

New Directions in Innovation Policy: Implications for the Northern Ireland Economy¹

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1. Introduction

Innovation is central to ensuring economic growth and improvements in social welfare. The pressures for economies to innovate have increased in response to global changes in the division of labour and increased international competition. In the UK, these pressures have been reinforced by the recent economic crisis – as innovation is seen as essential to ensuring long-term recovery, job generation and the rebalancing of the economy (Martin, 2010; NESTA, 2010).

The challenge for regional economies, such as in Northern Ireland, is to ensure that innovation policy is appropriate to the structure and competitive strengths of the local economy. A major limitation of many innovation policy initiatives is that they are still focussed on the needs of high technology manufacturing - with a particular focus on technology transfer and policies to increase research and development (R&D). It is important to recognise the importance of fostering wider innovation: this includes innovation in products, processes and practices; and innovation in all parts of the economy – including the service sector. One of the central features of successful wider innovation is collaboration by all the actors in the innovation system promoting effective knowledge exchange.

This report considers how wider innovation can be fostered in the Northern Ireland economy. The findings are based on a more detailed report on innovation performance in the European Union (see Abreu et al 2011) which also evaluated innovation policies in selected regions within the EU including: Schleswig-Holstein (Germany); North Brabant (The Netherlands); Liguria (Italy); Etelä-Suomi (Finland); and Västsverige (Sweden). A brief evaluation of the innovation policy strategies in these case study regions is outlined in Boxes A to E. A key finding of this report is the need to build collaborative structures that encourage knowledge exchange and promote open innovation. Such structures are currently in their embryonic phase in Northern Ireland – and their further development and expansion will help promote innovation and economic growth.

2. Innovation and growth in the Northern Ireland Economy

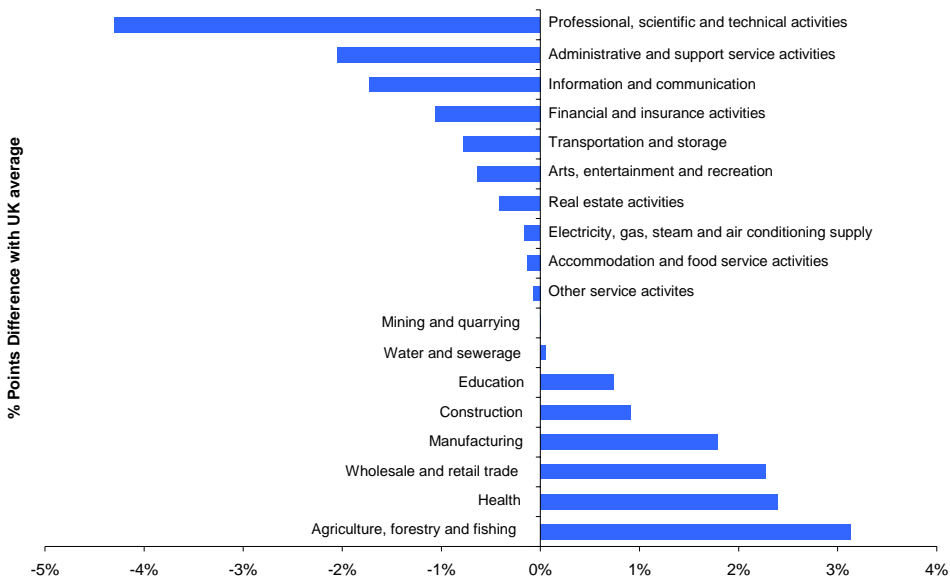
Prior to the current recession the Northern Ireland economy had grown rapidly during the previous twenty five years compared to the rest of the UK (IREP, 2009). Despite good overall growth in terms of output and employment, the economy still lags behind most of the rest of the UK in terms of productivity - with Gross Value Added (GVA) per capita remaining around 80% of the UK average since the mid 1990s.

Explaining the Productivity Gap

The productivity gap reflects both lower individual sectoral productivity (compared to the UK average) and also the structural composition of the Northern Ireland economy which has a relatively higher share of low productivity sectors compared to the rest of the UK. According to Oxford Economics (2007), two-thirds of the productivity gap in 2004 could be explained by lower productivity in individual sectors with the rest of the gap explained by industrial structure.

The industrial composition of the Northern Ireland (relative to the UK) is shown in Figure 1. As this shows, the Northern Ireland economy has a relatively large public sector (education, health and public administration). This is a sector where it is particularly difficult to reliably measure productivity. Other relatively large sectors include agriculture, construction, retail and manufacturing. The sectors that are relatively small compared to the rest of the UK include business services, transport and communications, other personal services and finance. Another important industrial characteristic of the Northern Ireland economy is a strong reliance on micro and SME firms and relatively few larger enterprises.

Figure 1: Industrial Structure 2010 (Relative to UK)



Source: Oxford Economics

Note: Employment is used as the measure of industrial structure

Innovation Performance in Northern Ireland

In terms of overall economic performance and productivity in particular, there are a number of key ‘drivers’ including innovation. According to the Independent Review of Economic Policy (IREP, 2009, p.35) ‘it is a matter of some concern that levels of BERD in NI manufacturing have lagged further behind the UK average in recent years..... Leading research economies, including Finland and Sweden, now have levels of BERD five to six times higher than in NI’.

Although it is important to highlight the low levels of private sector R&D in the Northern Ireland economy, there are important caveats that should be noted. First, private sector R&D is highly concentrated in specific sectors – such as pharmaceuticals and aerospace – thus some of the low level of R&D in the Northern Ireland economy will, at least in part, be a reflection of industrial structure rather than an endemic weakness in terms of innovation. Second, R&D is only one indicator of innovation – it fails to capture many of the wider notions of innovation and is a poor indicator of innovation activity in many sectors such as services. Third, Northern Ireland has a number of advantages that will help it promote innovation and economic growth in the future.

In order to evaluate the relative position of Northern Ireland with respect to the other UK regions, Table 1 below, based on the data from the UK innovation Survey (2009) shows the spatial distribution of innovative firms. The overall indicator (an ‘innovation active’ firm) is defined as a business that has engaged in any of the following (BIS, 2010b, p.7):

- Introduction of a new or significantly improved product (good or service) or process for making or supplying them;
- Innovation projects not yet complete, or abandoned;
- Expenditure in areas such as internal research and development, training, acquisition of external knowledge or machinery and equipment linked to innovation activities.

This evidence complements the innovation inputs indicators narrowly focused on R&D expenditures by providing an output based indicator of innovation.

