Smart Specialisation for Regional Innovation: Dissemination Report for Research Study of Northern Ireland

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Introduction

This dissemination report summarises a research study of innovation policy in Northern Ireland conducted by members of Newcastle University's Centre for Urban and Regional Development Studies (CURDS). It is based on one of 16 'living laboratory' reports on regions across Europe that formed part of the EU Seventh Framework Programme project *Regional Innovation for Smart Specialisation (SmartSpec)*. As this suggests, the recent development of a Research and Innovation Strategy for Smart Specialisation (RIS3) framework in Northern Ireland is at the heart of the report. More broadly, however, this RIS3 framework is studied as part of an ongoing development of the innovation system and policy of the region and situated within its wider economic, governance and institutional context.

The report draws on analysis of policy documents and academic literature, secondary statistics, and 16 interviews with key actors in the region carried out during several fieldwork visits in the period July 2014 to September 2015. Interim and final project reports were produced in November 2014 and November 2015 respectively. This summary public report is a more accessible version of the final project report in which the selected contents have been edited and restructured into 8 sections. As such the material mainly refers to developments up to the end of 2015, although some subsequent developments (e.g. the reduction of Northern Ireland executive from 12 to 9 departments) are also noted in this version finalised in June 2016. Statistics cited in the report have where possible also been updated to the most recent available from the public sources used (such as Eurostat).

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Executive Summary

This summary outlines the key points from research and identifies their relevant section within the report:

- It is clear that Northern Ireland overall has a relatively low innovation capability when compared to the rest of the UK - and that this is related to wider structural problems in the economy. This is despite recent positive trends such as a recent surge in expenditure on R&D by business. (*Sections 1 and 5*).

- However, this position needs to be seen in the historical context of the region, which means that it has only been over the past fifteen to twenty years (since the Belfast/Good Friday Agreement of 1998) that the political situation in the region has been more conducive to the development of the economy. This development has been supported by the economic policy of the Northern Ireland Executive, which has placed increasing emphasis on supporting the growth of innovative activities. (*Section 2*).

- Since the early development of innovation strategy in the region (after 2003) there has been recognition that the small size of the region necessitates some specialisation in terms of science and technology-based industrial strengths. This principle (preceding the introduction of smart specialisation by the European Commission) has been the rationale for Matrix, an industry-led advisory board to government, that from 2007 has been responsible for identifying future market opportunities for Northern Ireland in five key strategic

areas in which the region has some current capabilities: health and life sciences, information and communication technologies, agri-food, advanced materials/engineering, and sustainable energy. (*Section 4*).

- Efforts have also been made to move the nature of innovation policy interventions away from a dependency on public grants to individual companies, which was the prevailing culture inherited by the Department of Enterprise, Trade and Investment when the Northern Ireland Executive was established. In particular, through its main economic development agency, Invest NI, this department has introduced a range of support programmes that facilitate interaction amongst businesses and with higher education institutions (e.g. Innovation Vouchers, Collaborative Networks, Competence Centres) with the aim of encouraging the formation of a more coordinated system-based innovation environment in the region. (*Section 4*).

- The Northern Ireland Science Park has also emerged during this time period as an important intermediary in the region that operates autonomously from government, and through its CONNECT programme also encourages the development of the knowledge economy and greater connectivity between firms beyond its physical sites in Belfast and now also Derry~Londonderry. (*Section 3*).

- In this wider setting, the internal regional dynamic of updating the Innovation Strategy has taken precedence in importance over responding to the European requirement to develop a RIS3. Hence, Northern Ireland's approach to smart

specialisation, relating particularly to the priority areas identified through Matrix, is outlined as part of the Innovation Strategy: a separate Smart Specialisation Framework document was produced for the European Commission, the contents of which are mainly drawn from the Innovation Strategy. The Innovation Strategy, in turn, sits under the Economic Strategy, which has increasingly promoted a 'whole of government' approach to transforming the Northern Irish economy. (*Section 6*).

- Northern Ireland has also shown a recent commitment to taking social innovation seriously, which is reflected in its inclusion in the 2014 Innovation Strategy. This may position it ahead of other regions in relation to this emerging agenda and prove to be a source of distinctive economic development opportunities in the future. However, widespread recognition of the value of social innovation, and consensus over its exact meaning and scope as a concept, still needs to be reached in the region for this promise to be fully realised. (*Section 8*).

- Within a multi-level and cross-border governance framework, Northern Ireland has strong links and shared arrangements with both the rest of the UK and the Republic of Ireland. This is an important source of support for innovation activities in the region; for instance, through funding from UK bodies such as Innovate UK and academic research councils and through collaborative cross-border links facilitated through InterTradeIreland. These external relationships could be exploited more extensively in future innovation (or smart specialisation) strategies developed in the region (*Sections 2 and 6*).

- The research identified a number of institutional barriers to the successful implementation of innovation strategy in the region. These include gaps such as private venture capital funding, previous representation in the UK Catapult Centre programme (before its recent inclusion in the Precision Medicine network), and a governance body that can more effectively bridge strategy formation and implementation. Sources of fragmentation include the large number of departments that make up the Northern Ireland Executive, and a proliferation of public sector structures and initiatives for a small region. Some of these bottlenecks had accompanying proposals for institutional reforms already on the table, such as an Innovation Council and Chief Scientific Officer - although the details of these changes still needed to be worked out. There are also considerable challenges of adaptability related to the new strategic goal of public sector organisations assuming a greater role in enabling innovation in the region. This can be seen, for instance, in the role of the health and social care sector in the development of significant opportunities related to Connected Health. (*Section 7*).

1. Basic Economic Profile

The economic development of Northern Ireland has been hindered over the past forty years by a combination of decline in traditional heavy industries, a relatively peripheral location within Europe and the UK, and, particularly in the period up to the Belfast/Good Friday Agreement of 1998, political conflict and social divisions. This weakness in the economy is shown in Table 1.1 by GDP per inhabitant below that of both the UK and also the EU as a whole (on both measures included here). The unemployment rate, by contrast, is lower than that of the EU and only slightly higher than that of the UK. This, however, has to be considered alongside an economic inactivity rate of 27.2% amongst those aged 16 to 64 (for the period June to August 2014), which is the highest of any region in the UK and clearly above the UK average of 22.2%[1].

Table 1.1 – Employment and GDP indicators (2014)

	Northern Ireland	United Kingdom	EU-28
GDP per capita Euro (% of EU average)	26,100 (95%)	34,900 (127%)	27,500 (100%)
GDP per capita PPS (% of EU average)	22,400 (82%)	29,900 (109%)	27,500 (100%)
Unemployment rate	6.4%	6.1%	10.2%

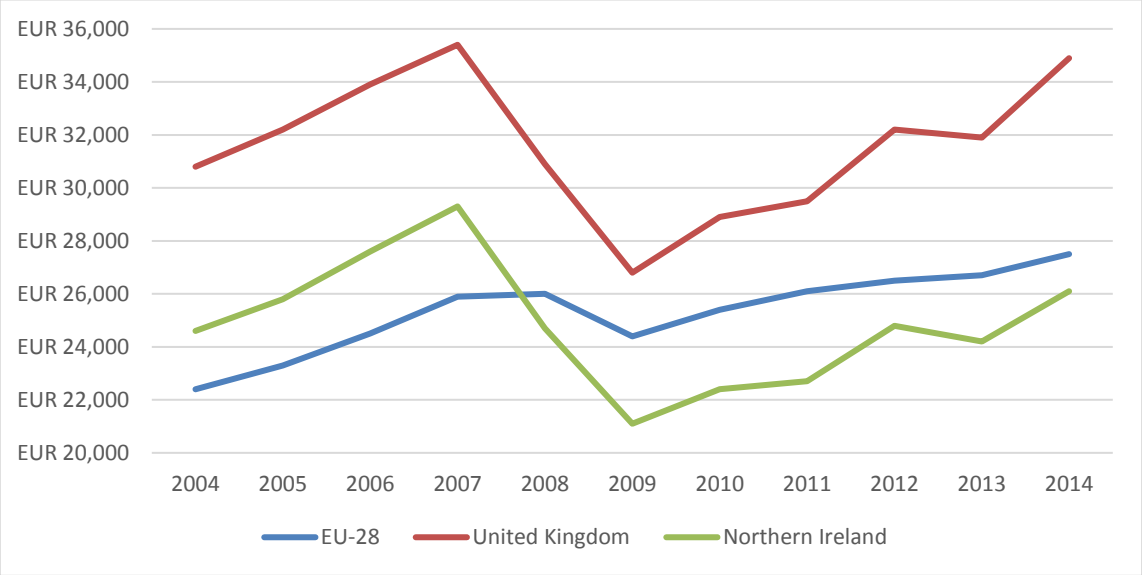
Source: Eurostat. (GDP figures at current market prices)

Figure 1 shows the change over the past decade for the first of the GDP indicators in the table above (in Euros). It clearly highlights the severe effect on the Northern Ireland economy of the global economic downturn after 2007. This meant that the GDP per

[1] http://www.detini.gov.uk/index/what-we-do/deti-stats-index/labour_market_statistics/labour_force_survey.htm

capita figure dropped below that of the EU as a whole, where because of a slow and inconsistent recovery it remained as of 2014. Northern Ireland was in 2014 also further from its 2007 peak (26,100 versus 29,300) than the UK as a whole (34,900 versus 35,400).

