universities and research organisations in Finland. The focus of TULI activities has been the early stages of the commercialisation process: activating the flow of potential 	<ul style="list-style-type: none"> • Size of fund: €25m between 2007 and 2011 (c.£22m) • Number of projects funded: 2,600 	<ul style="list-style-type: none"> Outcomes/impacts reported for TULI between 2008 and 2011: • 164 spin-outs • total revenue of €8.8m was

Programme	Description	Scale	Outcomes/impacts
	<p>ideas, supporting the development of commercialisation capabilities and structures, and extending the funding base (e.g. from initial investigations to proof of concept).</p> <p>The programme has now been replaced by a more focused TUTLI programme, which has an increased focus on funding those projects with the highest scientific value and commercial potential.</p> <ul style="list-style-type: none"> • Timescale: Launched in 2002 as TULI, bringing together disparate activities that had been ongoing since 1993, but now replaced by TUTLI. <p>Three phases to the project: Initial evaluation phase – ‘some’ weeks, Evaluation phase – 1-3 months, Refinement phase 1-6 months.</p>	<ul style="list-style-type: none"> • Maximum amount of funding for one project: Initially limited to €10k, but since lifted to €55k Funding for phase 1 limited to €5k, phase 2 is limited to €20k, and phase 3 is limited to €30k 	<p>generated from 76 companies in 2011, with median revenue of €25k</p> <ul style="list-style-type: none"> • over 150 jobs created • €5.4m licensing income • 512 patent applications filed.
FORNY and FORNY2020, Research Council of Norway – Norway	<ul style="list-style-type: none"> • Description: Operating across Norway, FORNY2020 aims to facilitate the commercialisation of results from projects conducted at publicly-funded research institutions and help bring product and services into the market, with proof of concept projects comprising the majority of funding from the programme, but with basic funding for TTOs also captured within the programme. The programme follows a predecessor programme FORNY, which was focused mainly on developing TTOs. <p>The FORNY2020 programme does not provide support for research activities, instead allocating funding for activities to verify and document the application of R&D results and confirm whether or not the results can lead to substantial commercial returns or be of some other major benefit to society.</p> <p>Also, both TTOs and start-ups are eligible for funding, with start-ups here defined as companies established less than six years ago at the time of submission of the grant application; such firms must base their activity on IP generated at publicly funded research institutions to be eligible for funding. This change was made due to the perception that businesses may be best placed to deliver commercialisation outcomes, rather than academics responsible for following up several projects.</p> <ul style="list-style-type: none"> • Timescale: The programme was launched in 2011; the FORNY predecessor programme operated from 1995 to 2011. 	<ul style="list-style-type: none"> • Size of fund: 497m kr (c.£48m) between 2011 – 2014 • Number of projects funded: in 2014, 23 projects funded (three led by businesses) 	<p>Outcomes/impacts reported for FORNY and FORNY2020 between 2011 and 2014:</p> <ul style="list-style-type: none"> • 197 patents, of which 34 were granted in Norway and 163 granted abroad. • 285 technology sales and licensing agreements • 128 reported business starts • Almost 1.5bn kr of follow-on capital investment secured (c.£138m).
TIDA, Enterprise Ireland – Ireland	<ul style="list-style-type: none"> • Description: Operating across Ireland, TIDA is designed to enable researchers in Ireland’s universities and institutes of technology to focus on the initial stages of an applied research project which 	<ul style="list-style-type: none"> • Size of fund: €25m between 2009 and 2013 (c.£22m) 	<p>Outcomes/impacts for projects funded from 2009 to 2013:</p>

Programme	Description	Scale	Outcomes/impacts
Proof of Concept Fund and the High Growth Spin-Out Programme, Scottish Enterprise – Scotland	<p>may have a commercial benefit if further developed.</p> <p>The programme enables researchers to demonstrate the technical feasibility of an applied research project directed toward the development of a new or innovative technology/product/process/service that has potential for commercial development.</p> <p>A compulsory entrepreneurship training programme for researchers was introduced post-launch.</p> <ul style="list-style-type: none"> • Timescale: The programme was launched in 2009. <p>Funding for projects is typically for two years.</p> <p>Impacts are expected between two to five years post-funding.</p>	<ul style="list-style-type: none"> • Number of projects funded: 283 between 2009 and 2013 • Maximum amount of funding for one project: Awards were capped at €100k in all years apart from 2010 when it was capped at €50k. 	<ul style="list-style-type: none"> • 7 spin-out companies • 57 patents • 9 licenses • 80 publications • 149 academic collaborations • 83 non-academic collaborations.
	<ul style="list-style-type: none"> • Description: Operating across Scotland, the Proof of Concept Fund supported the commercialisation of leading-edge technologies emerging from Scotland's universities, research institutes and NHS Boards. • It has since been replaced by the High Growth Spin-Out Programme, which offers higher funding totals to individual projects, but to fewer projects overall, with funding offered over three phases: Proof of Commercial Opportunity (Phase 1), Proof of Company (Phase 2), and Proof of Investment (Phase 3). • Life sciences, Technology and Energy projects form the basis of applications although relatively fewer life science projects are typically funded. A key criterion in deciding which projects to back is whether this scale of funding can move a project sufficiently close to commercialisation that there is a reasonable chance of subsequently attracting next stage scale-up investment. • Timescale: The Proof of Concept Fund was launched in 1999, and operated until 2014. • It was replaced by the High Growth Spin-Out Programme in November 2014, although some elements of the new model started being implemented under the original programme from 2011. • The programme changed to a three phase model, with Phase 1 to run for 3-12 months, Phase 2 for 12 -24 months and Phase 3 for 6 -15 months. • Impacts are expected within five years post-funding. • The change in the delivery model in Scotland was prompted by concerns that 	<p>Proof of Concept Fund: 2001 – 2011</p> <ul style="list-style-type: none"> • Size of fund: £47m • Number of projects funded: 235 (average funding per project £200k) <p>High Growth Spin-Out Programme: 2014 onwards</p> <ul style="list-style-type: none"> • Size of fund: £2m annual spend • Number of projects funded: 12 • Maximum amount of funding for one project: Total grants up to £750k (£20-200k for phase 1, £100-400k for phase 2, £100-400k for phase 3) 	<p>Outcomes/impacts for projects funded from 2001 to 2011:</p> <ul style="list-style-type: none"> • 50 new high tech companies formed • Over 500 knowledge-intensive jobs created in universities • Over 300 jobs created in new Scottish companies • 57 license deals • Over £243m post-PoC investment leveraged • Funding raised per spin-out p.a. £316k (pre-2011) • % projects resulting in spinout: 29% (pre-2011) <p>Outcomes/impacts for projects funded from 2010/11 onwards:</p> <ul style="list-style-type: none"> • Funding raised by spin-outs – £46.4m equity, £23.4m grants • Funding raised per spin-out p.a. £860k

Programme	Description	Scale	Outcomes/impacts
	<p>the previous programme left a gap at the end of the programme. Projects struggled to find follow-on investment to further pursue the projects that had been funded by Scottish Enterprise, which meant that momentum was lost and projects ended where they could have continued with additional funding. The new programme therefore seeks, with the third stage, to take the projects further, narrowing the gap between project end and investment readiness.</p>		<ul style="list-style-type: none"> • % projects resulting in spin-out: 65%.

Source: SQW analysis

Reflections on measuring impacts

Shortfalls of the current methodology

3.43 The impact analysis in this review followed the approach established in the most recent previous evaluation of the programme in 2014, in focusing on finance secured by projects post-PoC, and monetising impacts. This reflects the existing monitoring framework, and therefore the scope of the available monitoring data, as no new primary quantitative research was undertaken for this review. Taking an almost identical approach to calculating monetised impacts as the 2014 evaluation, the PoC programme is estimated to have a return on investment of 81p for every £1 spent for Phase I projects and 21p for every £1 spent for Phase II projects. Compared to other Government interventions, this may appear low, but as earlier, this must be seen in context:

- The assessment takes no account of future impacts; these are very difficult to predict for PoC projects, given they are some way from commercialisation (PoC only taking projects to TRL 3 or 4). Future impacts could be substantial; given the distance from realised commercialisation at the PoC funding stage, many impacts are evidenced several years after the PoC funding. The comparison of Phase I and Phase II impacts, and the difference in impacts for Phase I between the 2014 evaluation and this evaluation, support this argument; it is therefore not advisable to use the available data to compare the quality of projects between phases. It also takes no account of the benefits of the programme for those firms that license technologies developed from PoC projects, although this relates to a small number of the Phase I and Phase II projects to mid-2017.
- Even for those impacts that have been realised, evidencing the net effect robustly is complex, as other support (formal interventions or less formal advisory/mentoring inputs) could have been used to progress towards commercialisation. The possibility of key individuals having moved on from the project, or that spin-outs no longer have any involvement with their parent institution, also limits the ability to evidence impacts particularly in firms that spun-out of the universities some time ago.
- The GVA and return on investment calculations rely on outcomes related to spin-out turnover, licensing income and commercial income. However, PoC does not directly deliver these outcomes, as the intervention only supports projects to TRLs 3 or 4; further investment, and potentially other interventions, are required to achieve this.

PoC could be the best intervention available at moving projects to TRLs 3 or 4, but if there are few opportunities to take projects forward beyond this stage, then an assessment of the impacts of PoC based on return on investment would still suggest that PoC has performed poorly, even though issues preventing impacts may be more attributable to other elements in the commercialisation ecosystem.