Table 1: Innovative firms by region and type of innovative activity (%)

Type of activity	North West	Yorkshire and The Humber	East Midlands	West Midlands	East of England	London	South East	South West	Wales	Scotland	Northern Ireland	North East
Innovation active	56.3	60.7	55.5	58.7	59.1	55.8	63.3	57.8	58.6	54.8	54.8	59.5
Product innovator	22.7	24.1	24.5	25.1	23.6	22.9	27.8	25.6	24.4	21.3	16.8	21.0
Process innovator	10.6	13.1	11.9	12.9	13.7	13.2	14.2	11.2	13.1	12.5	10.6	11.7
Abandoned innovation projects	2.5	2.8	3.2	2.9	4.5	5.2	4.0	3.1	3.3	2.5	2.7	3.1
On-going innovation projects	4.9	4.5	5.7	4.4	6.5	6.9	6.6	5.5	4.4	5.3	4.3	4.3
Activities related to innovation	53.0	57.1	50.0	55.5	57.3	53.5	59.9	52.6	55.6	53.1	53.2	56.0

Source: BIS (2010b)

Overall, the regions with the highest propensity of innovation active firms are the South East of England and Yorkshire and the Humber; and the regions with the lowest are Scotland and Northern Ireland. This ranking is partially driven by differences in industrial structure; and the picture is more complex if we distinguish between product and process innovation. Overall, the data in Table 1 suggests that Northern Ireland shows a slightly inferior level of overall innovation compared to the rest of UK. Although Northern Ireland is one of the lowest ranked areas in terms of the share of innovation active firms – it should be emphasised that its share is only 3.4

percentage points below the UK average. Overall, the CIS data tends to provide a different picture compared with many other innovation indicators, such as those based on R&D, which suggest a much lower level of innovation in Northern Ireland compared to many other parts of the UK.

Northern Ireland's innovation advantages have been highlighted by Roper (2009). It is important to highlight two of its most important advantages based on our analysis of the innovation policies in other regions in the EU. First, governance and control over policy is important – often top-down national policies can be inappropriate to the history and needs of local economies. In the Northern Ireland case, devolution means that the Government has significant policy discretion concerning economic policy. This allows the development, and implementation, of a regional innovation policy appropriate to the needs of the Northern Ireland economy. Second, the case studies have highlighted the importance of universities in local innovation systems – with all the case study regions adopting some form of 'triple helix' approach to collaboration and innovation which stresses the interactions between academia, business and government. Northern Ireland has strong universities which not only produce high quality graduates and research – but which are highly connected to other parts of the local, national and international economy. Recent research has shown that Northern Ireland's academics are more highly connected than academics from any other part of the UK (Abreu et al, 2009).

3. Alternative approaches to innovation policy

At its basic and fundamental level, innovation is ‘the successful exploitation of new ideas’ (DIUS, 2008, p.12). At a more detailed level it is important to recognize that innovation can vary in terms of products, services, processes and business practices – and that it can take place in the private, public and third sectors.

Innovation is considered to be one of the main drivers of economic growth. According to the modern Treasury view it is one of the five main drivers, the others being investment, enterprise, skills and competition (HM Treasury, 2000; 2001). Although intuitively appealing, the drivers approach has a number of limitations when applied at the sub-national or regional levels. First, it is implicitly assumed that drivers are equally important in all areas, whereas local economic structures and local development paths will have a major impact on the role and impact of individual drivers. Thus ‘innovation’ policies may have different impacts in different locations. Second, the appropriate spatial scale of intervention may vary across locations. Therefore, processes of regional competitive advantage may be highly localised, while others may operate at different geographical scales, with some being national or global (Kitson et al, 2004). The limitations of simply applying the drivers approach to Northern Ireland have been highlighted by the Independent Review of Economic Policy which has argued that the drivers: ‘fail to sufficiently prioritise exports and inward investment as the key drivers at the regional level to grow the economy’ (IREP, 2009, p.7) and that it is ‘important to acknowledge the role of the public sector as a driver of regional economic growth in NI’ (IREP, 2009, p.32). In terms of innovation policy it is, therefore, important to consider the economic, social and institutional context in Northern Ireland, particularly when considering whether initiatives or policies implemented elsewhere would be appropriate for the Northern Ireland economy.

The types of support for innovation in advanced economies have evolved as these economies have grown and restructured. In particular, the relative decline of manufacturing and the growth of knowledge-based services requires a reassessment of innovation policy and instruments.

Mode 1 Innovation Policy: the Focus on Science and Technology

Much of the recent and current focus of innovation policy reflects the needs of manufacturing. There is a focus on support for R&D and on mechanisms to support technology transfer from the science base. Furthermore, policy has tended to focus on the production of technologies (such as information technology) rather than the diffusion of such technologies to other sectors of the economy. Although these are important components of an innovation strategy, they do not support much of the ‘hidden innovation’ in the economy (NESTA, 2007).

There has been significant restructuring in all advanced economies since the early 1960s, with the growth of services and a shift away from low value-added manufacturing. But the UK has moved to a more services-based economy more quickly than most of its competitors. More than 75 per cent of the UK economy is based on a diverse range of services including retailing, financial services, insurance, business services, leisure and tourism (Abreu et al, 2008). Although services are important in the Northern Ireland economy, many sectors are relatively smaller than in the UK as a whole (see Figure 1) – for instance, business services, other personal services and the finance sector (IREP, 2009).

Services need to play a major role in closing NI’s overall productivity gap with rest of the UK. The absolute size of NI’s services sectors means increasing their performance is necessary to close this gap. Improving the performance of services firms would raise NI’s aggregate productivity, but also, given their role, their improved performance would lead to increased productivity in other firms and sectors.

The Focus on R&D

In the UK, and the rest of the EU, there has been a focus on the notion that innovation can be increased through policies to encourage R&D. The underlying assumption is that private sector businesses do not do enough R&D because they do not capture all the benefits from doing it – simply because other businesses can copy what they do. Thus, policies such as R&D tax credits are assumed to encourage more innovation and economic growth. The case for policy support of R&D rests on two assumptions. First, that R&D is a good indicator of knowledge generation by firms. Second, that such knowledge generates spillovers to other firms and parts of the economy.

There are some empirical studies that rely on standard techniques that suggest that there are positive spillover effects of R&D - although this is not a universal conclusion and some recent studies do not identify positive spillovers (Haskell and Wallis, 2010). Furthermore, many parts of the economy that innovate often do so without spending on R&D – especially in parts of the service sector (Abreu et al, 2008).

The Focus on High Technology Manufacturing

R&D is important in the high technology manufacturing sector - but it is important to note that high technology manufacturing is a small part of most advanced economies (including the UK). According to the Sainsbury Review, high-value ‘knowledge-based services’ generate more than five times as much for the UK economy as generated by advanced manufacturing (Sainsbury, 2007). Furthermore, much of the UK economy consists of traditional sectors – such as conventional manufacturing and conventional services. It should be emphasised that there is significant potential for innovation in these sectors and because of their significant size they can make an important contribution to overall productivity growth. For instance, the three sectors that contributed the most to the productivity surge in the USA during the 1990s were (in order): wholesale trade; retail trade; and security and commodity brokers (Solow, 2001). All three are service sectors, and the first two are conventional services. The key to the productivity growth in these sectors was the use of technology, such as ICT, to improve process innovation and business practices.