Figure 1: GDP per capita (Euros) change 2004-2014



Source: Eurostat.

An indication of the economic structure of Northern Ireland in comparison to the whole of the UK, EU, and neighbouring Republic of Ireland (ROI) is given via figures for Gross Value Added (2013) by broad economic sector in table 1.2. This shows that the sector 'public administration, defence, education, human health and social work' (O-Q) accounts for a particularly large share of GVA in Northern Ireland (27.6%), reflecting the significant reliance on the public sector in the regional economy. By comparison, sectors relating to information and communication, financial, and other professional services (J, K, L, M-N) all account for a lower share of GVA in Northern Ireland than for both the UK and EU as a whole. The table shows that the ROI has a markedly

different economic structure to Northern Ireland, with a much larger share of GVA in private sector areas like industry (B-E), information and communication (J), and financial and insurance activities (K) despite the large effect of the 2008 recession here. This different economic trajectory is partly attributable to the success of the ROI in attracting Foreign Direct Investment from multinational companies (see Ramirez *et al.*, 2016).

Table 1.2 – Sector % of Gross Value Added by Basic Prices (2013).

	NI	UK	ROI	EU-28
% GVA - Agriculture, Forestry, and Fishing (A)	1.4	0.7	1.4	1.7
% GVA - Industry (except construction) (B-E)	18.8	15.4	23.4	19.3
% GVA – Construction (F)	5.2	5.9	2.7	5.3
% GVA - Wholesale and retail trade, transport, accommodation and food service (G-I)	19.8	18.0	15.8	18.9
% GVA - Information and Communication (J)	3.4	6.3	11.9	4.9
% GVA - Financial and insurance activities (K)	4.3	8.0	8.1	5.4
% GVA - Real estate activities (L)	8.7	11.3	6.8	11.1
% GVA - Professional, scientific and technical; administrative and support service (M-N)	7.3	11.8	10.6	10.5
% GVA - Public administration, defence, education, human health and social work (O-Q)	27.6	18.5	16.8	19.3
% GVA - Arts, entertainment, and recreation; other service activities; etc. (R-U)	3.6	4.2	2.4	3.6
Total GVA (Euro Million)	39,500	1,821,500	164,000	12,130,700

Source – calculated by author from Eurostat data.

Table 1.3 gives a picture of the competitiveness of Northern Ireland in relation to other regional economies in Europe. It has three related elements drawn from data available on the EU S3 platform trade visualization website[2] (all referring to total production for 2010). First, it shows the ranking of the top 10 competitor regions for Northern Ireland,

[2] See http://s3platform.jrc.ec.europa.eu/s3-trade-tool.

which are the European regions (outside the UK) that have the most competing firms active in the same geographic markets. The two ROI regions feature prominently in this list (ranked 1st and 4th), along with mainly larger regions with strong economies from across Western Europe. Second, it includes ten competitiveness indicators (listed across the top) and provides a ranking of them by their importance for Northern Ireland, with the most important indicators being those in which its competitor regions are strongest. This shows that the most important indicator for Northern Ireland is concentration of high-tech manufacturing, followed by public knowledge (composed of amount of public R&D and rank of universities in the region), foreign-owned companies (as share of total number of companies in the region), agglomeration size (population size, density and share of active population), and private knowledge (amount of business R&D and patents per inhabitant). Third, the scores (a normalised value) for these competiveness indicators are shown for Northern Ireland and its top 10 competitor regions (based on figures from the EU Regional Competitiveness Scoreboard). This shows that, perhaps unsurprisingly, Northern Ireland in general scores lower on these competitiveness indicators than the European regions with strong economies that are its most important competitors (outside the UK). In most cases this can be related to a combination of identifiable factors such as the region's small size (agglomeration size), peripheral location (connectivity), economic structure (e.g. lower levels of high-tech manufacture), and low innovation capabilities (public and private knowledge). Northern Ireland generally performs better in comparison to the two ROI regions, apart from on the indicator foreign-owned companies against the Southern and Eastern region.

Table 1.3 – Competitive performance of Northern Ireland and competitor regions.

Region	Competitor Rank	PuK	PrK	AS	CRR	CAir	FOC	CFBS	CLTM	CMTM	CHTM
Importance Rank for Northern Ireland		*2*	*5*	*4*	*8*	*7*	*3*	*9*	*10*	*6*	*1*
Northern Ireland, UK	**-**	**0.805**	**0.537**	**0.380**	**0.729**	**0.784**	**0.500**	**0.670**	**0.880**	**0.534**	**0.389**
Southern and Eastern, ROI	1	1.062	0.561	0.820	0.627	0.692	1.429	0.749	-	-	-
Île de France, France	2	2.173	1.315	1.640	1.269	1.263	0.725	1.527	0.553	0.847	-
Cataluña, Spain	3	1.369	0.453	1.044	1.010	1.095	0.768	0.640	-	1.278	0.567
Border, Midland and Western, ROI	4	0.412	0.471	0.415	0.407	0.457	0.417	0.485	-	1.534	-
Lombardia, Italy	5	0.566	0.786	1.131	1.090	1.090	1.119	0.714	-	1.314	0.772
Rhône-Alpes, France	6	1.607	1.039	0.956	0.913	0.883	0.383	1.060	0.881	1.174	-
Comunidad de Madrid, Spain	7	1.143	0.470	1.204	1.041	1.149	0.838	0.849	-	0.804	0.395
Düsseldorf, Germany	8	0.371	1.579	1.008	1.270	1.226	1.597	1.047	0.762	-	-
Veneto, Italy	9	0.497	0.628	0.669	0.948	0.935	0.529	0.554	-	1.308	0.769
North-Brabant, Netherlands	10	1.261	1.649	0.650	0.912	0.845	0.775	0.853	-	0.864	0.759

Source - http://s3platform.jrc.ec.europa.eu/s3-trade-tool

Key – **PuK -** Public Knowledge; **PrK** – Private Knowledge; **AS** – Agglomeration Size; **CRR** – Connectivity by Road/Rail; **CAir** - Connectivity by air; **FOC** - Foreign owned companies; **CFBS** - Concentration of financial and business services; **CLTM** – Concentration low-tech manufacturing; **CMTM** - Concentration medium-tech manufacturing; **CHTM** - Concentration high-tech manufacturing.

2. Governance Context

The current Northern Ireland Assembly was made possible by the Belfast/Good Friday Agreement of April 1998. It was first elected in June 1998 and received devolved powers in December 1999, but operated intermittently at first (with its powers being suspended and reverting back to the UK government Northern Ireland Office on several occasions when the political consensus required could not be reached) until the end of the last suspension and restoration of devolved powers in May 2007[3]. This occurred during the same period as the post-1997 establishment of a Scottish Parliament and Welsh Assembly by the new Labour Government, so that Northern Ireland now forms part of the asymmetric devolved governance structures of the UK (Goodwin *et al.*, 2005). The areas in which it has decentralised powers are reflected in the 12 departments shown in table 2.1 that, at the time of the fieldwork, comprised the Northern Ireland Executive (the subsequent reduction to 9 departments will be discussed in section 7). These cover areas such as education (including further and higher education), culture, health, planning and some parts of economic development policy, but not functions such as finance, defence, and international relations that remain controlled by the UK government. This means that Northern Ireland has limited income raising powers itself and is mainly funded through a block grant from Westminster.