- 3.44 The most recent evaluation of TIDA in Ireland noted the same challenges. It suggested that a meta-evaluation may be the best way to understand the impacts of intervention in this space, by looking at the impacts of interventions operating in this space taken as a whole, rather than looking at TIDA alone.
- 3.45 This is not to say that looking at these outcomes is unreasonable – understanding the extent to which projects are leveraging further income etc. is of interest to see how the programme is interacting with the wider ecosystem for commercialisation. But considerable caution should be applied in converting this into a GVA and return on investment that can be sensibly compared to other Invest NI interventions; it is difficult to assess robustly, and is also insufficient to capture the breadth and potential scale of impacts.

A more holistic assessment of ‘success’

- 3.46 What then should we look for in assessing PoC’s success? A useful place to start is the recent evaluations of comparable programmes with similar objectives. As discussed above, the comparators reviewed for the benchmarking focused attention on outcomes, rather than GVA impacts or return on investment. ‘Intermediate outcomes’ were key to these assessments. These:
- a) related directly to achieving the core objective of the programme (the number of projects and the extent to which it was moving towards commercialisation in terms of TRLs)
 - b) showed how the intervention was linking projects into the next stage of the commercialisation ecosystem e.g. commercial income leveraged, where this leveraged funding could be taken as justification for having invested in the project at the PoC stage, as another funder had looked at the project and seen the value in investing to take it closer to the market.
- 3.47 From this perspective, the current quantified monitoring data is helpful in its own right, irrespective of whether it is used to calculate GVA impact or return on investment.
- 3.48 In addition to these quantified impacts, there are qualitative outcomes that are not monitored to the same degree at present (albeit recognised in the targets for Phase II outcomes), but which are still important for driving improvement in the research base and commercialisation and thus ultimately economic benefit. While, for instance, it is not a specific aim of the PoC programme to employ researchers, their retention as part of the Northern Ireland ecosystem and the development of their abilities in commercialisation, alongside the benefits of the training and mentoring they and PIs receive, is a potentially important part of programme impacts. These local effects, initially at least embedded in the partner organisations, may ultimately lead to wider economic benefits, delivered through the development and retention

of researchers with relevant skills in commercialisation and growing technology-based businesses.

- 3.49 ‘Success’ then should be viewed in terms of the extent to which the programme is delivering against i) the intermediate quantified outcomes, showing where and to what extent projects enabled by PoC are being taken forward to further development, and ii) important qualitative effects. This is a more holistic approach to understanding the impacts of the programme within the wider ecosystem. It downplays the significance of GVA impact and return on investment calculations, as these are inevitably tentative – the evidence that can be gathered within a useful timespan is limited, and this may lead to rather spurious comparisons with other ‘closer to market’ interventions. A more rounded view of success provides the keystone for the consideration of options in section 4, which follows, and is then drawn through into the recommendations in section 5.

On this basis, ‘how successful is PoC?’

- 3.50 Based on the available information on intermediate quantified measures and the important qualitative effects of the programme, we concluded that the PoC programme is playing a significant and distinctive role in the innovation ecosystem in Northern Ireland. Phase I projects in particular have leveraged substantial amounts of funding from commercial partners, to take projects further to commercialisation, suggesting that other partners see the value of and opportunity for some of these projects.
- 3.51 Moreover, the programme has been valuable for developing the skills of the project team members, including the Principal Investigators and the research associates often recruited to deliver much of the work, generating increased close-to-market knowledge and enhancing abilities in commercialisation.
- 3.52 There was, nevertheless, a clear and consistent view from stakeholders that the PoC programme could and should be delivering more results, and also some fears that the impact in developing business potential from research, was reducing over time. There is a good case for intervention, but, could more be done to deliver – and accelerate – positive impacts from intervention? This is considered further in sections 4 and 5.

4. Options for future intervention

4.1 This Section explores potential options for future intervention to meet the core objective of the current PoC programme, namely to increase the level and quality of commercialisation from within Northern Ireland's research organisations.

Section summary

- After 14 years of operation, it is a good time to consider whether the model for PoC could be configured differently going forward. Possible options developed through consultations and desk research include both i) modifications to the current programme and ii) different models for intervention.
- Twenty-two possible modifications to the PoC programme have been identified. These were grouped into five sub-categories, those that: i) aim to ensure that the programme is targeted at those projects most likely to deliver commercial impacts; ii) are intended to better support project momentum and continuity; iii) increase the flexibility of the programme, in terms of timing and value of project, to drive greater value for money from the programme; iv) change the structure of PoC to widen access to funding, including through a staged approach to funding; v) are focused on delivering impacts in Northern Ireland.
- Seven potential alternative models are considered. These are split into demand-focused and supply-focused interventions. The demand-focused interventions are: Competence Centres; the Small Business Research Initiative; the Industrial Strategy Challenge Fund; the Small Business Technology Transfer programme. The supply-focused interventions are: UMass Lowell's DifferenceMaker; Cambridge's IdeaSpace; and the Royal Society of Edinburgh's Enterprise Fellowships programme.
- The options are not mutually exclusive; some could be used in tandem with others. They provide the base from which a shortlist of options is developed in section 5, with initial testing.

Overview of the options

4.2 There has been, and remains, a strong rationale for intervention to increase commercialisation activities in Northern Ireland, as explored in Section 2; Northern Ireland performs poorly in terms of innovation and commercialisation, with this holding back Northern Ireland's economic potential. The PoC programme is one of a number of interventions designed to increase commercialisation and innovation activity in Northern Ireland, but it is the only programme wholly focused on increasing the commercial potential (level and quality of commercialisation) of Northern Ireland's research organisations.

4.3 Section 3 considered the impacts that the PoC programme has had in achieving this objective. Phase I and Phase II projects have successfully leveraged over £30m of follow-on funding, £10m of income from commercial partners, and around £12m in equity investment to mid-2017, with over 20 spin-outs started. Based on the methodology used in earlier evaluations, return on investment figures remain low, at 81p net impact for every £1 of cost to mid-2017 for Phase I, although on other indices PoC performs reasonably well against its international comparators.

4.4 Most of the comparators considered in the benchmarking exercise have, been established for many years, as of course has PoC in Northern Ireland. But while the results from the Invest NI initiative have been evaluated, most recently in 2014, with small changes made to the programme, most of the other programmes have undergone fundamental restructuring

following reviews of their impact. In each case, these structural changes were intended to increase the focus on realising impacts by concentrating resources on fewer and larger projects, and/or by introducing multiple phases, under which projects are supported for a longer time, but with funding released only as specific thresholds are reached or surmounted. In light of this and stakeholder feedback, we consider how intervention in this space might be delivered differently in future, as an amended PoC programme, or in a different form.

4.5 Drawing on consultations with stakeholders in Northern Ireland, prior knowledge, consultations and desk research relating to international best practice, and the review of monitoring data and documents, a series of options are set out below. The starting point for these options is that a continued strategic case for some public intervention in this space is widely accepted elsewhere, with Proof of Concept as a recognised part of the approach. The distinctive role that PoC plays in the NI ecosystem is also acknowledged, and these options are put forward as ways to achieve the same headline objective, to increase the level and quality of commercialisation from within Northern Ireland's research institutions.

4.6 The options can be grouped as follows.

- **Modifications to the current PoC model.** With these options an Invest NI PoC programme would still exist, but with changes made to the delivery model. Some of these options represent minor tweaks to the current model; others are more substantive. These are based, in part, on findings from the review of Phase I and Phase II projects. In some cases they may represent changes that are already starting to be implemented in Phase III, in which case their inclusion here should be considered an endorsement of their validity. Some options relate to changes that are already in operation in some guise, but where greater formalisation of support would be beneficial.
- **Different intervention models.** These options draw on other models and best practice elsewhere that aim to increase commercialisation from the research base through different approaches; they include demand-focused and supply-focused interventions.

4.7 Some of the options are mutually incompatible. However, many of the options set out could be implemented in combination with or alongside others.

Modifications to PoC

4.8 The options presented in Table 4-1 include a range of modifications to the PoC model, but with PoC remaining as a specific brand and intervention. Twenty-two possible options are identified, which fall into five sub-groups, namely those that:

- aim to ensure that the programme is targeted at those projects most likely to deliver commercial impacts
- are intended to better support project momentum and continuity
- increase the flexibility of the programme, in terms of timing and value of project, to drive greater value for money from the programme

- change the structure of PoC to widen access to funding, including through a staged approach to funding
- are focused on delivering economic impacts in Northern Ireland.

A more targeted approach in selecting PoC projects

- 4.9 The review highlighted that there are various factors that make some projects more likely to achieve commercial impacts than others. These options focus on targeting funding at the projects most likely to deliver impacts, especially in Northern Ireland, in order to improve the efficiency and effectiveness of the programme.