The Role of Universities and Technology Transfer

There is increasing pressure from governments on universities to engage more actively with the business sector (see Lambert, 2003). In particular, it has been argued that increased and improved technology transfer from the science base will increase innovation and economic growth (see Kitson et al, 2009). Popular examples, which have been frequently cited as exemplars include: Cambridge University in the UK; Stanford University and the ‘Silicon Valley’ phenomenon in the US; and Massachusetts Institute of Technology (MIT) and the other Boston universities’ contributions towards the economic dynamism of Route 128 in the US. The focus on technology transfer – through such mechanisms as patents, licenses and spin-outs – has been at the centre of the policy debate. These are, however, only some of the range of

mechanisms through which universities can influence innovation and business performance (see below).

Mode 2 Innovation Policy: The Development of Innovation Systems

The limitations of Mode 1 innovation policy has recently led to a wider and more holistic approach to innovation policy (BIS, 2010a). Increasingly it has been recognized that innovation takes place within a ‘system’ with multiple players, multiple actors and multiple interactions. Furthermore, such systems vary according to regional and local characteristics – including local economic structure and local economic history.

Location and the Role of Clusters

At the regional level there has been a focus on ‘clusters’ often associated with work of Michael Porter (and with the earlier work of Marshall). The cluster concept suggests that regional competitive advantage is primarily based on the dynamics of geographically localised activities encompassing local competition, factor input conditions, local customers, and locally-based suppliers and supporting institutions. One of the most important factors that determine regional competitiveness is the degree of effective collaboration and the existence of facilitative social networks and institutional structures.

The strength of the clusters approach is that it stresses the importance of collaboration, trust and networks. Where the cluster approach is weaker is that it is often assumed that clusters (or policies to foster cluster development and growth) are similar in different places – places that have different histories, structures and institutions. As Martin and Sunley (2003, p.28) argue: ‘there are now so many different varieties of clusters and so many confusing claims about their theoretical basis, form, identification and significance that the concept is peculiarly elusive and hard to pin down’. Second, the approach tends to stress ‘local’ collaborations – whereas, in a globalised knowledge economy, it is important to consider the importance and impact of collaboration across multiple geographies (from very local to global). Third, the approach tends to lack specificity about how to build or sustain appropriate and effective collaborative structures.

The Shift to Open Innovation

A recent development in the corporate world and in the policy domain has been the recognition that much innovation involves multiple interactions between different research teams and corporate entities and is not developed by a single corporate laboratory (Chesbrough, 2003). For the vast majority of sectors and technologies, most researchers and specialists do not work within one company - indicating that expertise is widely spread. Thus, tapping into the research being conducted outside the company - or outside the region or locality - is vital for both corporate performance and economic growth. The open innovation model emphasizes the importance of letting ideas both flow both into and out of the business – and similar flow processes are important for regional growth. A variant of the open innovation model emphasizes the importance of customers as facilitating user-led innovation (von Hippel, 1988, 2005).

The recent emphasis on open and user-led innovation provides important insights, but a number of issues should be highlighted regarding the implications for policy. First, accessing external knowledge may be difficult and costly - particularly for SMEs - often because of a lack of information about who to collaborate with and how to do it. Second, accessing external knowledge needs to be combined with the internal capacity to absorb, assimilate and exploit such knowledge.

The emphasis on open innovation has a variety of complex spatial implications. Globalisation and developments in information technology indicate the importance of accessing ideas and expertise on an international scale. Conversely, the importance of tacit knowledge and human interaction stresses the importance of proximity and local networks to encourage and foster knowledge exchange and promote economic dynamism and innovation.

Universities and Knowledge Exchange – The Triple Helix Approach

Universities are especially important to local economies because of their stability – put simply, they do not move. The impact of globalisation and the response to economic shocks, such as the current recession, often results in the movement of key economic actors – as workers and businesses relocate. This can place a major strain on local economies – and major economic

actors that do not move, such as universities, can act as both as important ‘shock absorbers’ and as a stimulus to long-term growth.

Universities are powerful economic actors with important roles in the innovation ecosystem (Kitson et al, 2009). First, they are a source of ideas and technologies – many of which can be exploited for economic and social benefit. Second, universities act as significant employers and purchasers in many local economies. Third, they produce a skilled workforce that is often a crucial resource for local businesses. Fourth, they provide a locus for coordinating local activity, benefiting local firms both through the informal exchange of knowledge and expertise, and by offering an anchor around which regional clusters can form. Effective collaboration between businesses and universities is associated with improved business performance, including new market entrance and increased market share; production of an increased range of goods or services; producing higher quality goods or services; and generating higher value added (Kitson et al, 2009). Those collaborative structures that include business, universities and the policy community are frequently termed as ‘triple helix’ models (Etzkowitz, 2002).

Much of the collaboration between universities and businesses has focused on technology transfer from the science base - frequently focusing on patents, licenses and spin-outs. There are three significant limitations to the notion of ‘technology transfer’. First, university engagement with businesses includes a wide range of mechanisms including: problem-solving such as contract and cooperative research; and public space functions such as informal social interactions, meetings and conferences (Cosh et al 2006; Lester, 2005a, 2005b; and Lester and Piore, 2004). Second, engagement between universities and business is not solely limited but also encompasses other forms of knowledge from disciplines such as the social sciences and the humanities (Abreu et al, 2009). Third, engagement between universities and business is best considered as ‘exchange’ rather than ‘transfer’. Knowledge transfer implies a linear process, from the university researcher to the corporate sector. This oversimplifies many of the relationships between academia and the business sectors - which are characterized by continual interactions, feedback loops, and the co-production of knowledge.

The Need for ‘Boundary Connectors’

There are a number of factors that constrain or limit interactions between universities and businesses. Commonly cited constraints include cultural differences (academia is ‘different’ to business) and conflict over intellectual property (IP) issues. Empirical evidence, however, shows that the notion of cultural differences is vastly exaggerated and IP issues tends to be confined to a narrow range of interactions concerning technology transfer. Conversely, the evidence shows that the major constraints are a lack of information on how to engage and a lack of resources to initiate and manage interactions – and these constraints are most acute for SMEs (Abreu et al, 2009). To overcome these constraints, it is important to develop ‘boundary connectors’ – collaborative structures, organizations or individuals that can act as bridge between academia and business –and who can manage relationships for the interests for both parties. Such boundary connecting initiatives should reflect the structure, needs and objectives of individual local economies.