[3] http://www.niassembly.gov.uk/ABOUT-THE-ASSEMBLY/General-Information/History-of-the-Assembly/

Table 2.1 – Government Departments in the Northern Ireland Executive (2014/2015)

Office of the First Minister and Deputy First Minister
Department of Agriculture and Rural Development (DARD)
Department of Culture, Arts, and Leisure (DCAL)
Department of Education
Department for Employment and Learning (DEL)
Department of Enterprise, Trade and Investment (DETI)
Department of the Environment
Department of Finance and Personnel (DFP)
Department of Health, Social Services and Public Safety (DHSSPS)
Department of Justice
Department for Regional Development (DRD)
Department for Social Development (DSD)

The government department with the main remit for economic development (including innovation policy) was (at the time of the research) the Department of Enterprise, Trade and Investment (DETI). However, recent years have seen a more holistic 'whole of government' approach to economic policy that aims to engage the relevant ministries in fields such as education, health, employment and learning, and regional development/planning. This followed from the adoption of "Growing a Dynamic, Innovative Economy" as the top priority for the overall Programme for Government for the period 2008-2011, and led to DETI establishing agreements and joint boards with Departments including DEL and DHSSPS around areas such as skills in ICT and innovation in health.

The innovation landscape in Northern Ireland is also shaped by its position within a larger multi-level governance context. Within the UK, there are a number of national-level bodies that in some way shape the innovation policy domain in Northern Ireland. For instance, interviewees in Northern Ireland mentioned their interactions with organisations such as Innovate UK (formerly the Technology Strategy Board), UK Trade and Investment (a non-ministerial government department), the Design Council, the National Endowment for Science, Technology and the Arts (NESTA), and the UK

academic research funding councils. Amongst these Innovate UK was seen as particularly important as a source of funding that Northern Ireland had not thus far made full use of, possibly due to the presence of Invest NI as a more convenient alternative. However, there is a recognition that Northern Ireland needs to access more resources from outside the region, including Innovate UK as well as those at a European level. The strategic push for Northern Ireland to be awarded an Innovate UK Catapult Centre in the field of Precision Medicine will be discussed in section 7.

The complexity of this territorial governance system is further increased by the cross-border dimension with the Republic of Ireland (ROI). The Belfast/Good Friday agreement of 1998 also paved the way for closer relationships with the ROI, and led to the setting up of a North/South Ministerial Council as well as a British-Irish Council, both of which meet regularly to encourage cooperation[4]. Economic development is a particular focus for these shared arrangements: a specialist joint agency, InterTradeIreland, supported by Invest NI and its counterpart Enterprise Ireland in the ROI, was set up to encourage collaboration. Consistent with economic strategy on both sides this has prioritised innovation. In 2012, InterTradeIreland published an analysis of the innovation ecosystem for the whole of Ireland, which was predicated on the need for open systems that encompassed cross-border connections, and identified reasons for the current underdevelopment of these connections relating to lack of firm capabilities and interaction beyond established value chain partnerships (InterTradeIreland, 2012; also 2015). This followed an earlier cluster mapping exercise covering the whole of Ireland, which identified “developing all-island networks in the

[4] http://www.niassembly.gov.uk/ABOUT-THE-ASSEMBLY/General-Information/History-of-the-Assembly/

biopharma and medical devices, software, polymers and plastics, crafts and food sectors" (InterTradeIreland, 2005, p.3). InterTradeIreland also runs a number of relevant cross-border programmes related to collaborative innovation partnerships (Innova), technology transfer (Fusion), and innovation promotion events and masterclasses (All-Island Innovation Programme). New reforms now mean that academics from Northern Ireland universities can apply to some of the Science Foundation Ireland funding schemes as a co-investigator with partners from the ROI. Despite the emergence of these channels, a recent OECD research study highlights the potential for increases in cross-border flows and collaboration that mean the two territories cannot be said to currently operate as a single functional economic area (Nauwelaers *et al.*, 2013). Amongst the factors identified for this are differences in regulatory regimes and business environments (for instance, related to lower corporation tax levels in the ROI) that reflect the fundamental differences in governance arrangements and decision making capacity between the ROI (an independent sovereign state) and Northern Ireland (a devolved administration within the UK). This report also notes the lack of coordination between the development of smart specialisation strategies for Northern Ireland and the ROI, and cites greater innovation policy alignment as a way of strengthening cross-border interaction (Nauwelaers *et al.*, 2013, p.32).

3. The Northern Ireland Regional Innovation Ecology

The key non-government actors in the Northern Ireland regional innovation system can here be divided into three main groups. First, a relatively small number of large, R&D active companies in key strategic sectors. The main companies that continued to be referenced throughout our research included: Bombardier Aerospace, Caterpillar, Wrightbus, BE Aerospace, and Terex GB in the engineering sector; Seagate Technology in nanotechnology (hard drive manufacture); Almac Group, Randox Labs, and Norbrook Group in pharmaceutical and healthcare; and Citigroup, NYSE Technologies (now SR Labs), and First Derivatives in the area of financial service technologies. With the exception of a few firms such as Almac Group, most of these companies are externally owned branches. However, they often entered Northern Ireland through acquisition of indigenous firms (e.g. local family-owned engineering company FG Wilson became Caterpillar). The prominent position of these large firms is an important structural feature of the region's economy, and corresponds to a relative underdevelopment of a local SME base with R&D or other innovation capabilities.

Second, universities and other tertiary education or public research organisations. There are two universities in Northern Ireland (not including the Open University); Queen's University Belfast and the University of Ulster (which has four campuses in Belfast, Jordanstown, Coleraine, and Derry~Londonderry). Both of these institutions carry out teaching and research across a range of subject areas (covering arts and sciences), although Queen's is the more research-intensive of the two with particular capabilities in engineering and medical/life science fields. In a publication citation

impact (field weighted) analysis by industrial strategy sector in the recent Witty Review, the University of Ulster was ranked in the top 20 academic institutions in the UK in the field of Robotics (13th), and Queen's University in the top 20 in the fields of Aerospace (17th), Offshore Wind (17th), Construction (19th), and Energy Storage (16th) (Witty, 2013). Both universities have central administrative units that support these commercialisation and knowledge transfer activities – the Research & Enterprise Directorate in Queen's University Belfast and the Office of Innovation in the University of Ulster. Northern Ireland also has a healthy track record of university spin-off firm formation: according to the HEBCIS survey for 2012-2013 the region had 45 spin-off companies in 2012/2013 that had been active for three years or more (DELNI, 2014, p.10). However, other research has highlighted the typically low growth of these companies in the region, which means that their transformative impact upon the economy is arguably limited (Harrison and Leitch, 2010).

Two is the fewest number of universities in any UK region (next is North East England with five). However, in addition to this there are two teaching-only University Colleges (affiliated with Queen's University Belfast), six further and higher education colleges with multiple campuses and outreach centres across Northern Ireland, and also a specialist College of Agriculture, Food & Rural Enterprise (CAFRE) with campuses in three locations. The six further education colleges were reduced from 16 in 2007 and organised to cover geographical areas (Belfast Metropolitan, Northern, North West, South Eastern, Southern, and South West) (DEL, 2006). The colleges provide some higher education (e.g. degree and foundation degree) as well as vocational courses

and apprenticeships[5]. This helped the overall higher education participation rate for young people in Northern Ireland rise above 50% (for 2009/2010), which was the highest of any region in the UK, and also included a markedly higher rate for young people from lower socio-economic groups than the UK average (DEL, 2012, p.8). Although the regional colleges, by their nature as community-based organisations, offer a range of courses at different levels to ensure wider access to adult education, the specialist vocational and technical training they provide is central to the agenda of increasing skill levels in the Northern Ireland economy. Interviewees particularly cited their ability to respond to specific industry needs by putting on short-term courses for employees. The colleges also provide support for smaller businesses to, for instance, access more advanced technology, and they are increasingly involved in various knowledge transfer programmes in the region (e.g. through participation in the Innovation Voucher scheme for SMEs run by Invest NI).

In comparison to tertiary education provision, public research outside of the two universities is limited, but does include a separate Agri-Food & Biosciences Institute (AFBI), and R&D activities involving the NHS. The universities also host some more outwardly industry-facing applied research centres. For instance, the Northern Ireland Advanced Composites and Engineering Centre (NIACE), operating since 2012, brings together members of Queen's University, University of Ulster, and Bombardier Aerospace, and encourages participation by other firms in the region[6]. The Competence Centres outlined in the next section also fall into this category.