Table 4-1: Options to target PoC funding

#	Modification	Reason for inclusion
i	<u>Target the programme at projects most likely to commercialise in Northern Ireland</u>	<ul style="list-style-type: none"> • There are several key factors that help determine whether projects are successful, and whether they deliver impacts in Northern Ireland. • From stakeholder consultations, it is clear that the strength of the team (PI and research associates) is a key determinant, but this is given relatively little weight in the assessment process. Targeting at teams that have proven they can deliver may lead to funding projects that are more likely to deliver impacts for Northern Ireland. • Moreover, targeting at sectors that are more likely to deliver impacts in Northern Ireland could also help to ensure the programme does not fund projects that are unlikely to deliver impacts. This could be done by looking at which sectors have tended to deliver impacts for Northern Ireland, and which projects align well with the industrial base and industrial priorities of Northern Ireland.
ii	<u>Bring an investor perspective into the programme</u>	<ul style="list-style-type: none"> • This is important as, post-PoC, the ability to attract investment is a key step towards commercialisation for many projects. • Moreover, investors bring a different perspectives have different perspective to whether a project looks good or not, typically investing on the basis of the market opportunity and, importantly, the team that is delivering the project. • Understanding early whether a project is likely to have difficulty securing further investment could be used as a criteria for not funding projects at all, or for deciding whether to cut funding for a project at an intermediate stage, or as an opportunity to highlight what the options are for a project in terms of securing investment. • Although not undertaken for Phase I and Phase II projects in scope of this review, this is now taking place with Phase III projects at the application assessment.
iii	<u>Assess projects on the likelihood of being able to secure other funding at the end of PoC</u>	<ul style="list-style-type: none"> • There is often a funding gap for PoC projects at the end of the PoC funding period. This can prevent PoC projects moving closer to commercialisation. In this case, the PoC project is less likely to deliver commercial impacts. Only funding those projects where it is assessed that they are likely to be able

#	Modification	Reason for inclusion
	<p>was sufficient to move the project close enough to commercialisation by the end of the project that it would have a realistic prospect of attracting other investment</p> <ul style="list-style-type: none"> • This would be picked up during the assessment process. 	<p>to secure investment post-PoC could ensure that a higher proportion of funded projects go on to deliver commercial impacts.</p> <ul style="list-style-type: none"> • This model is adopted by the Scottish Enterprise High Growth Spin-Out Programme. One effect of this approach is that relatively fewer life science projects are funded compared to other technologies, as they are deemed less likely to be able to secure investment at the end of funding period.
IV	<p><u>Ensure the quality of projects funded is in line with national standards</u></p> <ul style="list-style-type: none"> • This would involve funding projects only if they would be amongst the best nationally, and would stand up to scrutiny nationally. • Practically, this could include inviting managers of other PoC schemes to attend some sessions of the assessment panels as observers/critical friends. 	<ul style="list-style-type: none"> • With just two main recipient institutions of PoC funding, the competition for projects is fairly limited. As such, some stakeholders felt that some projects were able to secure funding that would not have done had they been competing nationally. Inviting managers of other PoC schemes elsewhere to observe the assessment process, and vice versa, could help to ensure that the quality of projects funded is maintained. • This is now being undertaken for Phase III, through aligning the programme's standards with those of the research councils; this is not expected to have any effect on the overall number of projects, as Phase III has the same budget as Phase II.
V	<p><u>Increased focus, at assessment, on the market and IP landscape</u></p> <ul style="list-style-type: none"> • Assessments could be more focused on the market/technology/IP landscape, and less so on the technology itself or project plan. 	<ul style="list-style-type: none"> • Key to whether PoC projects successfully commercialise is the extent to which there is a market opportunity, and whether any other technology/IP has been secured that would deliver the same product etc. • However, the assessment of PoC projects was felt by some to focus too much on the technology itself (rather than the technology landscape) and the project plan; if more weight was given to the market/technology/IP landscape, this may ensure that only those projects with an identifiable opportunity are funded.

Source: SQW

More support to build project momentum

- 4.10 These options are intended to tackle one of the main barriers to further commercialisation for PoC projects: a lack of continuity. This results from a lack of further funding or support, leading to key team members leaving the project; this is particularly the case of the research associates employed specifically for the PoC project and who are tasked with much of the work of the project, with these people often leaving before the end of the project once they have secured a future role elsewhere. The consequence is a loss of project momentum, diminishing the ability to move the project onwards to commercialisation.

Table 4-2: Options to ensure project momentum and continuity

#	Modification	Reason for inclusion
VI	<p><u>Map out pathways to commercialisation</u></p> <ul style="list-style-type: none"> • This would involve mapping out the elements of the ecosystem that projects could flow into post-PoC, to show the possibility for continuity (perhaps a focus for Invest NI around two thirds of the 	<ul style="list-style-type: none"> • As above, maintaining momentum and continuity with PoC projects can often be difficult; projects typically need further investment and support to continue towards commercialisation. • This modification to PoC would be intended to situate the programme more effectively within the wider ecosystem, to make the longer term options

#	Modification	Reason for inclusion
	way through the PoC project), and to help develop strong relationships between the key elements e.g. with Competence Centres, Propel, techstart ^{NI} , industry, angel investors.	<p>for projects clearer to team members, even whilst the project is ongoing.</p> <ul style="list-style-type: none"> This is something that project teams must now do as part of their project under Phase III.
vii	<u>Post/mid-project review</u>	<ul style="list-style-type: none"> This would be an opportunity for the project team to showcase to other elements of the ecosystem what the project has achieved, and highlight what additional support is required to move the project further forward to commercialisation. This would allow attendees, who would know the support ecosystem well, to discuss potential ways forward for the project to continue towards commercialisation. This could be done as standard with projects, either towards the later stages of the project, or post-project, to give all project teams the opportunity to showcase their work and learn more about future possible support mechanisms. This would add to the process that is now underway with Phase III projects.
viii	<u>PoC alumnus award for research associate</u>	<ul style="list-style-type: none"> At present, the research associates gain no recognition for the commercialisation work they undertake through PoC. Research associates often leave for work elsewhere part way through the PoC project, as they do not expect to remain employed by their institution at the end of the PoC project. An award for alumni could be a good opportunity for them to showcase what they have done to their peers and future potential employers, with the intention that such an award would incentivise them to stay involved in the project until it is completed.
ix	<u>Fuller role for mentors</u>	<ul style="list-style-type: none"> Some mentors have proven useful to the project teams in delivering their PoC projects, but some have not. The latter is often where mentors have provided limited input to the project. Having a fuller role for the mentor, perhaps more as another team member than a traditional mentor model, could be useful in bringing together more effectively the academic expertise of the PI with the entrepreneurship and industry knowledge of the mentor. This would not be necessary with all projects, such as where the team have the requisite skills to commercialise their project and do not need a mentor or only need limited inputs, but it could be useful for those with less experience or less desire to fully commercialise their projects themselves.
x	<u>Entrepreneurship training as a core part of project</u>	<ul style="list-style-type: none"> Project teams often have limited knowledge of commercialisation, industry and entrepreneurship. However, the most successful PoC projects are often those where the project team has some experience of this. Even for those that had no previous practical experience, having training in the core concepts of entrepreneurship was cited as useful by consultees. Not all project teams would need training on entrepreneurship where they already have the requisite skills, but for those with no experience, training could be a core element of the PoC

#	Modification	Reason for inclusion
	and ICURE, but training could be rolled out further for those that need it.	programme; it may even attract new people to the programme.
xi	<p><u>A Memorandum of Understanding, or similar, between the universities and Invest NI</u></p> <ul style="list-style-type: none"> This would involve a Memorandum of Understanding or similar agreement being signed between the universities and Invest NI committing to commercialisation activities. This would not necessarily be a formal agreement with defined requirements; it may involve an informal communique committing the institutions to work with Invest NI to increase commercialisation of their research base, and provide project teams with the support, time and space they need to succeed in doing so. 	<ul style="list-style-type: none"> Commercialisation is one of a number of priorities for research organisation; for universities, it is typically a lower priority than teaching and research. One of the challenges for the PIs leading the projects is getting the time and support to pursue it, with universities often reticent to release the PIs from other duties to do so, particularly as many of the best academics at commercialising are amongst the best at teaching and research. A commitment to give academics the time and support they need could be a powerful reminder of the importance of and commitment to supporting commercialisation. A published commitment, from the research organisations and Invest NI, to work together to increase the commercialisation of the research base could also be a powerful message to academic teams that commercialisation can be taken seriously as a career route.

Source: SQW

Offering a more flexible approach to PoC project funding

- 4.11 The majority of PoC projects receive £106k of funding from Invest NI, with most using this to pay a research associate to undertake the project for 12 months. But no two projects are the same; in reality some need more money or more time to reach TRL 3 or 4. These options therefore consider how the programme could be more flexible to differing requirements, and in doing so increase the value for money of investment.