The Future: A Mode 3 Innovation Policy Embracing Social Capital and the Public and Third Sectors?

Recent developments have led to shifts in innovation policy. There are also new areas that innovation policy is starting to embrace. First, a new and recent focus on innovation in the public and third sectors. The public sector is major consumer in the macroeconomy and its purchasing strategy can have major impact on the innovative activities of its suppliers. Furthermore, innovation can improve the production, delivery and reduce the cost of public services. The third sector - which encompasses charities, social enterprises and other not for profit organizations - is now considered as an important supplier of community services (as suggested by the notion of the ‘big society’) although how innovation takes place in the sector has not been fully researched.

Other factors which are increasingly important in understanding and developing local innovation systems include social capital and the development of a creative and innovative environment. Social capital encompasses issues such as trust, civic engagement and networks. Evidence suggests that knowledge is more effectively exchanged in areas with high levels of social capital (Iyer et al, 2005). In terms of creativity is important to create a social and physical environment that both retains and attracts creative people. Such ‘talent’ magnets not only have high levels of

social capital but also have effective physical infrastructures and a buoyant cultural environment. Such places have a ‘buzz’ which can contribute to a dynamic innovative environment – generating a virtuous cycle of growth as a creative environment will attract more creative people. A final factor to consider is that the main current focus of innovation policy has been directed at improving economic performance – with metrics such as increases in economic growth or higher levels of productivity. An alternative is to focus on the impact that innovation may have on well-being and the quality of life. This would require innovation policy to put greater emphasis on such factors as working conditions, the transport system, the quality of the built environment and the environment.

Lessons from Europe

Regional and local economies are increasingly being influenced by global forces - as shown by the impact of the financial crisis and the rise of newly industrialised nations. Although these shifts are global, many of the most important responses to such shifts will be local or regional. For advanced regions such as Northern Ireland, future prosperity will depend on the further development of its knowledge-based economy – and this does not refer exclusively to high technology sectors – as the use of knowledge and improvements in innovation are important for **all** sectors of the economy. Although innovation policy in many regions in the EU (such as in Northern Ireland) is rooted in a Mode 1 policy framework; other regions, such as North Brabant (see Box B), Etelä-Suomi (Box D) and Västsverige (Box E) have shifted to a Mode 2 framework. And in some cases (such as North Brabant) there are some indications of a movement towards a Mode 3 framework – with an increasing focus on social capital, trust and creating innovative spaces. Knowledge-based growth requires innovation and the development of skills, networks and the use of local assets (such as universities). And this requires a high degree of local connectivity - as ideas are most effectively exchanged and exploited through people communicating with one another - most knowledge is ‘tacit’ and is held by people and is not ‘codified’.

The types of initiatives that would benefit from this approach would be the development of ‘innovation communities’ which would build and help to maintain networks to promote collaboration and knowledge exchange between businesses, universities and other actors

(including from the public and third sectors). Innovation communities require people with specialist skills and knowledge to help foster collaboration between partners with different motives and competences. Such skills may require ‘T-shaped’ individuals – skilled workers who have in-depth industrial or technological expertise but also have a wide range of business skills that enable them to connect with both the business community and with academia (CIHE, 2010).

4. The Innovation Policy Framework in Northern Ireland

Northern Ireland has embarked on a 'regional innovation journey' (Roper, 2009) and policy has moved from rhetoric to action (DETI, 2008). There have been a number of initiatives to support innovation in the NI economy, many supported through Invest NI (IREP, 2009) and some of the major innovation policy initiatives are outlined below.

Grants for R&D

The R&D Grant scheme administered by Invest NI provides significant financial support for a range of R&D activities. The grant rates vary at the discretion of Invest NI and are determined following an appraisal and an assessment of need for each individual project. The level of funding is also dependent on the type of project and the size of the business. Furthermore, the grants for R&D provide additional assistance for companies wishing to collaborate with others from industry and academia. It is argued that collaboration allows smaller businesses to develop innovative technologies without having to invest in large R&D departments – a development consistent with the open innovation model.

Competence Centre Programme

Competence Centres are collaborative organisations which are led by business to undertake market focused strategic R&D for the benefit of industry. Companies that are members of the Centres are committed to collaborate to engage in high-risk, long-term research. The companies benefit from early access to the intellectual property produced the Centre and from knowledge exchange through the Centre and associated networks. The Centres are supported by individual researchers.

Venture Capital Funds

The Northern Ireland Spin Out (NISPO) initiatives support start-up and early stage businesses in Northern Ireland. The support includes a £5 million venture capital fund, the Invest Growth Fund, which focuses on seed and early stage businesses with high growth potential and a £3 million proof of concept fund, the Invest Growth Proof of Concept Fund, which is funded by Invest NI to provide funding to very early, non-university projects.

Knowledge Transfer Partnerships

Knowledge Transfer Partnerships (KTP) is a UK-wide programme that facilitates and supports the formation of partnerships between business and academic institutions including universities, further education colleges and research organisations. KTPs are focussed on knowledge exchange so that expertise within higher education is transferred into the rest of the economy to develop innovative new products, services and processes. KTPs enable new capability to be embedded into a business allowing access to new skills and expertise to improve competitiveness, productivity and performance. KTPs can be used across a wide range of businesses, including micro, small and large businesses – and organisations from the public and third sectors. KTPs are based on projects undertaken by a recently qualified specialist (the Associate). KTPs can vary in length from 1 to 3 years (classic KTP) and from 10-40 weeks (shorter KTP), depending on the needs of the business and the objectives of the project.

Small Business Research Initiative (SBRI)

The SBRI aims to use government procurement to drive innovation. It provides business opportunities for innovative companies whilst serving the needs government departments. The SBRI is based on competitions for new technologies and ideas in specific areas which aim to engage a broad range of companies in short-term development contracts. These competitions are supported by the Technology Strategy Board and are made available to businesses on its website². SBRI enables government departments and public sector organisations to procure new technologies through a phased development programme, and also provides paid contracts for business at critical stage of product development.

Innovation Vouchers

Innovation vouchers are designed to enable small Northern Ireland enterprises to access knowledge and expertise to develop innovative solutions to business issues. The programme provides a voucher of up to £4000 to enable small enterprises to engage with one of the universities, colleges and other publicly funded research organisations throughout Northern

²<http://www.innovateuk.org/deliveringinnovation/smallbusinessresearchinitiative/competitions.ashx>

Ireland and the Republic of Ireland. A business may apply for up to three vouchers for different projects.