[5] http://www.anic.ac.uk/higher-education.aspx.
[6] http://www.qub.ac.uk/research-centres/niace-centre/

Third, the Northern Ireland Science Park (NISP), established in 1999 and located on a former shipyard in Belfast's Titanic Quarter, provides space and specialist facilities for a mix of larger firms (e.g. Citigroup) and smaller technology-based start-ups. The two universities in the region, along with DETI, have been involved in the formal governance of the NISP Foundation (a not-for-profit company) since its foundation. The Science Park also houses spin-off firms from the two universities, as well as research activities in the form of Queens University's Institute of Electronics, Communications and Information Technology (ECIT), which includes the leading Centre for Secure Information Technologies (CSIT).

NISP, while being established later than science parks in many other places (only following the Belfast/Good Friday Agreement), has come to assume a significant role as an innovation actor in Northern Ireland. As part of its intention to be a region-wide network and not just a physical site, NISP has adopted the CONNECT model developed in San Diego, California as a platform to support entrepreneurship and knowledge-based economic development. There are several different programmes that NISP runs underneath this CONNECT banner; including the Springboard entrepreneurship support scheme, the Halo business angel network, and the Knowledge Economy Index. The common factor, however, is that "the CONNECT programmes are designed to facilitate a culture of collaboration between the region's highest quality science and technology entrepreneurs, research institutions, professional services providers and investors"[7]. The success of the CONNECT

[7] http://www.nisp.co.uk/nisp-connect/about/.

programmes was felt by interviewees to rely on the position of NISP as an intermediary that, autonomous from government and not taking stakes in the commercial ventures that arise from its activities, can operate as a neutral “honest broker” in the region.

NISP has also recently expanded to a second site, in Derry~Londonderry, that uses the same organisational model. The North West Regional Science Park, although located away from the main centre of higher education in Belfast, has links with the University of Ulster Magee campus, as well as a cross-border partnership with the nearby Letterkenny Institute of Technology in the ROI. Derry is also the location for C-TRIC (Clinical Translational Research and Innovation Centre), formed through a partnership between University of Ulster, the Western Health and Social Care Trust, and Derry City Council. This facility, as well as having local economic development functions in aiming to support start-up enterprises and attract investment in health, has also increased research capacity by giving the University of Ulster (which does not have a medical school) access to patients in the health service so it can do clinical research in its Centre for Stratified Medicine (based alongside C-TRIC).

4. History of Regional Innovation Policy in Northern Ireland

The establishment of the Northern Ireland Assembly in the late 1990s can be seen as a watershed in the development of innovation policy within the region. Prior to this, under 'direct rule' by the Westminster government, Northern Ireland was still recognised as "a separate entity within the UK state" (Goodwin *et al.*, 2005, p.426). It had a Department for Economic Development with four arms-length agencies: the Industrial Development Board (IDB), the Industrial Research and Technology Unit (IRTU), the Local Enterprise Development Unit (LEDU), and the Training and Employment Agency. Post-1998, the Department of Economic Development became DETI in the new Northern Ireland Executive, and inherited these agencies (apart from the Training and Employment Agency which became part of DEL). However, following a review of its structures, the IDB, IRTU, and LEDU were integrated to form the single economic development agency Invest NI in 2002.

This institutional restructure occurred in conjunction with the beginnings of a change in the forms of innovation support offered in the region. Previously, as Cooke *et al.* (2003) outline, this had been characterised by the direct allocation of public grants to firms by the IDB (for larger firms), LEDU (for SMEs), and particularly in relation to R&D projects (sometimes involving universities), by the IRTU. This they argue had led to a 'grant-dependent business culture', which meant that innovative firms in Northern Ireland "forged their own globalized, individualistic and often isolated pathways to success and security, drawing on IRTU, ... [IDB] or LEDU for support but otherwise operating systemically mainly with distant partners" (p.376). Two reports

commissioned at the time by the Northern Ireland Economic Council pointed towards the recognition of the need to move away from this approach. *The Capabilities and Innovation Perspective: The Way Ahead in Northern Ireland* by Michael Best argued that "large subsidies have not been catalysts for innovation, capability development, skill formation, technology management, or regional growth dynamics" and recommended that "an industrial policy which facilitates the development of the capabilities which constitute entrepreneurial firms and cluster dynamics offers the potential to advance the region's competitive advantage in high value added activities" (2000, p.2). *Developing a Regional Innovation Strategy for Northern Ireland* made the complementary case that the region needed to develop an innovation system through measures that promoted the formation of networks and greater interaction between firms, universities and other supporting organisations (Cooke *et al.*, 2002).

This more entrepreneurial and networked perspective, along with the recognised need to address low levels of R&D, was reflected in the first Regional Innovation Strategy for Northern Ireland, published in 2003 by an inter-departmental working group chaired by DETI as part of the 2001-2004 Programme for Government. The strategy specified four main priorities: create a coherent R&D and innovation infrastructure; enhance the use of R&D and innovation by the business sector; develop a culture of innovation and enterprise; and sustain the regional innovation system (DETI, 2003). An accompanying action plan produced the year after this strategy, and covering the period up to 2006, included elements that can be interpreted as the genesis of the current smart specialisation approach in the region. It observed:

> As a small region, Northern Ireland does not have the capacity to play a leading role in every branch of science and technology. This RIS Action Plan therefore sets out to establish priorities through which we can generate real economic and social value, both in terms of building or maintaining expertise in Northern Ireland's universities, and in enhancing the competitiveness and innovation capabilities of our business sector. This does not rule out consideration and work in other areas that have the potential to contribute to the growth of a competitive economy. (DETI, 2004, p.15).

The action plan identified five priority technologies - Information & Communication Technologies; Life Sciences (encompassing biotechnology); Aerospace Technologies; Nanotechnologies; Agri-food Technologies - that were "considered to be of greatest relevance to the future growth of the Northern Ireland economy", and which were "based on existing research, recent UK innovation and technology policy developments, and the views of key stakeholders in the public, private and education/academic sectors" (p.15-16). This approach can be seen in the establishment of Matrix, the Northern Ireland Science Industry Panel by DETI in 2007. Although Matrix was based on the Science and Industry Council model already operating in other regions of the UK, and took its initial cue of priorities from the UK Technology Strategy Board, it has proved to be an important organisation in helping to guide innovation policy within Northern Ireland. During 2008, Matrix published a series of Horizon reports in five key science and technology areas – health and life sciences, information and communication technologies (ICT), agri-food, advanced materials, and advanced engineering. The aim of these reports was to identify future market opportunities for Northern Ireland in these areas through an analysis of existing

technical capabilities and horizon-scanning foresight activities covering periods of 2, 5 and 10 years. Subsequently, Matrix has produced other non-horizon reports in relevant supporting areas such as procurement, 'intellectual capital' of SMEs, and social innovation. The Horizon reports were also beginning to be updated during our fieldwork – a second health and life sciences report was published in 2015 and a new review for Digital ICT has followed in 2016. In terms of the technologies covered, the advanced materials and advanced engineering areas have been combined, and sustainable energy has been added as a fifth area (with a Horizon report published in 2013). Matrix is an independent-of-government advisory body and the reports are produced by panels in each of these technology areas that may involve membership from academia and public organisations such as Invest NI, but significantly (in terms of a smart specialisation approach) are predominately comprised of private sector members from the sector in question. Hence, in the words of an interviewee, one of the key impacts that Matrix has had in the region has been to "empower industry", and particularly in relation to some of the smaller firms in the region represented on the panels that may previously have flown under the radar of government, to "give those companies a voice for the first time". The way that these Matrix areas have fed into the innovation/smart specialisation strategy of the region and some possible limitations of the model will be covered in section 6.

The priorities identified and promoted by Matrix have been influential in shaping the operational implementation of innovation support by Invest NI as well as the formation of strategy by DETI. Although Invest NI is still geared towards providing direct capital and R&D support and services to individual companies with export potential, the nature of this intervention has broadened significantly from simple grant allocation to

encompass a range of innovation and network based programmes. This change was given impetus by the publication in 2009 of an *Independent Review of Economic Policy* commissioned by DETI, which described its "central thrust" as "the need to prioritise Innovation and R&D investments more aggressively, both for existing businesses in NI and also as a means of attracting potential new investors to the region" (Barnett *et al.*, 2009, p.5). A focus of this report's recommendations were improvements that Invest NI could make in its programme of support for innovation, and interviewees from our research did identify the broader suite of schemes this agency operates, enabled by the availability of greater funding from sources outside the region such as the Innovate UK or European Framework projects, as an important change in the landscape over the past five to ten years. The services offered by Invest NI (combining functions performed in the past by a number of separate agencies) now ranges from programmes such as innovation vouchers specifically to support activity by smaller firms, to R&D grants for larger companies.