Table 4-3: Options for a more flexible PoC programme

#	Modification	Reason for inclusion
xii	<p><u>Flexibility on funding timeframe</u></p> <ul style="list-style-type: none"> This option would allow, and encourage, projects to define the timeframe that their project would need to operate over in order to reach TRL 3 or 4. The main emphasis in assessing applications would be in driving down the amount of time required, to ensure that projects are focused and have momentum, but projects could be for longer than is currently typical, if deemed necessary. 	<ul style="list-style-type: none"> The majority of PoC projects are delivered mainly over 12 months (by funding a researcher for this time period). Although Sequential PoC and PoC Plus funding are available to continue PoC projects over a longer timeframe, these are only used in exceptional circumstances. As such, the expectation is that all PoC projects, regardless of technology area or complexity, reach TRLs 3 or 4 in the same time period. However, in some cases, more or less time may be required for projects to reach this stage. Greater flexibility could help to mould the programme to the requirements of projects, helping to support projects more effectively.
xiii	<p><u>Flexibility on funding total</u></p> <ul style="list-style-type: none"> This option would allow, and encourage, projects to define the amount of funding the project requires to reach TRL 3 or 4. In some instances, this could allow for funding higher than the current £106k, although it would be important at the application stage to set out why more is needed to 	<ul style="list-style-type: none"> The majority of PoC projects are awarded £106k. Although Sequential PoC and PoC Plus funding are available to receive more funding, these are only used in exceptional circumstances. The expectation is that the majority of PoC projects, regardless of technology area or complexity, reach TRLs 3 or 4 with £106k of PoC funding. Greater flexibility on funding totals would allow for a greater range of projects to be funded, including

#	Modification	Reason for inclusion
	reach TRL 3 or 4. The assessment process would be important for driving down the level of funding requested, to ensure that projects are only awarded the funding they need.	<p>some larger projects where more funding is necessary to reach TRL 3 or 4.</p> <ul style="list-style-type: none"> Using the assessment process to drive down the funding request would also help to increase the value for money from the investment, where less funding than the maximum is really required for the project.

Source: SQW

Widening the scope of PoC

- 4.12 The options below highlight ways in which the scope of the PoC programme could be widened, to better link into other parts of the commercialisation ecosystem, and to ensure that different types of projects are able to secure funding, where these would be beneficial to Northern Ireland.

Table 4-4: Options to widen the scope of PoC

#	Modification	Reason for inclusion
xiv	<u>Introduce a formalised Proof of Principle/Market stage</u>	<ul style="list-style-type: none"> This would involve allocating a large number of projects a small amount of funding to deliver Proof of Principle/Market projects, with a smaller number taken forward to PoC based on the outputs of this stage, with these able to access a higher level of funding.
xv	<u>Open funding to non-Northern Ireland institutions if impacts are expected to be delivered in Northern Ireland</u>	<ul style="list-style-type: none"> Some proof of principle projects are currently undertaken, with Ulster University funding a small number annually; these have been noted as valuable for formulating the projects that go forward to PoC by some consultees. They help to kick start the projects and define the scope and opportunity for commercialisation. Formalising this approach would help to highlight the journey through to commercialisation, and would emphasise the need to come to PoC with a well-developed proposition. A staged approach means that a potentially larger number of projects have the opportunity to secure funding initially, but also means that the highest level of funding is available only to those projects most likely to succeed (based on the work during/potential at the end of the first stage). This would be helpful for focusing on those projects that appear to have highest potential, based on the early work undertaken. In practice, this could mean that if one institution delivers more impacts or have higher potential at the close of the first stage, they may receive a proportionately higher share of the second stage funding. The PoC programme currently only funds projects from Northern Ireland-based research organisations. This would address the core objective of the programme, if opening the programme up to other organisations created more competition for funding, thereby stimulating a higher quality of project to come forward. However, this option is not feasible at the present time, as the Department for the Economy and Invest NI do not have the powers to offer this.

#	Modification	Reason for inclusion
xvi	Funding for collaborative projects <ul style="list-style-type: none"> Under this option, some funding would be set aside for collaborative PoC projects. These may be larger PoC projects, and could be collaborations within or between research organisations, or between research organisations and other organisations. 	<ul style="list-style-type: none"> Having funding set aside for collaborative projects specifically would encourage researchers to work with others to deliver their project. This could allow the projects to bring in expertise from elsewhere, to deliver a higher quality of project. An interesting example from elsewhere is that of England's Connecting Capability Fund, which seeks to encourage universities to work together to deliver high quality, innovative, best practice in knowledge exchange, recognising that universities could achieve more in knowledge exchange by working together. In addition, innovation is increasingly found at the convergence of technology areas. A collaborative approach to projects could allow for genuinely innovative approaches to technology and innovation.

Source: SQW

Ensuring impacts are delivered for Northern Ireland

- 4.13 The final suite of possible modifications to the PoC programme originates from a recognition that, where projects do successfully commercialise, the benefits are not always delivered in Northern Ireland. These options seek to increase this likelihood.

Table 4-5: Options to increase impacts for Northern Ireland

#	Modification	Reason for inclusion
xvii	Focus on different sectors for each round <ul style="list-style-type: none"> Each call would focus on a different sector, perhaps aligned with economic growth areas/economic strengths of Northern Ireland. 	<ul style="list-style-type: none"> Concentrating on specific sectors, especially growth sectors and priorities, could help to increase the potential for benefits to be felt in Northern Ireland. Where PoC projects match priority sectors or sector strengths, they may find it easier to find other support, expertise or customers, which could improve their prospects for commercialising and increase the chance that at least some of the benefits will be felt in Northern Ireland.
xviii	Launch challenge funding/prizes <ul style="list-style-type: none"> This would involve reserving funding for a key area of research that aligns with Industrial Strategy/sectoral strengths of Northern Ireland's industry or research base. Projects would still be PoC projects, but with a pre-determined technology area. 	<ul style="list-style-type: none"> Challenge funding would offer the opportunity to encourage applications for projects that are of interest to Northern Ireland either as economic growth areas or industrial strengths, thereby increasing the potential for projects to deliver impacts in Northern Ireland and address challenges that Northern Ireland faces economically or socially. This could also be a useful way of aligning projects to the activities of different funding bodies, to help increase the chance of projects accessing wider investment.
xix	Focus on spin-outs <ul style="list-style-type: none"> A focus on developing spin-outs would prioritise this over other forms of commercialisation, e.g. licensing. 	<ul style="list-style-type: none"> Spin-outs are generally more likely to deliver identifiable impacts in Northern Ireland e.g. through job creation, whilst licensing may only contribute to the university's finances, especially where the license is to non-Northern Ireland based firms. Focusing only on those projects that are identified as potential spin-out opportunities could therefore help to deliver impacts in Northern Ireland. Scotland's High Growth Spin-Out Programme is an example of where this has been done elsewhere; the programme focuses specifically on spin-outs as

#	Modification	Reason for inclusion
xx	<u>Focus on licensing within NI</u>	the most appropriate way to deliver economic impact from investment in this space.
xxi	<u>Increased PR/marketing of the programme and its benefits as well as commercialisation generally</u>	<ul style="list-style-type: none"> A focus on licensing only where there is likely to be an opportunity to license in Northern Ireland may increase the potential for projects to deliver impacts in Northern Ireland. Practically, this could mean focusing on projects where there are already key organisations based in Northern Ireland that could be potential customers, or by identifying potential customers as part of the application process. Increasing the profile of PoC and of commercialisation more generally, and promoting widely the successes and how they were achieved, could inspire more researchers to take up PoC and commercialisation activities. It would also help in building a larger community of researchers involved in commercialisation, and emphasise the opportunity for commercialisation in Northern Ireland, potentially attracting new high quality researchers to Northern Ireland. Building this community could help to embed a culture of innovation and commercialisation, with the programme a key conduit for achieving this.
xxii	<u>Increased authority for Technology Transfer Offices (TTOs)</u>	<ul style="list-style-type: none"> Despite the TTOs being of a similar size at the two universities, PoC projects from Queen's deliver a proportionately higher economic impact than those from Ulster. The TTOs should be empowered to encourage only the best and most serious commercialisation prospects to come forward, and made accountable for the projects that do so.

Source: SQW

Different intervention models

- 4.14 As recognised by OECD¹², the core strategic objective of increasing the level and quality of commercialisation from within Northern Ireland's research organisations could be approached through other types of intervention not only through a PoC mechanism.

"While patents, licenses and spin-offs remain important channels for commercialising public research, other channels such as collaborative research, (e.g. public-private partnerships), student and faculty mobility as well as contract research and faculty consulting appear to be increasing in importance. Student entrepreneurship has emerged as a focus of efforts to promote knowledge transfer and commercialisation"

- 4.15 Here we present examples of interventions elsewhere drawn from stakeholder consultations, prior knowledge and desk research on best practice, that could form a framework for new

¹² See [OECD \(2013\). Commercialising Public Research: New Trends and Strategies](#)

interventions in Northern Ireland, and help achieve the same objective. The options are grouped in two categories:

- demand-side interventions, seeking to increase demand for innovations, to encourage more research from organisations to be commercialised
 - supply-side interventions, to build the capacity and capability for commercialisation, as with the current PoC programme.
- 4.16 It is important to recognise that the scope of these interventions is in many cases wider than PoC. They are considered here in terms of their potential contribution to the same strategic objective that the PoC programme currently seeks to achieve: that is, to bring about an uplift in the amount and quality of commercialisation activity from the research organisations in Northern Ireland. They are not considered in terms of their contributions to other parts of the innovation ecosystem.
- 4.17 For each option, a description of the intervention and the reasons for inclusion in this review are set out. Most of these options could operate alongside PoC in its current or a modified form; they need not necessarily replace it.