Matrix

Matrix is the Northern Ireland science and industry panel which has been formed to advise Government on the commercial exploitation of R&D and science and technology. Matrix is a business led organisation which identifies key areas of science, technology and innovation where Northern Ireland has a competitive advantage and advises on the policy required to exploit these strengths and improve economic performance. One of Matrix's major initiatives includes the development of 'Industry-led Innovation Communities' (IICs) to facilitate co-operation and knowledge exchange and to foster innovation - the seedbed of which is the Collaborative Network Programme (see below).

Collaborative Network Programme

Invest NI's Collaborative Network Programme (CNP) supports collaborative behaviour to improve business performance - this can include collaboration with other businesses, academia and training providers. With the programme, a collaborative network must have a minimum of four NI-based private sector companies, but may also have other partners from both within Northern Ireland and beyond.

The programme supports network development at various stages of development: embryonic - early stage of growth with no formal structure in place; established with further growth potential; mature – but with growth possibly stalled; and declining – but with the potential for renewal.

The programme supports a range of activities:

- Lead facilitators - support for individuals to galvanise a network with a key theme
- Support for lead facilitators - administrative, training, information support for Leaders to allow them to develop the collaborative network at a faster rate than otherwise would be possible.
- Training lead facilitators, network members and the wider business community to enable participants to contribute fully to the network.

- Tools for collaborative networks - analytical and developmental tools that can be used by lead facilitators across NI
- Facilitation of networks through activities such as facilitated workshops, study visits etc
- Promotion of networking and clustering - use of targeted workshops market or sector specific events to raise the potential for innovation or risk reduction by participating in a network.

Policy in Northern Ireland: A Need to Move Forward

There are two general strands to the support for innovation in Northern Ireland. First, support for R&D (or related forms of innovation expenditure); and second, support for collaboration and knowledge exchange. This suggests that although much of innovation policy is based on a Mode 1 framework, there has been some shift towards a Mode 2 framework. This raises a number of issues with respect to whether this shift has yet gone far enough and whether it should be accelerated? First, whether support for innovation is too focused on financial incentives and a grant-dependency culture - and whether it may be appropriate to shift the focus to more targeted support for the innovation system rather than support for individual businesses? Second whether the balance between support between R&D and knowledge exchange is appropriate? It may be beneficial to shift the balance further towards better knowledge exchange and increased connectivity in the innovation ecosystem - as R&D tends to be only concentrated in specific parts of the economy (in particular, high-tech manufacturing) and because the shift to open innovation systems indicates the importance of the encouraging knowledge flows and the exchange of ideas.

5 Moving Forward: Building a Networked Economy

The analysis of the recent developments in innovation policy and practice in the EU illustrates the importance of building a networked economy. The discussion below, first outlines the guidelines for building a networked economy; and, second, it considers how this could be implemented in Northern Ireland.

Guidelines for Moving Forward

The guidelines for moving forward stress the importance of adopting a systems approach to innovation which moves beyond focussing on single policy instruments. Such an approach should embrace the specificity of local economic structures including important local economic actors such as universities.

Adopt a Systems Approach

It is important to recognise that innovation evolves from a complex set of relationships among actors within an innovation system – such actors include businesses, universities and the policy community. Innovation policy in the Swedish case (see Box E) shows that policy should develop to support the development of the system with particular focus on addressing and filling ‘structural holes’ which prevent the system operating effectively.

Importance of Local Economic Structure

Policy development must reflect the key sectors in the local economic structure. Even when these may be traditional sectors they have the potential to be upgraded and transformed into fast growth and innovating sectors. It is a significant policy challenge to develop new industries from scratch rather than exploiting and developing existing competitive advantage. Similarly the policy in North Brabant (Box B) developed in response to economic crisis and the need to rejuvenate the local economic structure For instance, the innovation policies in both Liguria (Box C) and Schleswig-Holstein (Box A) have been based on exploiting current economic strengths to help revitalise the local economy.

Adopt a Broad Notion of Innovation

Traditionally, innovation has focused on product development in high technology manufacturing. This is, however, only part of the innovation spectrum. Innovation not only includes product development but also includes process innovation and innovation in business practices. Furthermore, innovation is not restricted to high technology manufacturing but it is also important in the rest of manufacturing and the service sector. One of the limitations of policy in some of the case study regions is that innovation in services remained on the margins of the policy debate and has not benefitted significantly from policy initiatives. Where policy is tending to encompass broad notions of innovation include the more advanced regions of Europe such as Västsvrige in Sweden (Box E) and Etelä-Suomi in Finland (Box D).

Foster Connectivity and Openness

A knowledge-based economy requires the effective movement and exchange of ideas and knowledge. The focus on open innovation illustrates the benefits of knowledge moving in and out of businesses and between other actors in the economy such as universities. Building a connected and open economy, however, is not easy or costless. In particular, connecting to sources of ideas and expertise is particularly difficult for SMEs – as these firms often lack the information about how to connect and the resources to initiate and manage connections. Furthermore, the evidence from the case studies indicates that many older firms (often in traditional sectors) are resistant to changing their business practices and are also reluctant to become more open. Thus, building a networked economy requires investment - either in individuals who can develop and facilitate networks - or to build intermediary institutions with skilled staff. The importance of building connectivity is apparent in all the case study regions with a variety of initiatives and institutions.

Importance of Key Regional Economic Anchors

Globalisation and economic volatility have created challenges for regional economies. In particular, these processes have encouraged the mobility of factors of production – as workers and firms move in response to economic shocks and shifts in competitive advantage. This places a premium on the role of local economic ‘anchors’ – those actors in the production and innovation system that do not move in response to economic change. For instance, the presence

and proactive role of Philips is critical to the success of the High Tech Campus in Eindhoven (see Box B). Many of the most important of these actors include universities and hospitals (sometimes referred to as ‘eds and meds’) – which can act as important local employers; purchasers of local inputs; suppliers of skilled labour; ‘attractors’ for other economic actors; and sources of ideas and knowledge. All of the case study regions are building and strengthening links between their universities and their local economies.

Develop a Triple Helix Approach

The Triple Helix approach to innovation policy stresses the importance of interactions between business, government and academia. These interactions encourage knowledge exchange and foster the innovation process to provide social and economic benefits. It is important to develop networks and collaborative institutions that foster the triple helix model. As shown in the case study regions, there has been a widespread adoption of some form of triple helix approach – from the less systematic forms in Liguria (Box C); to multiple forms, at different levels, in Etelä-Suomi (Box D) and Västsverige (Box E).

Develop Bridging Networks

When developing networks it is important to ensure that connections are not restricted to the local or regional economy. Instead, networks should be outward looking and seek to build national and global connections. This will ensure access to the best and most appropriate knowledge for economic actors in the local economy. There has been a concern in some of the case study regions that networks tend to be locally focussed – and so there has been a recent shift to making networks more nationally and internationally connected - as in the case of Schleswig-Holstein (Box A) and North Brabant (Box B).