A particular focus of innovation policy in the region has been the encouragement of firms to collaborate within sectors or with local universities. This aims to address the low levels of connectivity in the region that are considered one of the factors behind its relatively limited innovation capability. For smaller firms, and those in traditional but still strategically important sectors such as Agri-Food, the perceived unwillingness to cooperate with competitors and other firms was seen as a significant cultural barrier to more 'open' forms of innovation flourishing (see Roper and Hewitt-Dundas, 2012). Several relevant programmes run by Invest NI now involve a built-in element of collaboration between groups of participating firms or entrepreneurs. For instance, the Propel scheme which supports promising entrepreneurs to develop a business idea

through mechanisms such as mentoring, providing funding to cover their early salary costs, and of particular relevance here, group workshops for the participants with similar needs that act as an opportunity for them to form networks. Another notable example of this, the Competence Centres, are outlined in the box below. As mentioned above, the Northern Ireland Science Park (NISP) has also become active in delivering innovation and entrepreneurship support through its Connect programme that includes various initiatives aimed at encouraging greater connectivity in the region (see above).

Box 4.1 – Competence Centres

The Competence Centre initiative is of special note here because, as well as being clearly aligned with the smart specialisation priorities of the region, it can be understood as an attempt to leverage the research capacity of the two universities to help increase the innovation capabilities of Northern Irish firms.

The programme, core funded by Invest NI and based on a model that has previously been applied in the Republic of Ireland, has over the past four years established a series of centres for pre-competitive collaborative industrial R&D by companies in key areas identified through the Matrix process described above. Although the activities of the Competence Centres are very much intended to be industry-led, and have a remit to work across different public research organisations (including where appropriate the Agri-Food and Biosciences Institute), they are all housed in a specific university or university-related organisation where existing research strengths are concentrated. Three Competence Centres have been operating since 2013:

- The Centre for Advanced Sustainable Energy (CASE) is based in Queen's University Belfast and linked to an established industry-focused environmental research centre (Questor).
- The Connected Health Innovation Centre (CHIC) is based in the Nanotechnology and Integrated BioEngineering Centre (NIBEC) in the University of Ulster.
- The Northern Ireland Advanced Engineering Competence Centre (NIAECC) is based in NIACE, the research facility established jointly by the two universities and Bombardier Aerospace, and shared by a number of other engineering companies.

In 2015 a new Competence Centre in Agri-Food was announced, which will be based in Queen's University. There are also plans to set up a fifth Competence Centre in Cloud Computing, covering the remaining Matrix technology area (ICT) (DETI, 2014b).

The current Competence Centres work slightly differently from sector to sector, but the shared focus is on helping companies to work together (in groups of at least three) on applied research projects into areas of collective interest at a stage before commercialisation. Two of the three currently operating centres (CHIC and NIAECC) have a group of firms who are members of the centre through a subscription model, while CASE has a more open model where any company (potentially including those from outside Northern Ireland as partners) can participate by paying a fee contributing to the cost of projects. The topic of the projects are generally intended to come from the companies, but these ideas may be stimulated by the academic partners, through for instance (in CHIC), calls for projects relating to certain key themes. The projects are also subject to an approval process to ensure their quality, which involves the centre board or steering group with representatives from the two universities and some

or all members companies. When the projects have been approved, the research in question is then mainly carried out by experienced researchers who (using the Invest NI funding) are employed by the universities.

If the projects do directly create an opportunity for commercialisation, there is scope for one or more of the companies involved to pursue this: the common model adopted by the Competence Centres is that the university owns any intellectual property from the research, but this can then be licenced back to the participating companies. However, the possible outcomes of the projects carried out in the Competence Centres include broader benefits for companies, including opportunities for learning and the early testing of ideas that could lead to future research or commercialisation. The joint nature of the projects also mean that the Competence Centres can be understood as part of the efforts in Northern Ireland to increase connectivity by facilitating new relationships between companies in the same sector and with the universities. This element brings with it potential issues that need to be managed by the centre management, but interviewees stressed that collaboration on projects often involved firms in who were part of the same supply chain, rather than those that were directly competing with each other. The centres involve different types of firms with varying levels of research capability, but the benefits of participation are particularly clear for smaller companies who may not have the capacity or experience to carry out research independently. For instance, at the time of the research CHIC had around thirty companies signed up as members, the majority of them SMEs within this emerging sector around connected health (see Vallance, 2017). Hence, the model in this respect seems to be of particular value in Northern Ireland where the economic structure is dominated by these smaller companies that may have a low tendency to

collaborate. The targeting of these centres at the Matrix areas also means that they have the potential to be an instrument directly serving the regional innovation (and smart specialisation) strategy focus on key priority areas.

These kinds of initiatives demonstrate how Northern Ireland has moved away from the earlier reliance on the allocation of grants to individual companies as the dominant innovation policy instrument. The region has, therefore, been at least partly successful in transitioning its mode of innovation support from a firm-oriented to a system-oriented approach (see Nauwelaers and Wintjes, 2003). Indeed, while the Grant for R&D scheme (intended for larger companies than are eligible for the Innovation Voucher scheme) is still a core programme for Invest NI, it now offers additional funding for projects that involve collaboration with other firms or universities. Invest NI, through the collaborative networks team, also try to reduce this traditional dependency on public support within the region by promoting opportunities for companies to access funding from external sources such as the UK TSB or EU Horizon 2020 as part of wider consortiums.

5. Innovation Performance

A relatively small innovation capability has been one of the main weaknesses in the Northern Ireland economy. In the European Union Regional Innovation Scoreboard Northern Ireland has been classified in the Regional Innovation Followers group in the years 2004, 2008, 2010, and 2014, and in the lower Regional Moderate Innovators group in 2006 (Hollanders *et al.*, 2014, p.50). Regional Innovation Followers perform at between 90% and 120% of the EU average, and this puts Northern Ireland in the same group as the other UK NUTS 1 regions apart from the South East and East of England (that are Innovation Leaders). Together the regional innovation leaders and followers account for 91 of the 190 European regions included in the Innovation Scoreboard (for 2014), meaning Northern Ireland will be in classified in the top half (*ibid.*).

However, the values on individual indicators from the Regional Innovation Scoreboard 2014 given in table 5.1 shows that on many counts Northern Ireland performs below this level. This gives a normalised value of between 0 and 1, where the best performing EU region out of the 190 included in this exercise has a value of 1 and the worst performing a value of 0. Northern Ireland only has a value above 0.5 for the two indicators of ‘population with tertiary education’ and ‘innovative SMEs collaborating with others’ (*which is high for all the UK regions). Notably, Northern Ireland ranks amongst the bottom half of all EU regions for most indicators. In particular, it performs poorly for measures relating to SMEs (innovating in-house, introducing products or process innovations, and introducing marketing or organizational innovation). This

may reflect the especially large proportion of very small, micro-enterprises in the Northern Irish economy, which will typically have limited capability to support innovation (MATRIX, 2014).

On a national scale, Northern Ireland ranks in the bottom two amongst the 12 UK regions on 7 out of 10 indicators. In the UK Innovation Survey for 2013, Northern Ireland was also the bottom ranked region in terms of the proportion of enterprises that were 'innovation active' (40% versus 45% for the whole of the UK) (Northern Ireland Statistics & Research Agency, 2014, p.5). This lagging position is widely recognised within the region and improving on it was cited by interviewees as a goal for economic policy (DETI, 2014a).