Demand-side interventions

- 4.18 These interventions seek to increase demand for innovation, to encourage greater commercialisation of research assets at institutions. Four interventions are set out:
- Competence Centres
 - Small Business Research Initiative
 - Industrial Strategy Challenge Fund
 - Small Business Technology Transfer

Name of the intervention	Competence Centres
Description	<p>Competence Centres, funded by Invest NI, were set up to bring together universities, research institutes and innovative businesses to undertake collaborative research in areas with a direct industrial focus. The centres give firms the opportunity to develop new products, processes and services and accelerate their commercialisation, giving local companies access to leading edge solutions and skills. Membership of a centre is open to any company, whether Northern Ireland-based or not. There are four Competence Centres at present, focusing on Northern Ireland's industrial strengths: Connected Health Innovation Centre (CHIC); Centre for Advanced Sustainable Energy (CASE); Northern Ireland Advanced Composites and Engineering Centre (NIACE); and Agri-Food QUEST.</p> <p>Invest NI is providing £20m of funding for the centres over five years – £5m for each centre. Through this funding, the centres part-fund research projects (up to 75% of costs), with each project including at least three companies (who make an in-kind contribution of up to 25% of project costs) and one of Northern Ireland's research institutions (Queen's, Ulster or the AFBI). The funding is given to the academic institute working on the project, with the institute then undertaking the research on behalf of the firm.</p>
Reason for inclusion	<p>The focus of Competence Centres, already operational in Northern Ireland, is on giving businesses the opportunity to access the research base in Northern Ireland to undertake research of commercial merit on their behalf; the onus is on the businesses to identify the area of research. The Competence Centre and PoC approach could be combined, allowing for projects to be brought forward by the</p>

research organisations themselves, who would find a business looking to commercialise the research they are able to undertake. This could otherwise operate on a similar basis to the Competence Centres at present.

The advantage of this approach is that it brings the Competence Centres and PoC under one umbrella programme, potentially giving both more visibility amongst the business base. Moreover, undertaking research that there is a known customer for would increase the likelihood of impacts being achieved. This would help achieve the core objective of intervention in this space.

One potential disadvantage is that this would only fund research that has an immediate customer that will work with the institutions, which may limit the opportunity to fund some 'blue skies' research, and thus realise the full commercial potential of the research base.

Source: SQW analysis

Name of the intervention	Small Business Research Initiative
Description	<p>The Small Business Research Initiative (SBRI) brings together public sector organisations and firms to respond to challenges identified by the public sector. An issue is identified by the public sector organisation that they want to address, with a call launched to find a firm to take on the task of developing a technology to address the issue.</p> <p>Businesses that win calls receive full costs for demonstrating their proposed technology solution (phase 1), with the potential to secure subsequent funding from the programme to develop a prototype (phase 2). On completion of phase 2, the intention is that the technology should be ready to be commercialised, at which point the public sector may take up the technology, following standard procurement processes. The company developing the technology retains all IPR. More than 2,200 SBRI contracts valued at over £270 million have been awarded since 2009, generating business opportunities for companies and benefiting more than 70 government bodies.</p>
Reason for inclusion	<p>Again, SBRI is already operational in Northern Ireland. It is for companies to access funding to address challenges identified by the public sector. The concept of the public sector identifying challenges to be addressed could be implemented in relation to the research institutions too. Challenges could be identified by the public sector in Northern Ireland, e.g. the NHS, local authorities etc., with the research organisations then competing for funding to develop technologies to address these challenges.</p> <p>The advantage of this concept is that it makes it much more likely that Northern Ireland achieves benefits from the projects funded, as any successful projects have the opportunity benefit the public sector. In addition, it is an opportunity for the research organisations to showcase their solutions to real world problems that ought to also apply across the public sector elsewhere, perhaps bringing increased profile to the research organisations. An intervention in this space would provide new avenues for the commercialisation of research.</p> <p>A potential limitation to the value of this approach is if the challenges identified are not well-aligned with the competencies of the research organisations in Northern Ireland, given its relatively small research base compared to the rest of the UK, although this could be addressed by trying to align the challenges with research strengths. The relatively small size of Northern Ireland compared to the rest of the UK could also potentially limit the variety and quantity of projects to come forward.</p>

Source: SQW analysis

Name of the intervention	Industrial Strategy Challenge Fund
Description	<p>The Industrial Strategy Challenge Fund (ISCF) has been created to provide funding and support to UK businesses and researchers, to undertake research and development across key technology areas, as set out in the Industrial Strategy. It is set to be administered by UK Research and Investment from 2018.</p> <p>Six initial technologies were identified: Healthcare and medicines; Robotics and artificial intelligence; Clean and flexible energy; Driverless vehicles; Manufacturing and materials of the future; Satellites and space technology. Further technology areas are to follow. These were chosen based on the quality of the research base in these areas in the UK, and the market potential for these technologies.</p> <p>The intention is that, through the ISCF, Government will bring together the UK's research base with the ambitions of business to respond to these challenges. The fund will invest at any stage of technological development from early research to commercialisation. It will be used in various ways, such as funding collaborative research between businesses and academics, placing</p>

graduates within companies, or funding technology demonstrators to test near-to-market technologies in real-world environments.
Reason for inclusion
<p>The ISCF takes a whole system view on the commercialisation of technology, investing at any stage of development. Intervention in the same space as PoC would not seek to operate in the same manner, as other initiatives might do so e.g. techstart^{NI}. However, the whole system view, and emphasis on key growth priorities is of note. Moreover, the ISCF will fund collaborative research between businesses and academics, placing graduates within firms, and funding technology demonstrators, each helping to commercialise the research base.</p> <p>An advantage of this approach is that it emphasises the public sector's commitment to support commercialisation of research in particular technology areas. It also offers the flexibility to do so in different ways, with technology demonstrators offering the opportunity to test near-to-market technologies, thereby encouraging the commercialisation of early stage research to take advantage of this opportunity, and with funding for collaborative research between businesses and academics. Such an approach would need to reconcile the strengths of the business base in Northern Ireland, the strengths of the research base, and major emerging market opportunities.</p>

Source: SQW analysis

Name of the intervention	Small Business Technology Transfer
Description	<p>The Small Business Technology Transfer (STTR) programme provides funding to small businesses to work with research institutions on R&D in priority areas for the US economy, bridging the gap between early stage science and commercialisation. The aims of the programme are to stimulate technological innovation, foster technology transfer from research institutions to small firms through corporate R&D, and increase private sector commercialisation of federal R&D efforts.</p> <p>Each Federal agency with extramural R&D budgets of over \$1bn are required to reserve 0.3% of that budget for STTR awards to small businesses. The agencies designate the topics for R&D and accept proposals. The five agencies currently involved in the STTR programme are the Department of Defense, Department of Energy, Department of Health and Human Services, National Aeronautics and Space Administration (NASA) and the National Science Foundation.</p> <p>Projects are funded in three phases:</p> <ul style="list-style-type: none"> • Phase I: up to \$150k for one year to establish the technical merit, feasibility and commercial potential of the proposed R&D efforts, and to determine the quality of performance of the business • Phase II, is for Phase I awardees only, comprising up to \$1m over two years to continue R&D, based on the outcomes of Phase I • Phase III is not funded by STTR, with monies instead potentially coming from Federal agencies directly; this phase is to continue R&D towards commercialisation, based on Phase I and Phase II outputs, and potentially production contracts for products, processes or services.
Reason for inclusion	<p>Similar to a combination between the Competence Centres and the SBRI in terms of focus, an STTR programme would provide funding to businesses to work with the research institutions to respond to a challenge identified by the public sector in Northern Ireland.</p> <p>This would have the benefit of bringing both business and the research organisations together to respond to challenges identified for Northern Ireland, thereby supporting the commercialisation of the research base, positive impacts on the business base, where businesses are Northern Ireland-based, and benefits to the public sector organisation, if they implement the solution developed. The phased approach presented here takes projects from inception to commercialisation; a PoC-type intervention may focus only on Phase I.</p> <p>Potential limitations to this approach are similar to those identified for the Competence Centre and SBRI approaches, including a potentially limited number of projects, as well as potential mismatch between the challenges, the research base, and the business base in Northern Ireland.</p>

Source: SQW analysis

Supply-focused interventions

4.19 Other possible models are similar to PoC in that they are supply-side interventions. The three interventions summarised below all seek to create an ecosystem that is amenable to commercialisation, although focusing on different elements. They are:

- UMass Lowell's DifferenceMaker
- IdeaSpace
- Royal Society of Edinburgh's Enterprise Fellowships.