Governance and Policy Implementation

The development of an effective regional innovation system requires a local governance system that can shape and implement policy that is appropriate to the characteristics of the local economy. A ‘bottom-up approach’ is considered to be one of the strengths of the innovation system in the Swedish region of Västsverige (Box E); and although it can be argued that Finnish policy is largely centralised it must be taken into account that Finland is small economy, similar

in size to many regions in Europe. One of the advantages of the Northern Ireland economy is that devolution allows the development and implementation of a targeted innovation policy – thus policy can be shaped according to the needs of the local economic structure; through local public procurement; and through adjusting the regulatory framework to local needs.

Impact, Evaluation and Metrics

The case study evidence indicates the challenges of identifying appropriate methods of evaluation – there are a number of different approaches both at the stage of assessing applications and in evaluating the performance of initiatives. This suggests that there are a number of features of the innovation process that need to be factored into when considering impact and evaluation. First, many innovation processes take a long time before they have an impact on standard economic indicators such as GVA or productivity. This suggests care is needed when using metrics in the policy process. Second, many of the important changes in the innovation system are behavioural or attitudinal – and these are sometimes difficult to capture in conventional metrics. This may suggest the need for a wider range of alternative metrics – which can capture changes in behaviour but also indicate whether policy initiatives are on the appropriate ‘trajectory’. Third, some innovation processes are high-risk and may fail – the distribution of success is highly skewed – but those that do succeed can have major social and economic impact. This suggests that some high-risk projects should be considered. The ‘fear of failure’ is considered as a constraint on innovation in the private sector – but it may also be a constraint on policy initiatives from the public sector.

The Framework and Implementation of Policy

The analysis above provides guidelines for the development of the framework of innovation policy in Northern Ireland. Two points should be emphasised. First, the discussion below is not intended to be prescriptive but to inform the future development of innovation policy. Second, the discussion builds on the ‘innovation journey’ that is already underway in Northern Ireland. In particular, the lessons from the case studies show the importance of collaboration and connectivity – and these principles underpin the recent development of innovation communities and the collaborative network programme in Northern Ireland. The broad objective should be to

continue to build a networked economy that will foster the knowledge exchange process and encourage knowledge-based growth.

Shift from Grant Support to Institutional Support

Business support in Northern Ireland has historically been based on grants – and this still applies to many aspects of support for innovation. An alternative is to shift resources to providing institutional support through supporting network development and the creation of collaborative structures. The benefit of structural support is that its objective is to create behavioural change – through encouraging collaboration and the transfer of knowledge. These are benefits that can spread throughout the economy, whereas the impacts of grants are likely to be short-term with the impact diminishing when grants are removed. A number of the case studies show the benefits of building appropriate institutional frameworks that promote innovation. Some of these are large scale with significant funding (such as TEKES with an annual budget of €600 million) – others are smaller scale such as ISH in Schleswig-Holstein (with an annual budget of €-4 million)³. Northern Ireland could consider establishing a boundary connecting institution of a similar scale to the ISH which would help to develop collaborative networks in the local economy (see below).

Development of Collaborative Structures

Although collaboration is important for the innovation process, there is no automatic mechanism through which the market develops appropriate collaborative networks or structures. A role for policy is to fill this structural hole in the innovation system by creating, or facilitating the development of, appropriate intermediate institutions. Such institutions can be ‘industry’ or ‘market’ led but require support and facilitation from the policy domain - and should include all actors in the innovation system including universities. In Northern Ireland, the development of innovation communities and the collaborative network programme are positive steps in the development of a collaborative framework to foster innovation. An important issue is whether such networks or communities should be managed by individual facilitators (‘boundary connectors’) or a collective institutional framework (a ‘boundary connecting’ organisation). The benefit of the latter is that it can take a systems perspective (not just the needs of one network); it can promote cross network connections (economy of scope); can deal with peak-load problems

³ Although due to budgetary constraints, public funding of ISH is being terminated at the end of 2011.

(when the needs of one network are high); and can provide a central source of support staff and resources needed by most networks (innovation road mapping, event management etc).

A Professional Secretariat

Collaborative structures that act as boundary connectors between businesses and other actors in the innovation system require specialist skills – to understand the motives and skills of all parties; to communicate effectively; and to initiate and manage relationships. Thus the establishment of an institutional structure that promotes and facilitates boundary connecting (see above) would require ‘T-shaped’ individuals – skilled workers who have in-depth sectoral or technological knowledge but also have a wide range of business skills that allow them to connect to other parts of the local innovation system. These skill sets may be in short supply and may require additional initiatives to train specialists (see below).

Training of Boundary Connectors

There is likely to be increased global demand for such boundary connecting functions and skills - as intermediate institutions grow and develop – and as open innovation spreads throughout the corporate sector. This may provide an opportunity for the Universities in Northern Ireland to develop appropriate programmes to fill the gap in the market. These could take various forms: such as the provision of executive education courses; or the development of a bespoke Masters programme which combines skills in technology and business⁴.

Importance of Supporting Wider Innovation

Collaborative structures should not be limited to industries that are perceived to be ‘high technology’. All sectors can benefit from improved knowledge exchange and can benefit from lessons from other industries. There should, of course, be prioritisation of those sectors where Northern Ireland has a competitive strength and which are likely to have the largest impact on the economy – but these may include traditional sectors including those in the service sector. This requires two main developments. First, a foresight planning process to establish the areas of:

⁴ As an example see the Cambridge MPhil in Technology Policy, see: http://www.jbs.cam.ac.uk/programmes/mphil_techpol/index.html

competitive strength, academic excellence and long-term potential - very much along the lines of recent and current Matrix initiatives. Second, policies that are developed should not be narrowly confined to technological innovation or high-technological sectors but should support wider forms of innovation.

Direction, Metrics and Evaluation

Collaborative structures need to be guided by the needs of the economy – including business, academia and the policy community. Furthermore, such direction should be concerned with long-term developments – and policy should not shift based on short-term changes or temporary shocks to the economy.⁵ Moreover, metrics should be embedded into the collaborative frameworks – but they should be used to inform policy and not to direct policy. As the impact of innovation policy is long-term, appropriate metrics include those that capture behavioural change and those that indicate that the direction of change is on the correct trajectory. Such metrics could be developed based on the data already collected in the Community Innovation Survey – these include behavioural indicators, innovation activities and outputs (at the firm level) such as:

- Growth objectives
- Sources of information
- Collaborative behaviour
- Innovation activities
- Innovation outputs including new products, processes and business practices

The benefits of such indicators is that they more accurately capture changes in innovation practices and they are more appropriate than macroeconomic indicators (such as GVA and GVA per capita) – as the latter can be influenced by external shocks, cyclical changes and other factors.