Table 5.1 – Northern Ireland regional innovation performance

Indicator	**Value**	**Rank UK regions**	**Rank EU regions**
Population with tertiary education	0.560	11/12	79/190
R&D expenditure in the public sector	0.344	7/12	98/186
R&D expenditure in the business sector	0.299	8/12	98/186
Non-R&D innovation expenditure	n/a	n/a	n/a
SMEs innovating in-house	0.287	12/12	129/190
Innovative SMEs collaborating with others	0.808	9/12	9/190*
EPO patent applications	0.211	11/12	=95/186
SMEs introducing products or process innovations	0.236	11/12	145/190
SMEs introducing marketing or organizational innovation	0.201	11/12	140/183
Employment in knowledge intensive activities	0.368	12/12	146/189
Sales of new to market and new to firm innovations	0.414	11/12	=127/190

Source: Hollanders *et al.* (2014)

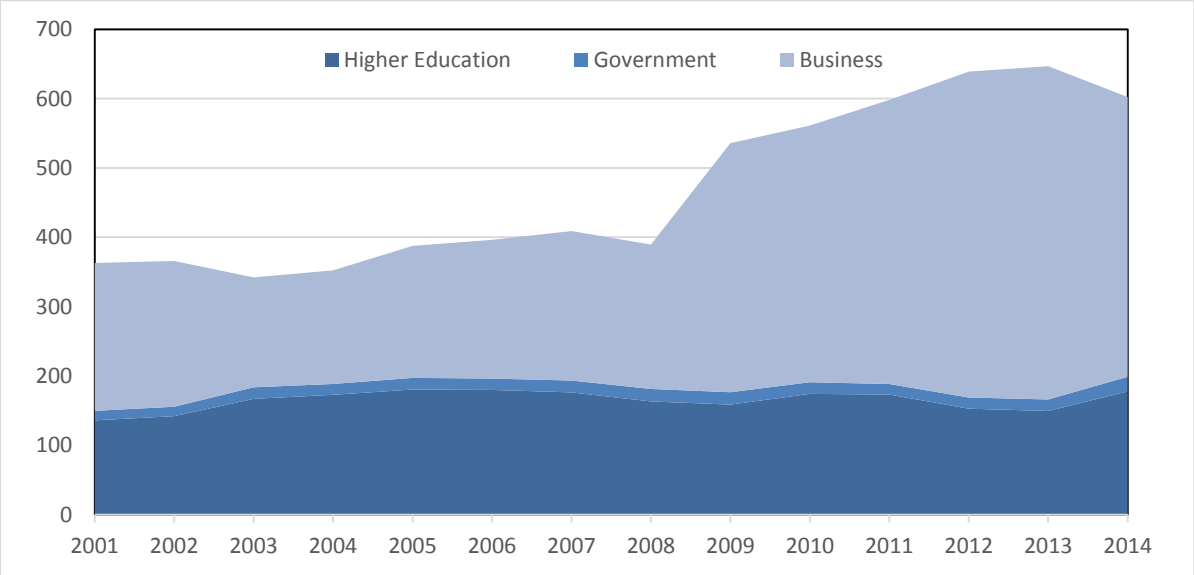
This underperformance is symptomatic of more general weaknesses in the economic structure of the region (section 1), which is still dominated by relatively low-value

activities and, therefore, has persistently low levels of labour productivity (Barnett *et al.*, 2009; Reid, 2013). However, while these structural issues remain prevalent, in recent years (coinciding with the growing policy emphasis on innovation) there have been some notable upward trends in Northern Ireland's innovative performance that are not reflected in the Regional Innovation Scoreboard indicators above. This can, for instance, be seen in the annual Knowledge Economy Index reports produced by the Economic Policy Centre at the University of Ulster for NISP CONNECT (2014; 2015). The most striking example of this has been the significant increase in Business Expenditure on R&D, which had previously been at a low level within Northern Ireland (behind most other UK regions). As figure 5.1 illustrates, this more than doubled in real terms between 2008 and 2013; from £208.2 million to £480.7 million (before declining slightly in 2014). During the same period Higher Education and Government R&D expenditure stayed fairly constant, meaning that the proportion of total R&D expenditure accounted for by Business rose from 53.5% to 74.3%, and this drove an increase in the combined (real terms) level of R&D expenditure in the region from £389.5 million to £646.8 million[8]. This meant that Northern Ireland moved above the UK average in terms of levels of both overall R&D and BERD as a percentage of GVA (NISP CONNECT, 2014). The major caveat for this figure, well recognised by interviewees, is that this increase was due to substantially greater spending by a few of the large companies in sectors such as aerospace and life and health sciences that are disproportionately important in Northern Ireland (section 3). In 2014, 54% of the total BERD came from larger companies (with over 250 employees), despite these representing only 7% of R&D performing companies (Northern Ireland Statistics & Research Agency, 2015, p.11). This is in-part due to the typically small (micro) size of

[8] https://www.economy-ni.gov.uk/publications/current-publication-research-development.

the remaining majority of firms in Northern Ireland. However, R&D spending amongst SMEs (less than 250 employees) did also increase by 29% (in cash terms) between 2009 and 2014 (Northern Ireland Statistics & Research Agency, 2015, p.11). Some interviewees also suggested that the smaller companies in the region may undertake activities in areas like process or service innovation that do not register within the official statistics on R&D (see NESTA, 2007 on 'hidden innovation').

Figure 5.1 - Northern Ireland Expenditure on R&D (real terms) in £millions 2001-2014.



Source - Northern Ireland Statistics & Research Agency (Research & Development 2014 Headline Table)[9].

[9] https://www.economy-ni.gov.uk/publications/current-publication-research-development.

6. S3 Strategy, Implementation and Assessment

The European Commission requirements in relation to the production of a research and innovation strategy for smart specialisation (RIS3) have roughly coincided with the development of a new Innovation Strategy in Northern Ireland (agreed in September 2014), which sits under a wider Economic Strategy (from 2012) and alongside corresponding strategies/policies for areas like enterprise, skills, and investment (DETI, 2014a, p.6). Therefore, DETI (the responsible department in the region) decided not to create a separate strategy (and related consultation process) for smart specialisation, but to embed this within the new Innovation Strategy. The submission to the Commission to fulfil the RIS3 ex-ante conditionality was emphasised to be a smart specialisation *framework* document (DETI, 2014b), that included a full analysis and description of the relevant process in the region, but no new policies or objectives that were not already contained within the Innovation Strategy approved by the Northern Ireland Executive. Correspondingly, the Innovation Strategy has a section in which the smart specialisation priorities for the region are clearly stated. These priorities (shown in table 6.1) are a series of marketplace opportunities within the five areas used by Matrix (the Science Industry Panel discussed above) along with five cross-cutting enabling themes that aim to address some of the barriers in the region already touched upon in this report - e.g. underdeveloped firm innovation capabilities, low levels of collaboration, a large public sector facing funding reductions. Hence, although the formation of the new Innovation Strategy (and associated smart specialisation framework) involved wider consultation with key stakeholders in the region, it was from the existing Horizon report recommendations that the core industrial and technological priorities included had been identified. This is so that these

Matrix panels can be understood as the main medium through which the equivalent of an ‘entrepreneurial discovery process’ has taken place in Northern Ireland.

Table 6.1 – Smart Specialisation Priorities for Northern Ireland

Marketplace Opportunities	Agri-Food Technologies	Integrated Value Chain Traceability Niche/Functional Food Packaging & Shelf Life
	Sustainable Energy	Intelligent Energy Systems
	ICT	Software Engineering Big Data/Data Analytics Cyber Security Capital Markets Digital Content
	Advanced Manufacturing/Materials	Advanced Engineering Composites Electronics & Electrical Components
	Life and Health Sciences	Connected Health & Stratified Medicine
Enabling Themes	*Leadership & Cultural Change*	
	Open Innovation	
	Public Sector Innovation	
	Access to Finance	
	Increase Capacity & Capability	

Source – DETI, 2014a, p.25.

In terms of these marketplace opportunities, there was awareness in the region that the five overarching areas used by Matrix were very broad and likely to be replicated in many other regions. This was, however, also felt to be a trade-off against these areas being inclusive and supporting major sectors of current employment in the regional economy. The success of the approach to smart specialisation in Northern Ireland is more reliant on the specific niches that emerge from the Matrix process representing distinctive regional capabilities and genuine prospects for stimulating growth. For instance, the first Life and Health Sciences Matrix report identified Connected Health and Stratified Medicine as specific priorities, while the Sustainable Energy report highlighted the single area of Intelligent Energy Systems. To this end,

interviewees believed that the introduction of smart specialisation requirements had forced them to think more critically about identifying narrower domains for prioritisation of future funding, but concerns were also raised that the Horizon Report reviews carried out by Matrix in these areas had not been updated since the original round in 2008 (with the exception of Sustainable Energy that was added in 2013) and the exercise was (at the time of our initial fieldwork) only just in the process of being repeated in the ICT and Life & Health Science areas. As a vehicle, however, Matrix does have the advantage of being well established as a framework within the regional strategic landscape (predating the current European policy concern with smart specialisation) and having significant participation from the private sector. Another strength is that links across the different Matrix sub-panels do seem to exist, meaning that this structure has not morphed into a set of silos, and potential synergy or cross-fertilisation in innovation across these different areas are recognised – for instance, between Life and Health Sciences, Advanced Materials, and ICT in the field of Connected Health. This is reflected in the smart specialisation framework document through a 'related variety' analysis that maps links formed by areas of potential specialisation between different market opportunity domains (see DETI, 2014b, p.38).