Name of the intervention	UMass Lowell's DifferenceMaker
Description	<p>UMass Lowell's DifferenceMaker is focused on engaging the University's students in entrepreneurship, and raising awareness of the potential for entrepreneurship. There are several interventions within this programme of activity, including:</p> <ul style="list-style-type: none"> • A series of events with entrepreneur speakers to discuss key factors in entrepreneurship, including IP, funding etc. • The Idea Challenge, where student teams present innovative solutions for the chance to win \$35k, with workshops to support them to develop entrepreneurial skills, like business planning, understanding markets, customers and opportunities etc.; students are encouraged to pull together interdisciplinary teams. • Freshman Make A Difference is a year-long effort to engage new students in solving problems through entrepreneurial action. • The Campus Catalyst Competition, providing a \$500 grant plus support for student teams to develop innovative ideas, with potential growth opportunities for the promising projects. <p>Fellows are appointed, from amongst faculty members to provide mentoring and programme support, with this said to be deemed a prestigious role within the faculties.</p>
Reason for inclusion	<p>There is an increasing recognition, from the OECD as above, but also from evaluation activity, such as that of Norway's FORNY programme, of the emergence of student entrepreneurship in the commercialisation of the research base.</p> <p>This intervention would seek to broaden the base of people undertaking commercialisation activities within the research organisations, helping to increase knowledge and skills around commercialisation. Importantly, it would also potentially help to embed an entrepreneurial approach within the institutions, and demonstrate to students the opportunity of being both entrepreneurial and innovative.</p> <p>The focus here would be on building up the population of potential entrepreneurs, which could <i>indirectly</i> lead to an increase in commercialisation activity, but it would not <i>directly</i> fund the commercialisation of the institutions' research.</p>

Source: SQW analysis

Name of the intervention	IdeaSpace
Description	<p>IdeaSpace is part of the University of Cambridge, operating under the Pro-Vice Chancellor for Research, but provided day-to-day by IfM Education and Consultancy Services Ltd. It supports a community of entrepreneurs in Cambridge who start businesses with high impact potential – expected to positively affect the lives of a million people within three to five years.</p> <p>The organisation provides support to business founders to develop in their roles, and also provides office, meeting and social space and other resources; flexible workspace is provided to stimulate members to share knowledge and experience as they develop their businesses and build their teams.</p> <p>IdeaSpace also engages with Government, agencies and research institutions to develop policies, strategies and programmes that are supportive of start-ups, and also inform and provide cases for R&D activities at the University relating to early-stage ventures.</p> <p>IdeaSpace currently has 300 active alumni members, representing 190 ventures.</p>

Reason for inclusion
<p>Some elements of this initiative are beyond the scope of any intervention aimed at increasing commercialisation at research institutions directly e.g. the provision of business space. However, there are some elements of IdeaSpace that could be of interest, in seeking to build an active group of entrepreneurs around the research institutions. As an initiative that is both led by business but embedded within the research institution, it has an important role in informing and providing the case for R&D activities to be undertaken at the research institution in relation to businesses, potentially tying commercialisation directly into research activities. In addition, there would be a community of skilled entrepreneurs ready to take forward research for commercialisation activities, reducing the need to find customers or for the institutions or academics to have to commercialise their research themselves alone before securing customers. These activities could perhaps be tied into those of a bulked up MATRIX.</p> <p>As with DifferenceMaker, this approach would not <i>directly</i> fund commercialisation of the institutions' research, as the main focus of its activities is on building the community of entrepreneurs, but through doing so it could potentially lead <i>indirectly</i> to an increase in commercialisation.</p>

Source: SQW analysis

Name of the intervention	Royal Society of Edinburgh Enterprise Fellowships
Description	
<p>RSE Enterprise Fellowships are intended to enable promising science and technology researchers to develop into successful entrepreneurs and encourage new businesses to be developed in Scotland, based on a technological idea developed by the Enterprise Fellow, with the Enterprise Fellow expected to play an important role in taking the idea forward.</p> <p>Each Fellowship is hosted by a research organisation for a 12 month period, with the programme supporting researchers with entrepreneurial ambition by providing: a 12 month salary; business training, including a four-day 'bootcamp' and 10 workshops; business mentoring; access to financial/entrepreneurial networks; business development funding. The awardee is able to focus solely on refining the business idea for the year of their fellowship.</p> <p>The programme is supported by Scottish Enterprise, Highlands and Islands Enterprise, the Science and Technology Facilities Council and the Biotechnology and Biological Sciences Research Council.</p>	
Reason for inclusion	
<p>Enterprise Fellowships would offer researchers the opportunity to become entrepreneurs, using their talents as a researcher and developing their abilities in entrepreneurship. Importantly, an Enterprise Fellow would be given a salary for 12 months to focus solely on their business idea whilst developing their entrepreneurial skills. If a similar arrangement could be made as in Scotland, with research councils joining in funding Fellowships, this would not only reduce the cost to Invest NI, bringing new money into Northern Ireland, it would also give the Fellows the opportunity to showcase their abilities and their project to potential future funders.</p> <p>A programme of this nature could also be a good way of attracting entrepreneurial researchers to Northern Ireland's research organisations, knowing that they would have the opportunity to gain a Fellowship themselves, and given the community of Fellows that would build up over time and, hopefully, become embedded within Northern Ireland.</p> <p>This would not capture all of the potential commercialisation projects, as it would be aimed at those people that want to become entrepreneurs, rather than the researchers who wish to develop a technology but not take it forward to commercialisation themselves. However, it would support those with the ambition to be entrepreneurial who may be more inclined to push forward with their commercialisation project.</p>	

Source: SQW analysis

5. Recommendations

Section summary

- The headline recommendation of this report is that PoC should continue in a modified form, as there remains strong rationale for intervention in this space. The proposed modifications focus on delivering a more structured programme, in which the content at project level is designed to encourage, enable and achieve commercial results. The new programme should be embedded in, and be a more visible part of, the institutions' missions.
- We also recommend that other complementary measures are considered further and piloted e.g. enterprise fellowships and other measures aimed at researchers rather than research projects, and at students (as potential entrepreneurial researchers of the future). These seek to enable PoC to be more effective, by enabling and improving wider linkages between the research community and business.
- A full economic appraisal will be needed to further explore and test these options for future intervention, and to set out detailed objectives and key performance indicators.

Overview

- 5.1 In this final section of the report, recommendations are developed for the future form of PoC. Some of the options delineated in section 4, are brought forward as a shortlist, combining modifications to the programme, and key elements of the other different models which could form part of the mix. This draws on the wider experience of members of the SQW consulting team, as well as the analysis undertaken for the project; it is also informed by discussions with, and initial feedback from, the client steering group and the two universities.
- 5.2 **Based on the evidence presented above, and the wider context, there remains a strong rationale for continued Proof or Concept funding.** Proof of Concept funding performs a very important role supporting the development of the innovation ecosystem by stimulating commercialisation activity, as recognised by local stakeholders, and through its use in comparator schemes in many other locations across the UK (the vast majority publicly-funded) and worldwide. For Invest NI, Proof of Concept funding sits at a particularly early stage in the entrepreneurship ecosystem (as in Figure 2-1) and in the range of interventions provided by Invest. The realisation of benefits that can be monetised in terms of their economic value will necessarily be very long term, and forms only part of the rationale for intervention. PoC is also an important lever to drive further innovation and commercialisation activity, as innovation becomes of ever-increasing importance for the future economic fortunes of Northern Ireland.
- 5.3 **Based on feedback from stakeholders and the evidence base, we do not recommend replacing PoC with an entirely new programme.** Although there are challenges in operating a scheme where there are essentially just two beneficiary institutions, this would be a challenge for any replacement intervention.
- 5.4 **The headline recommendation of this report is therefore that PoC should continue, but with modifications aimed at achieving greater impact, through identifying the innovative potential of the research propositions at different stages, re-assessing progress towards commercialisation, and seeking to embed the programme within the wider Northern Ireland ecosystem.** We have set out proposed changes in the content and

form of delivery, together with some specific proposals for its overall positioning as part of the innovation ecosystem in Northern Ireland. This recommendation draws on stakeholder feedback, and recognises the recent and on-going progress in honing the programme to deliver greater impacts for Northern Ireland.

- 5.5 **We also recommend that additional, complementary measures, such as enterprise fellowships and other measures aimed at researchers, are considered further and piloted.** Similar to the existing programme, these would lie at an early stage of the innovation ecosystem with limited monetised impact in the short term, but with potentially very important positive effects on Northern Ireland's culture of entrepreneurship and commercialisation, thereby supporting innovation and business development in the longer term.
- 5.6 Before going into the detailed recommendations, we briefly revisit the objectives for the programme, put forward four principles which we believe should influence the shape of the future offer and content of the programme and, based on this, suggest possible modifications to the KPIs. We also set out why we have discounted some of the modifications at this stage.

Objectives and KPIs

Objectives

- 5.7 The core objective of this amended model would be, as now, to increase the level and quality of commercialisation from within Northern Ireland's research institutions. The specific operational objectives would also remain largely the same as the current programme.
- 5.8 However, some additions could be made, which reflect the wider aims of PoC, and its intended role as part of a wider eco-system, notably to:
- increase the size of the extant community of researchers engaging in commercialisation of research from the research organisations in Northern Ireland
 - improve the links between the institutions and other elements of the funding and support ecosystem around commercialisation
 - increase the scale and intensity of interactions with external organisations and individuals involved in commercialisation process.

Core principles

- 5.9 The possible modifications set out in section 4 have been assessed against three principles, which stakeholders identified, which have proved important elsewhere and which we believe should be made explicit in Northern Ireland. These are:
- A more structured programme, which also provides more flexibility, with the potential to tailor support to the specific type and form of innovative research project, and the funding gap these face in moving towards commercialisation
 - A programme in which the content at project level is designed to encourage, enable and achieve commercial results, drawing as and where appropriate on commercial

expertise and other experience, including linking into other initiatives aiming to support embryonic and early stage enterprises with real growth potential

- A programme which is embedded in, and a more visible part of, the universities' missions.