⁵ The cuts in public funding for the ISH in Schleswig Holstein is an example of long term policy being compromised by the short term impact of the recession on public finances.

6. Summary: Making Progress on the Innovation Journey

Developing an appropriate regional innovation policy must reflect the economic structure and local culture and institutions. As such, there is no one ideal model or perfect exemplars that can be completely replicated in different regional settings. But the lessons from this study of do provide a prospective way forward for the innovation journey in Northern Ireland, which would include the following elements below.

- Evaluate whether sufficient foresight planning has been undertaken to establish the areas of competitive strength, academic excellence and long-term potential growth potential in the Northern Ireland economy.
- Develop institutional support for broader innovation and move away from grant support.
- Evaluate the feasibility of establishing a new boundary connecting organisation (or develop existing institutions) that would help to build networks of innovation communities that would include business, academia and the policy community. Given prevailing budgetary constraints this could at least be partially financed through reducing grant dependency; seeking private sector support; and by providing some services on a fee paying basis.
- Evaluate whether there are sufficient ‘boundary connecting’ skills in (or that can be attracted to) the Northern Ireland economy that can ensure that intermediary institutions have appropriate skills.
- If there is an existing or potential boundary connecting skills shortage then consider developing specialist educational and training programmes in collaboration with the Universities in Northern Ireland.
- Develop an appropriate system of governance – including a prominent role for business and academia.

- Develop a range of metrics to evaluate projects to support and to understand how initiatives have a long-term impact on innovation, business performance and economic growth.

The impact of the financial crisis led to a worldwide recession. But the most appropriate response to a global shock is at the local level. The need for rebalancing local economies shows the importance of implementing a local innovation strategy. Although such a strategy will take time to improve economic performance, it is fundamental to shifting the growth path of the economy and ensuring future prosperity for the citizens of Northern Ireland.

BOX A: Schleswig-Holstein (Germany): A Focus on Narrow Innovation

Schleswig-Holstein is a state in northern Germany, with a population of 2.8 millions - its capital city is Kiel and other major cities include Lübeck, Flensburg and Neumünster. The regional economy has a relatively low level of productivity compared to the rest of Germany and it has a traditional economic structure with particular strengths in shipbuilding and agriculture (and related industries, such as food processing). The Schleswig-Holstein economy has a high share of SMEs and relatively few large companies (similar to the structure in Northern Ireland). Furthermore, it has a history of low levels of innovation and investment in R&D (by comparison with other regions (or states) in Germany). Although Schleswig-Holstein has relatively low unit labour costs by German standards, the region is facing increasing competition from low-cost locations throughout the world – including Asia and Eastern Europe.

There is concern about intensified global competition and Schleswig-Holstein's relatively poor economic performance compared with much of the rest of Germany. To improve the innovative and economic performance of the region a cluster policy was developed based on developing sectors where the region had a competitive strength and which could be developed to increase both regional and national economic growth. The sectors were chosen based on an iterative selection process which included an empirical analysis of regional economic strengths; an analysis of scientific strengths in local universities; and an evaluation of emerging technologies. The sectors include: life sciences, tourism, maritime economics, information and communication technology, dietary industries, renewable energy (in particular wind energy), microsystems and chemical industries.

The region has also adopted the Triple Helix approach to university-business collaboration. There are three major universities in Schleswig-Holstein. Increasingly, the universities and research institutes are focusing on the transfer of technology and collaborative behaviour - for instance the latter is facilitated through the encouragement of research in the universities that is based on a consideration of use and the development of outreach companies by many local universities to provide research for the local businesses. Furthermore, the region developed intermediate organisations that promote collaboration between universities and business – such as

'Innovationsstiftung Schleswig-Holstein' (ISH) and the Business Development and Technology Transfer Corporation of Schleswig-Holstein (WTSH). A range of networks have been developed which promote knowledge exchange and create mechanisms to facilitate the transfer of knowledge and expertise.

There are a number of strengths of the Schleswig-Holstein approach to innovation policy. First, it incorporates a systems approach to the Triple Helix framework. Second, it recognises the importance of intermediary institutions which promote collaboration. Third, in general, it recognises the importance of encouraging behavioural change and not a policy framework based on subsidies and grants. Fourth, the framework recognises that innovation policies have impact in the long term – and this requires care in using metrics.

There are, however, some limitations of the Schleswig-Holstein approach. First, the policy framework tends to focus on high technology manufacturing despite the economy being now primarily service-based. Second, there is a focus on a narrow notion of innovation – concentrating on technology and R&D – tending to exclude other, and wider, forms of innovation. Third, this tends to result in a concentration on collaboration between businesses and the science base – and not collaboration with other academic disciplines. Fourth, the focus tends to be on local and regional collaborations – an effective collaboration framework also needs to build links with national and international partners. Fifth, long-term innovation policy has been compromised by short-term budgetary constraints - this has been particularly highlighted by the announcement at the end of 2010 that the public funding for the ISH would be terminated at the end of 2011.

Box B: North Brabant (The Netherlands): Rebounding from Recession Through Open Innovation

North Brabant is a province located in the South of The Netherlands which has a concentration of high-tech manufacturing and knowledge workers, and it is among the most innovative regions in Europe. The region's main industries are automotive industries, electronics, medical equipment, biotechnology, and information and communications technology and recently there has been a growth in creative industries, particularly industrial design, software and textiles. But around 20 years ago, however, the region was struggling to overcome a deep recession. The response to this shock was the development of a new strategy based on the Triple Helix model.

Businesses, policymakers and academics in the region, agreed to collaborate to ensure regional economic growth. The Triple Helix model formed the basis for decision-making for both the national government Peaks in the Delta programme, and the local Brainport initiative. Also, the High Tech Campus Eindhoven emerged against the background of these developments, and was originally conceived as a research park to house all the separate R&D departments of Philips, which were scattered across Eindhoven and other European locations. The campus started with the redesign of Philips Research, which was already located on the site and the Municipality of Eindhoven supported the plan as a way of raising the national and international profile of the city. This location was highly successful, and the atmosphere of openness and the concentration of high-value knowledge production and facilities encouraged collaboration amongst researchers. The campus currently houses over 90 companies, including more than 40 start-ups, and a number of specialist service companies, and employs around 7,000 workers on campus, originating from over 50 different countries It is also frequently cited as one of the most successful examples of open innovation in practice.

The success of the North Brabant region, and in particular, of the city region of Eindhoven reflects a number of interacting factors. First, the benefits of an appropriate system of governance, and the willingness of different sectors of the community to work together to promote the local economy. In particular, the use of a Triple Helix mode of governance has proved to be very successful in encouraging growth in the region, and promoting its image

nationally and internationally. Second, the focus on open innovation: the initiative of the High Tech Campus Eindhoven has led to new highly successful collaborations that have led to numerous new products, services and spin-off companies. Third, the role of Philips illustrates the importance of having an anchor economic anchor as a focus for regional growth. Fourth, the creation of an interesting and enjoyable place to live and work (a place with 'buzz') has helped attract domestic and foreign knowledge workers.