In line with the position of the smart specialisation framework in the wider economic policy of Northern Ireland, the plans for implementation of the strategy and monitoring/evaluation of progress are all taken from the Innovation Strategy so that no extra structures or processes will need to be set up. The Innovation Strategy (and smart specialisation framework) includes a number of actions underneath the headings culture change, knowledge generation, knowledge exchange, and knowledge exploitation. The summary of these actions is shown in table 6.2. An

accompanying Action Directory has been published alongside the Innovation Strategy, which contains more detailed actions, timeframes, and responsible departments/agencies under these headings. This document shows that the strategy is supported by a diverse policy mix, which draws on initiatives from across different areas of the government (see DETI, 2014c). The Smart Specialisation Framework also identifies a range of other government strategies and programmes that pertain to the five overarching market opportunity areas, which link into other domains such as ICT/digital, health and energy policy (DETI, 2014b, p.41).

Table 6.2 – Summary of Key Actions included in the Innovation Strategy

Cultural Change	1	Examine the feasibility of establishing an Innovation Council
	2	Establish a Public Sector Innovation Lab
	3	Implement a new Communication Strategy on Innovation
	4	Develop new Social Innovation accelerator programmes
Knowledge Generation	5	Prioritise R&D funding towards opportunities identified in the Programme for Government and the Economic Strategy
	6	Undertake a new research and technology capabilities study across the public and private sectors
	7	Develop a foresight programme that will identify new and emerging technologies and key future markets for local companies
	8	Develop a Creative NI Framework to foster and nurture a culture of 'creativity and design thinking'
Knowledge Exchange	9	Enhance our support to companies to engage in open innovation activities, either through the development of an Open Innovation Centre or the provision of a new support service
	10	Increase our investment in establishing industry-led collaborative networks, particularly those focused on market opportunities identified in the Economic Strategy
	11	Increase our investment in programmes and initiatives that support collaboration between businesses and academia
	12	Increase our support to local companies and research organisations to secure at least €145m from Horizon 2020
Knowledge Exploitation	13	Fund a new world-class business accelerator
	14	Develop an Open Data Strategy and Action Plan for Northern Ireland
	15	Increase investment in the use of Small Business Research Initiative
	16	Support the expansion of the Northern Ireland Science Park

Source – DETI, 2014a, p.61.

In terms of monitoring, the Innovation Strategy includes a new commitment for DETI to produce an Annual Innovation Report, in which progress against targets from the strategy will be tracked using secondary data from European and UK sources (DETI, 2014a, p.58). The development of the Innovation Strategy has been informed by best practices observed from recent benchmarking research exercises against both a number of relatively small but successful European and non-European countries (Finland, Singapore, Republic of Ireland, Sweden, New Zealand, and Estonia), and against a set of European regions with superior innovation performance and (in some cases) a similar industrial structure (Abreu *et al.*, 2011). In preparing the Smart Specialisation Framework, Northern Ireland also undertook a peer review workshop in May 2012 (as a member of the Smart Specialisation Platform) and received an expert review (by the Technopolis Group and funded by the European Commission) that evaluated both the existing innovation system and the unfolding RIS3 process. This report expressed some reservations about the broad nature of the priorities identified in the then draft Smart Specialisation Framework, but praised other elements such as the quality of the evidence base that had been developed in Northern Ireland to inform economic/innovation policy (Reid, 2013). Despite the shared governance links with other parts of the UK and the Republic of Ireland (see section 2), the Innovation Strategy and Smart Specialisation Framework seems to have little in the way of explicit reference to coordination of the policy in question with these neighbouring or other regions (although there is a section in the Innovation Strategy on forming wider international partnerships). While Northern Ireland will have observed the approaches to smart specialisation being followed in these regions (including hosting a UK smart specialisation conference in October 2013), the strategy formation process has largely been focused within the region.

7. Institutional Barriers and Reform

During the fieldwork a number of institutional gaps or barriers related to the innovation system and policy in Northern Ireland were identified. Several of these were accompanied by prospective institutional reforms that had been planned or proposed to address the issue at hand. These will be outlined together in this section of the report.

Northern Ireland has (for its size) a relatively well developed set of research and innovation institutions, but one clear gap mentioned by several interviewees throughout the fieldwork was the lack of a UK Catapult Centre. This is "a technology and innovation centre where the very best of the UK's businesses, scientists and engineers can work side by side on research and development, transforming ideas into new products and services to generate economic growth"[10]. The Catapults were first set up by the UK government through Innovate UK (then known as the Technology Strategy Board) in 2010. They now form a network of ten centres in different fields that serve the whole of the UK, but have a physical base in one or more locations throughout the country. Although intermediary organisations fulfilling similar functions have been set up in Northern Ireland, most notably the Competence Centres described in section 4, interviewees felt that obtaining a Catapult would significantly benefit the region – not least due to the status it would convey for being a leading base for that activity in the UK. To this end, during the period covered by the fieldwork, Northern Ireland was in a process of bidding to host all or part of a new Catapult Centre

[10] https://www.catapult.org.uk/.

in the field of Precision Medicine (the use of "diagnostic tests to select the most appropriate treatment for individual patients"[11]). This area of Precision Medicine (with the closely related fields of Personalised and Stratified Medicine) is an existing strategic priority in the region, identified as a clear future priority for the region in the first Matrix Life and Health Science report (Matrix, 2008), and corresponds with biomedical research strengths in both of the region's universities. In 2015 it was announced that this would be a multi-location centre, and that one of the six regional nodes will be in Northern Ireland (with an expectation that this would be physically based in Belfast). Hence, this means that this gap looks to be at least partly filled in the near future, and although the level of resource that is likely to be attached to this new centre will be limited by being stretched across the multiple UK hubs, interviewees in Northern Ireland were hopeful that this new Catapult Centre would have a more far-reaching impact in terms of stimulating activities and connections both within Northern Ireland and with the rest of the UK.

Another recognised area of institutional thinness is the low availability of private sector venture capital funding from within the region. The small number of potential sources of funding was felt to reduce competition and therefore outcomes, and to be a particular problem for enterprises too small to be able to access alternative sources in locations like London or Dublin. The public sector has, however, initiated schemes in the region to try to help fill this gap. For instance, NISP (with funding support from Invest NI and InterTradeIreland) runs the Halo business angel network that, similar to the Springboard enterprise support programme, works by matching companies in

[11] https://www.catapult.org.uk/precision-medicine.

needs of support with individuals who are able to provide investment[12]. Invest NI also runs a Proof of Concept funding programme.

Some interviewees also believed that there was a possible gap in terms of a governance organisation that could provide a link between strategy formation and implementation. Matrix was widely thought to be effective at the former of these (identifying opportunities). However, as only an advisory body to government rather than a delivery or facilitation body, there was a view that ideas that emerge from its foresight activities were often not properly followed through on. Relating to this institutional space, at the time of the fieldwork there was a proposal in the region, which was codified in the new Innovation Strategy, to set up an Innovation Council with representation from across the public, private, academic, and third sectors (DETI, 2014a). Interviewees expressed the hope that this would be a body with executive powers to be able to make policy decisions and monitor progress of implementation. A related gap in Northern Ireland, which the Innovation Strategy again proposes filling, is the absence of a Chief Scientific Officer (in contrast to England, Scotland, and Wales) who could work across government departments to help joined-up thinking and provide a strong voice for the region externally. However, in both of these cases there was still a degree of uncertainty around what the exact role of these new bodies would be, how they would fit into the existing governance structures in the region, and how they would be funded. In relation to the Innovation Council in particular, there was a worry that this could lead to duplication with vehicles like Matrix and/or the Economic

[12] http://www.nisp.co.uk/halo/about/.

Advisory Group (set up in 2010)[13], if this new board did not replace or absorb their functions in some way.

This issue was representative of a more general recognition that governance approaches in the region were perhaps overly-bureaucratic, leading to a proliferation of structures and initiatives from the public sector as a response to problems or needs. The fragmentation that results from this could also be seen in the range of support programmes for innovation/economic development in the region, that interviewees described as a 'confused landscape' in need of clearer mapping and coordination to become coherent to the intended private sector audience. Possible duplication could also be seen, for instance, between the Invest NI Propel and NISP CONNECT Springboard schemes that are both targeted at aspiring entrepreneurs in the region.