Key performance indicators

- 5.10 As the objectives remain unchanged, many of the KPIs for a modified PoC will also remain the same, notably: the establishment of new commercial ventures such as spin out companies and joint ventures; the achievement of licence agreements; leveraging of seed investment (e.g. Angel or Venture Capital); leveraging additional Research Council funding; leveraging additional commercial funding; leveraging additional commercial funding not directly related to the project but gained as a result of commercial contacts made during the project; the creation of new commercially exploitable Intellectual Property; production of a prototype or working demonstrator of the technology; evidence that the technology is capable of scale-up to commercially viable levels; the identification of potential commercial partners.
- 5.11 In addition to these, two further KPIs are proposed, which focus attention on the operating conditions and wider context in which PoC operates: i) the number of academic staff engaged in commercialisation activities; ii) the proportion of academic staff with improved entrepreneurial skills. It is not possible to quantify targets for these at this stage; further KPIs may also be added as economic appraisal work is undertaken.

Modifications not taken forward

- 5.12 Of the long list of modifications set out in Section 4, eight are not taken forward in the recommendations for a new intervention. These are set out in Table 5-1, with the reasons for not now pursuing them.

Table 5-1: Modifications not taken forward for further consideration

Modification	Reason for not taking forward the modification
Target the programme at projects most likely to commercialise in Northern Ireland	<ul style="list-style-type: none"> • In principle, this would be a good way to maximise the impacts of the programme, by targeting the programme at people that are more likely to deliver impacts (i.e. those with experience and industry connections), or by focusing on those areas (technologies, sectors) that are most aligned with the industrial base of Northern Ireland. • In practice, such an approach would diminish the opportunity for the programme to support the development of a wider community of people with the ability and desire to commercialise. Moreover, some projects that have performed well would have been excluded from funding on this basis. Academics should be encouraged to learn about and undertake commercialisation activity; barriers to doing so will not help in this regard. There are other ways to get around the lack of experience, such as training, or a fuller role for mentors, as explored later in this Section. • Focusing on those technologies and sectors of relevance to Northern Ireland's industrial base may also miss the opportunities from more 'blue skies' research that the universities undertake.
Assess projects on the likelihood of being able to secure	<ul style="list-style-type: none"> • In theory, this approach would ensure that only those projects that could secure subsequent investment would be able to access PoC funding. This is in line with the comparator programme in Scotland, in seeking to exclude projects that have no realistic chance of being continued post-PoC.

Modification	Reason for not taking forward the modification
investment at the end of PoC	<ul style="list-style-type: none"> In practice, future ‘fundability’ is difficult to ascertain at the initial assessment, given the early stage nature of the projects and the complex ‘moving feast’ of the innovation and commercialisation funding ecosystem. Rather than discounting projects at the application stage, it may be better to address elsewhere the nature and scale of the post-PoC funding gap, and to improve the relationship between the various elements of the ecosystem, as explored later.
Flexibility on funding timeframe	<ul style="list-style-type: none"> Flexibility of funding timeframe would reflect the likelihood that some projects need longer to reach TRL 3-4 than others, and therefore should be given longer to do so. Feedback from the universities suggested that having a time limit is helpful in maintaining focus and momentum for projects; having a relaxed approach to timing for projects would potentially lead to projects not having the momentum to succeed. The existing flexibility in timing was broadly deemed sufficient.
Flexibility on funding total	<ul style="list-style-type: none"> Flexibility of funding total was also intended to reflect that different projects may well need different amounts of money to reach TRL 3-4. Feedback from the universities suggested that in practice, this would not work as intended. It would lead to all projects asking for more money, with an emphasis on fitting the project to the budget rather than fitting the budget to the project. However, whilst this option has not been taken forward and an upper limit will remain, it should be incumbent on the applicant to prove why they need the amount they are bidding for; a reduced amount of funding should be offered if applicants cannot sufficiently justify their request for the maximum funding.
Open funding to non-Northern Ireland institutions if impacts are expected to be delivered in Northern Ireland	<ul style="list-style-type: none"> In principle, this might offer the opportunity to secure impacts in Northern Ireland from commercialisation of research from institutions outside Northern Ireland. It would also provide greater competition for funding, potentially driving up the quality of applications. In practice, it is unlikely that many projects will come forward that would be able to evidence that they would have any impacts in Northern Ireland, with spin-outs most likely based near their parent institution. This would limit the number of projects from institutions outside Northern Ireland that would be funded and therefore also limit the effect of increased competition. Given the likely low effect and potential complications in awarding funding to institutions outside Northern Ireland, implementing this option could prove to be a distraction for the programme.
Focus on different sectors for each round	<ul style="list-style-type: none"> This modification was intended to lead to a greater focus on e.g. priority sectors, aligning the programme with the sectoral priorities of Northern Ireland. The aim of this modification is sound, but in practice narrowing each round to specific sectors, given the small number of institutions and small number of projects coming forward from each of them, would potentially limit the reach of the programme. As some sectors would be out of scope, this could limit the potential to support the development of commercialisation abilities across the institutions’ research disciplines and to embed a culture of commercialisation. A more appropriate to focus efforts on priority sectors and industrial strengths would be to have challenge funding aimed at specific issues, running alongside an ‘open’ call for projects. This is considered further later in this section.
Focus on spin-outs	<ul style="list-style-type: none"> Spin-outs tend to deliver the greatest direct jobs impacts from PoC projects. A focus on spin-outs would therefore emphasise funding for projects to go down this route. However, for many of the projects that come forward for PoC, licensing is the most appropriate route to commercialisation, particularly for life science projects, where market entry costs are high for spin-outs. In practical terms, it is difficult at the application stage to know what the most appropriate route forward for a project will be – spin-out or license. Restricting the programme to spin-outs could mean that some projects do not take the most appropriate route to commercialisation: licensing may have been more appropriate. It could

Modification	Reason for not taking forward the modification
Focus on licensing within NI	<p>also mean that fewer projects come forward, limiting the development of a community of academics with commercialisation experience.</p> <ul style="list-style-type: none"> • Leaving the programme open to both spin-outs and licensing opportunities, but restricting licensing to Northern Ireland firms, was suggested as a way to increase business benefit and impact in Northern Ireland. • In practice, an insistence on licensing in Northern Ireland would be over restrictive. Given the small industrial base, it may not be possible for some projects to secure licence agreements with Northern Ireland-based firms, and where it was possible, the results could be commercially sub-optimal. This approach would also limit the opportunity for projects to work with major global firms that are based outside Northern Ireland. • Looking holistically at the benefits of licensing (beyond the business benefits), keeping the licensing opportunities open to firms outside Northern Ireland would be beneficial for developing the abilities and reputation of the researchers and the profile of the institutions, and could also lead to new opportunities for research and commercialisation, potentially with those large firms based outside Northern Ireland.

Source: SQW

A reconfigured PoC programme

- 5.13 The interaction between research and business does not follow a single, unchanging, form. In some fields, the capacity to apply computing power and software and model the range of possible new developments is enabling rapid testing and accelerated prototyping at a pace which is changing the form and timescale for research. The parameters for some types of research are also changing as a result of other factors, including cyber security which brings new opportunities and constraints. As discussed throughout this report, reconsideration of the form in which PoC should operate is timely; a revised programme should encompass more flexible approaches, as ‘one size fits all’ is unlikely to be appropriate or effective in the future. This has implications for Invest NI, in managing a potentially more complex programme, and also for the universities, and in particular for their TTOs, in re-interpreting the need and appropriate form of PoC, and providing the gateways for its effective use. The set of proposed modifications, a subset of the possibilities identified in section 4, are grouped under the three principles set out above.

A more structured, and more flexible, programme

- **Introduce a formalised Proof of Principle/Market stage.** The most substantive modification would be to adopt a staged approach to the programme. The first stage would be for all projects, allowing project teams to prove the principle of their work. This could be along the same lines as Ulster University’s current Proof of Principle programme, but as a formal route into PoC, with a large number of projects funded.

The second stage would then be reserved for those projects that look most likely to be taken forward to commercialisation, based on the outcomes of the proof of principle stage, and could help therefore to support those projects with most potential to deliver impacts for Northern Ireland and sift out those with lower potential. In practice, this could lead to second stage funding being proportionately more concentrated on one institution than at the first stage, if that institution’s projects appear to have higher potential at the end of the first stage.

Such an approach could mean that more projects are funded overall, giving more people a taste of commercialisation, whilst also giving a smaller number perhaps more money than at present, given that they are competing against fewer projects for the largest share of funding. They could then potentially be funded to take projects further towards commercialisation than at present, closing the gap between PoC and other funding sources. This would follow the approach adopted elsewhere, including in Scotland and Finland. This could be combined with a match funding requirement for projects, thereby making it possible for the programme to fund more projects, and helpfully demonstrating commitment to commercialisation on behalf of the project team and institution.

Given the administrative requirements of operating a multi-stage programme, it is imperative that the application process is kept as simple as possible and that moving from one stage to the next should be seamless.

- **Mid-and post-project review.** This would add to the process already underway with Phase III projects, to ensure that project teams have the opportunity to showcase their progress with those delivering other potential sources of support or potential future funders, and again to highlight to the project teams the options going forward beyond PoC.
- **Entrepreneurship training as a core part of project.** Entrepreneurship training would be a valuable element for many of the people working on PoC projects, where they have no prior knowledge or experience of entrepreneurship. Training would help to ensure that those taking PoC projects have a good sense of how to commercialise their research. Moreover, having this as a core element of a genuine programme, rather than a funding stream only, may help to attract new researchers, and emphasise the nature of the projects as a route for commercialisation
- **Ensure the quality of projects funded is in line with national standards.** The recommendation here is that Invest NI work with organisations elsewhere, to learn from how programmes are operated elsewhere and, importantly, how projects are funded and on what basis, to ensure that applications and projects are seen on a 'level playing field' with elsewhere. This is now being undertaken, for Phase III, through aligning the programme's standards with those of the research councils; this should be continued.