A key underlying source of fragmentation in Northern Ireland, and barrier to coordination across the whole of government, is the large number of departments in the executive (12 at the time of the research) considering the small size of the region. As discussed in section 2, there has been an increase in cross-departmental agreements to work together in key areas, but interviewees cautioned that while this coordination may occur at the policy level, at the implementation level it can prove more difficult due to a tendency towards 'territorialism' in some areas. There is also the fundamental practical barrier that different areas have different primary objectives that are not easily compatible – for instance, the creation of export-led jobs in economic development and patient outcomes in health. Increasing financial

[13] http://www.eagni.com/about-us/.

constraints faced by government departments were also cited as a barrier to more resources being allocated towards non-core sources of funding that could be dedicated to overcoming this misalignment, and facilitating more collaboration across these boundaries. Political divisions in Northern Ireland can also still be a barrier to effective collaboration between departments with ministers from different political parties.

A recommendation of the *Independent Review of Economic Policy* in 2009 was that the Department of Enterprise, Trade and Investment (DETI) should merge with Department of Employment and Learning (DEL) so that all economic development functions (significantly for innovation policy including higher and further education) are together in one larger ministry (Barnett *et al.*, 2009). In early 2015 this reform was confirmed, and (subsequent to the fieldwork) carried out in 2016 with most of the functions of DEL being integrated with those of DETI to form a new Department for the Economy. Notably, this now means that the department responsible for training, skills, and further and higher education is the same as is responsible for economic development and innovation policy.

A final potential institutional barrier in the region will be the challenges faced by the public sector in adapting to taking on the greater role in undertaking and enabling innovation in Northern Ireland it has been given in the new Innovation Strategy. This barrier relates to the generic inability of large public organisations to easily alter their established structures and cultures, but here it can also be understood to result from the financial pressures currently faced by, for instance, the health and social care

system in Northern Ireland. This makes members of this sector less able or willing to contemplate changes in behaviour not directly related to their main priorities. These issues may, for instance, affect the further development of Connected Health (a strategic marketplace opportunity in the region) as an innovation domain (Vallance, 2017).

8. Social Innovation

In the broader context of an emphasis on ‘smart, sustainable, and inclusive growth’ in the EU’s Europe 2020 strategy, the emerging concept of social innovation is gaining increasing currency. However, the ambiguity that surrounds this notion, and particularly the nature and suitability of its association with the similarly fledgling concept of smart specialisation, remains problematic (see review by Richardson *et al.*, 2014).

Social innovation has recently entered the mainstream innovation policy discourse in Northern Ireland, influenced by the raising profile of this agenda on both a UK and European level. The 2014 Innovation Strategy includes a short sub-section on ‘stimulating social innovation’. This recognises the potential of social innovation to:

> enable organisations across all sectors of the economy to bring about systemic change through applying their respective expertise and resources to resolving some of the more intractable social problems, whilst simultaneously having a positive impact on employment, knowledge retention and export capability.
>
> (DETI, 2014a, p.19)

The strategy includes corresponding commitments to establish a new social innovation working group, and social innovation accelerators in Belfast and the North West of Northern Ireland. Alongside social innovation, there is also a strong complementary

emphasis in the Innovation Strategy on public sector innovation as part of the section on ‘cultural change’ and also as an ‘enabling theme’ for the marketplace opportunities identified through smart specialisation. This recognises the particular importance of the public sector to the Northern Irish economy as a potential opportunity to drive wider innovation (through for instance the exploitation of public sector data) as well as to help improve services and efficiency during a time of pressure on government spending.

This explicit inclusion of social innovation in the Innovation Strategy was influenced and informed by near parallel work, driven by an individual at the time seconded to DETI, on a report called *Harnessing Social Innovation to Drive the Northern Ireland Economy*. Although this was not formally one of the Horizon reports in key science and technology areas, it was produced and published with the support of Matrix, and involved broadly equivalent ‘foresight’ steps of mapping current capabilities and future opportunities in the region relating to social innovation as a potentially cross-thematic agenda (Warnock, 2014). The report was also guided by the temporary formation of a DETI Social Innovation Panel, which had representatives from across third, private and public sectors in Northern Ireland, and London-based organisations like NESTA, the Young Foundation, and Bethnal Green Ventures/Social Innovation Camp who are active in promoting social innovation. Accordingly, while the report features examples of social innovation practice from around the globe, it adopts a common definition of social innovation made by the Young Foundation (through the FP7 project Theoretical, Empirical, and Policy Foundations for Social Innovation in Europe (TEPSIE)) as “new solutions ... that simultaneously meet a social need … and lead to new or improved capabilities and relationships and better use of assets and resources” (*ibid.* p.13). This

is accompanied by a strong message that social innovation can potentially take place across the public, private, third, and academic sectors; as well as encompassing socially beneficial changes in different domains such as health, education, and environment sustainability. The report also advances the view that social innovation can provide opportunities for commercialisation and economic development, particularly where products, services or ideas related to social problems can be exported to other regions.

The potential impact of social innovation in Northern Ireland can be linked to its distinctive social challenges of post-conflict resolution and continuing divisions, underpinned by high levels of deprivation. This context has led to the emergence of a large number of community and voluntary sector organisations dedicated to addressing these problems on either a local or regional scale. However, interviewees recognised that, with exceptions such as the large social enterprise Bryson House, these organisations generally have low capabilities to be innovative due to their small size, limited funding, and tendency not to collaborate with other organisations in the third or public and private sectors. To help address these barriers in the region, the Building Change Trust was established in 2008 with National Lottery funding to last 10 years and a remit to support capacity building and new ways of working in the community and voluntary sectors. This trust has organised its ongoing work around six themes, which include social innovation, and related areas such as social finance, collaboration, and inspiring impact[14]. Their work under the social innovation theme has engaged the Young Foundation to produce the report *Growing Social Innovation in*

[14] http://www.buildingchangetrust.org/

Northern Ireland (Norman *et al.*, 2013). More recently, they have also ran a programme called 'Techies in Residence' to facilitate the use of digital technologies to help solve social problems through short-term placements of employees from technology companies in third sector organisations[15].

This embracing of social innovation by different actors in Northern Ireland, despite the common approach of seeking to be connected to wider UK and international thinking around this emerging agenda, has involved some clear variations in perspective and wider confusion about the meaning of the term. Social Innovation is generally understood to involve the creation of solutions to social problems, but interviewees articulated different views of whether this could be achieved through a scaling up of existing community development approaches, or whether it necessarily required the application of new technical knowledge from business, the public sector, or academia. While some expressed the view that there should be openness to these solutions potentially coming from any type of organisation, others questioned if transformative change could be supported by the current grant-dependent third sector, and therefore believed that social innovation implied a greater role for the private sector and social enterprises that can generate profit while also producing beneficial social outcomes.

These differences in emphasis are reflected in the issue of where social innovation should sit within the current Northern Ireland government structures. The activity that led to the Matrix report mentioned above and inclusion of social innovation in the Innovation Strategy took place in DETI, which explained the emphasis on the potential

[15] http://www.techinres.com/

economic benefits of social innovation for the region in these documents. DETI was also responsible for the policy on social economy in Northern Ireland, and this contributed to a wider perception amongst some in the region that social innovation could be narrowly equated with this, instead of potentially cutting across different sectors. Since the publication of the Innovation Strategy, however, interviewees reported that the Department of Social Development (DSD) had been more active in pushing the agenda forward in the region by taking the lead in establishing a Social Innovation Working Group. This is significant in terms of the tensions discussed above, because DSD is the department responsible for the government policy on the community and voluntary sector. Interviewees expressed hope that this Working Group would be cross-departmental (as well as cross-sectoral) with involvement from other departments with a potential interest in social innovation; including the Department of Finance and Personnel, Department of Justice, and Department of Health, Social Services and Public Safety. This is supported by the strong link made between economic and social goals as twin priorities of the overall programme for government in Northern Ireland. However, the more general institutional barriers to effective working across government departments discussed in the preceding section, means that this collaboration in social innovation may also prove challenging in the future. While there does seem to be some momentum behind the idea of social innovation in Northern Ireland, the continuing uncertainty about this terminology and the processes involved is another potential barrier to its future development. This is reflected in the view of some that, while the inclusion of social innovation in the Innovation Strategy was significant for placing this concept in the mainstream innovation policy debate for the first time, more attention could still have been paid to elaborating and integrating it within this strategy. Notably for the focus of this report,

social innovation was not mentioned in the Smart Specialisation Framework document, despite this being based on the Innovation Strategy.

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