Drawing other business growth expertise into projects

- **Bring an investor perspective into the programme.** Specifically, the recommendation here would be for the programme to work more closely with investors (e.g. techstart^{NI}) throughout the projects, in order to increase awareness of the opportunities, and help guide projects towards investment readiness, and specifically not for investors to have a say in whether a project should be funded from the outset, at which point it is deemed to be too early to make an investment decision. This is already taking place with Phase III projects at the application assessment; it should be continued, and should be undertaken with all projects that come forward, including once approved. Increasing networking between PoC project teams and potential future seed/venture capital investors might also be valuable in some cases.

- **Map out pathways to commercialisation.** This would involve increasing knowledge of the PoC programme in the wider ecosystem, but also increase knowledge of future funding/support options for the project teams, so that they understand how they might commercialise. This is something that project teams must do as part of their project under Phase III of PoC; stakeholders should work with project teams to help to map this out and make the ecosystem as easy as possible to navigate and understand.
- **A fuller role for mentors.** A fuller role for mentors could, in some cases, help to push forward projects towards commercialisation, where members of the team are less experienced in commercialisation and business, or less interested in this element of the project. Moreover, they could be seen increasingly as an important member of the team helping to commercialise the project, with some interest vested in its success, rather than a traditional limited mentor role.
- **Increased focus, at assessment, on the market and IP landscape.** The recommendation here is for the assessment to be weighted more towards the market landscape and technology landscape, and therefore the likely opportunities for the project, with less focus on the technology itself or the project plan. In practice, with a staged approach to PoC, this weighting may be more important at the second stage than the first (which might include a focus on establishing the market landscape and IP landscape).

Higher profile for the innovation-commercialisation route within universities

- **A Memorandum of Understanding, or similar, between the universities and Invest NI.** As above, this could be an informal communique, rather than an agreement with enforcement measures. The intention would be that it is simply a statement from the institutions of their intent to support those that want to commercialise research could be a valuable way to show existing staff, and potential new staff, the supporting environment in their institution for commercialisation, helping to deliver buy-in throughout the institutions.
- **PoC alumnus award for research associate.** PoC could learn from elsewhere and make the programme more enticing from a people perspective by giving recognition to the efforts of researchers in delivering PoC projects, to encourage them to remain on the project until it is completed, but also to help attract new researchers and help foster a community of alumni.
- **Increased PR/marketing of the programme and its benefits as well as commercialisation generally.** As with some of the other options, this is recommended so that the programme has a higher profile amongst prospective PoC project leads and researchers, including potentially helping to attract researchers from elsewhere.

Other possible modifications

- 5.14 Three other possible modifications could bring new perspectives to the programme.
- **Provide funding for collaborative projects.** This would entail funding being set aside for projects where project teams bring in expertise either from other disciplines or from other institutions, including from outside Northern Ireland. This would be useful in bringing in new research expertise and also in encouraging best practice and innovation.
 - **Launch challenge funding.** The recommendation here would be for Invest NI to identify challenges, periodically, that it would like to fund some PoC projects to help resolve. It may be appropriate to target these where: i) the institutions have strengths in commercialisation e.g. life sciences and engineering as with PoC; ii) there is industrial strength or where there are priority technologies/sectors, and particularly where there looks set to be policy emphasis and other funding streams that could take projects forward post-PoC e.g. in relation to technology areas identified in the UK Government's Industrial Strategy and the Grand Challenges (growing the Artificial Intelligence and data-driven economy, clean growth, future of mobility, ageing society), and the existing Industrial Strategy Challenge Fund.
 - **Increased authority and accountability for Technology Transfer Offices (TTOs).** We recommend that Invest NI explores new ways of empowering the TTOs to ensure that the best projects, and those where commercialisation is being taken most seriously, are the ones brought forward for PoC funding, as well as exploring ways to make the TTOs more accountable for the success or otherwise of their institution's PoC projects. This could include performance-related funding for the TTOs, based on the impacts from their institution's projects, and/or a review of the TTOs processes, aimed at ensuring that only the best PoC projects come forward and these receive full internal support.

Other learning from elsewhere

- 5.15 Other, complementary, models for intervention should be explored further, with a view to their possible piloting alongside PoC. Of the seven set out in Section 4, four are highlighted here; these are judged to have the most relevance and best alignment to the space that the PoC programme operates in, and therefore the greatest potential for positive effects.
- **Enterprise Fellowships.** Invest NI should seriously consider implementing a similar intervention to the Enterprise Fellowships programme, perhaps even delivered by the Royal Society of Edinburgh given their existing expertise and experience. There may be different ways to implement such an intervention. It may be possible to integrate this programme with PoC, or for it to operate either before, after, or alongside PoC. Unlike PoC which is related to projects, the focus with the Enterprise Fellowships is ostensibly on the individual. Such an intervention could therefore help give surety to researchers that there are opportunities to undertake entrepreneurship activities other than PoC, and also gives researchers a sense of achievement at the end of the Fellowship. Moreover, it could help to attract new researchers to Northern Ireland that are interested in entrepreneurship, therefore

perpetuating and embedding commercialisation and entrepreneurship within the institutions and helping to build a community of like-minded individuals.

The operational objectives and KPIs relating to an Enterprise Fellowships intervention would be the same as those for the current PoC programme set out previously.

- **DifferenceMaker.** Student entrepreneurship is increasingly recognised as an important way to embed entrepreneurship within institutions. Piloting an intervention to support students to engage with commercialisation activities would be useful for building up a pool of people that could potentially become entrepreneurial researchers in Northern Ireland. This would also be useful for highlighting the intent of the institutions to support commercialisation and entrepreneurship. This could be a relatively low cost way to achieve these outcomes.

Objective: the main operational objective here would be to increase the number of students engaged in commercialisation. KPIs: appropriate KPIs would include the number of students engage in such activities, the number of students that go on to take positions at the institutions as researchers engaging in commercialisation.

- **IdeaSpace.** The development of a community of entrepreneurs around the institutions, ready to take projects towards commercialisation could be valuable. An intervention of this scope could then combine the entrepreneurial leads with the mentoring, with these being key individuals in the delivery of the project. This would also allow academics to pursue projects but then return their focus to their institution after the project has reached a stage where the entrepreneur can take it forward. Moreover, linking this into MATRIX could provide a valuable input to emerging policy discussions, helping to ensure the different parts of the ecosystem are mutually supportive and linked together.

Objective: the main operational objective here would be to develop a pool of entrepreneurs to take projects forward. KPIs: number of entrepreneurs 'signed up' to the community; number of projects the entrepreneurs are involved in.

- **Small Business Technology Transfer (STTR).** A form of the STTR programme should be implemented, to direct commercialisation activities in areas of interest to Northern Ireland's public sector, encouraging research that would be intended to benefit Northern Ireland and bring together business and the research base.

Objective: the main operational objective here would be to increase the number of commercialisation relationships between businesses and research organisations in Northern Ireland, as well as the number of businesses working with the research organisations to win work with public sector clients. KPIs: appropriate KPIs would include the number of projects that the institutions are working with both businesses and the public sector on, the number of public sector contracts won by Northern Ireland-based businesses on the basis of commercialisation undertaken for the STTR project.

Next steps

- 5.16 Finally, we anticipate that, following further feedback and discussion, a revised model for PoC, still with sub-options, would be set out and tested in more detail in a full economic appraisal. The preferred model would be formally assessed at different scales of resourcing, and also against: a) keeping the programme in its present form; b) ceasing intervention in this space entirely. Following economic appraisal work, detailed targets for new intervention would be set out, including more detailed objectives and KPIs.
- 5.17 Prior to this, Invest NI might speak directly to Scottish Enterprise to understand more fully and first-hand the programme operated in Scotland, given that the recommendation amendments to PoC in Northern Ireland bring it partly in line with the approach there, in terms of the stage approach, but without Scotland's sole focus on spin-outs.
- 5.18 We would anticipate that, if judged relevant, some of the wider learning on related initiatives, outlined above, would be further considered and pursued in parallel, rather than as part of the modified intervention, although some elements might be brought into, or closer alongside, PoC at a later stage. This could include discussions with the Royal Society of Edinburgh in relation to piloting Enterprise Fellowships in Northern Ireland.
- 5.19 An important consideration of the economic appraisal would be the implications for scarce human as well as financial resources. Many of the recommendations above point to a higher profile programme adapting to changing conditions and opportunities. This has implications for increased senior involvement from Invest NI in steering and reviewing the intervention; also, for university partners, and in particular for the role of TTOs, in operational management and delivery.
- 5.20 It is important that there is no gap in provision for intervention in this space between the end of Phase III and the launch of any new intervention, as this will be disruptive to project and programme momentum and efforts to develop the innovation ecosystem. The change from Phase III to any new intervention is already being smoothed by introducing some of the recommended modifications incrementally, and this could continue while Phase III is underway.

We also recommend that Invest NI undertake further exploration with the universities, to reach a better understanding of why, overall, the projects led by Ulster University have been less successful in delivering outcomes than those from Queen's University Belfast, and to inform any decisions on how the programme can be altered to remedy this.