BOX C: Liguria- Italy: Promoting a Triple Helix Approach

Liguria is a physically small but is a densely populated region located between the French Cote d'Azur and the industrial pole of Milan in Lombardia. Historically, Liguria specialised in basic metals and machinery primarily for the shipping and aeronautical industries. The market structure linked to these sectors was traditionally characterised by the presence of large mixed private-public firms. The region also faces the challenges of an aging population

In terms of innovation policy, the region is adopting a Triple Helix approach – encouraging the cooperation of universities with businesses – with an important role being undertaken by the Faculty of Engineering at the University of Genoa. This latter is a pool of human capital supply, which particularly suits the regional sectoral composition of industries and the dominance of large shipping and mechanical engineering enterprises.

The current financial crisis is having an impact on regional innovation policy: funds for innovation projects are being used to alleviate the problems of struggling firms and industries affected by the crisis. A related issue - which reflects the size structure of firms in Liguria - is that larger firms attract a disproportionate share of public funds compared to those allocated to small highly innovative firms. This imbalance is also reflected in the allocation of the funds for training - which are often linked to, and sometimes constrained by, the needs and the demand for human capital coming from the large mechanical engineering and shipping firms and not from highly innovative small firms specialising in the ICT, robotics and biomedical sectors.

Innovation policy in Liguria – in line the European funding and policy framework – focuses mainly on (basic) R&D expenditure, and financial support for start-ups and spin-offs in high-tech manufacturing. Furthermore, the increasing concern of the Regional Government with the problem of an ageing population has stimulated demand for innovation linked to the introduction of robotics in the public health. Innovation policy in Liguria, therefore, primarily focuses on the manufacturing sector and basic research. The main limitation is that policy has tended to focus on traditional innovation policies such as R&D and high technology manufacturing and has not embraced wider innovation and innovation in other sectors.

One of the most successful innovation platforms carried out over the last decade in Liguria – within a Triple Helix framework – has been the PRAI Liguria initiative. This initiative is explicitly focussed on enhancing collaborations between research and business and involves the University of Genoa, the National Research Council of Italy (CNR) and the Liguria Region. The success of PRAI has resulted in a unique way of matching researchers from the University of Genoa and CNR with small entrepreneurs through the funding of research grants to cooperate with an enterprise. PRAI funded in the first instance a total of 26 projects, involving 29 enterprises and 61 researchers from both the University of Genoa and the CNR. These first sets of beneficiaries cooperated to create two technological poles of excellence in shipping and mechanical engineering technologies; and energy, environment and sustainable development technologies. PRAI was successful because the size of the funds was manageable; the projects were focused on the strategic sectors identified at the regional level; and this sparked the demand for specific human capital and therefore has funded a number of graduate and post-graduate training programmes in the main universities in Liguria.

BOX D: Finland – A Systems Approach to Innovation

Finland is a highly prosperous country and its region of Etelä-Suomi, which includes the capital city Helsinki, is one of the most innovative regions in Europe. The economy of the region is home to a variety of high-technology sectors, including high-technology manufacturing, ICT, biotechnology, environmental industries and knowledge-intensive business services, metals, paper and wood, oil refining, chemicals and the food industry.

Two of the most important institutions that support innovation in Sweden are TEKES and VTT. TEKES is part of Finnish Ministry of Employment and the Economy, and is an important public funding agency for research funding in Finland. In 2009, TEKES invested approximately €600 million in support for enterprise projects and finance for universities, polytechnics and public research institutes. The innovation funding agency TEKES plays a crucial role as an intermediary, not only in funding research projects, but also bringing together businesses, universities and research institutes and promoting the flow of ideas and the creation of networks. A key element in the success of TEKES is that the project proposals it receives are evaluated by experts on the basis of business merit.

VTT is a public research institute which is the largest of its kind in Europe. It employs 2,700 researchers and provides research and development (R&D) services to companies and other organisations in areas such as applied materials, biological and chemical processes, energy, ICT, industrial systems management, micro-technologies and electronics. It is organised as a not-for-profit research organisation under the and receives 30% of its income in the form of a government grant, with the additional 70% from services provided to small and large companies. VTT offers a range of services from developing technology and business plans, through to strategic research, product and service development, IPR and licensing, testing and prototyping and innovation management. Recently, there has been focus to support service sectors, in particular the construction industry, by offering services beyond the traditional technological research and development areas such as management and logistics. A key to the success of the VTT is its focus on applied research, and its success in generating substantial income through services provided to private clients, allowing it to stay at the cutting edge of technology research without competing with blue skies research being conducted at the universities.

One of the main insights from the Finland is that it adopts a systems approach to innovation with an important role for Government. The national Research and Innovation Council, headed by the Prime Minister, oversees innovation policy across different ministries and agencies, and signals the importance

placed on innovation by the central government. The policy framework also adopts a Triple Helix model with a central role for universities in the innovation system. A focus on innovation is also evident even at the level of municipalities, many of which offer information and support services for business in their areas.

BOX E: Sweden – Promoting Local, Open and Broader Innovation

Sweden is a highly prosperous country and the region of West Sweden specialises in medium-high-technology manufacturing such as automotive industry, trucking and shipbuilding, as well as textiles and energy sector. The region is a major transport and logistics hub and because of its historical dependency on large manufacturing sectors it has a history of structural change. West Sweden is one of the most innovative regions in Europe, especially in relation to R&D intensity and patenting.

Innovation policy in Sweden is driven by regionalisation of economic development and industrial policy. Each of the regions in Sweden produces a Regional Development and Regional Growth Programme to provide vision of long-term and sustainable regional growth. At the national level there has been a shift from targeting lagging regions to promoting opportunities and exploiting unique strengths in all regions. Government has focused on the development of bottom-up regional innovation programmes which concentrate on local regional competitive advantages, provide long-term process support mechanisms rather than one-off cash injections, and enforce triple-helix type collaborations between industry, academia and the public sector. Furthermore, innovation policy promotes broader innovation in conventional sectors such as agriculture and forestry, textiles, food industry, tourism, maritime and creative industries are integral part of multi-sectoral innovation programmes currently run in Sweden.

Important institutions that promote innovation include the Swedish Research Council and VINNOVA. The former focuses on fundamental research and has a budget of €360 million, whereas the latter supports demand-driven research and innovation. VINNOVA has an annual budget of around €13 million and employs around 200 people. VINNOVA focuses on promoting triple helix collaborations between industries, the science base, and the government across the country and in each of the regions. Its main areas of activity include support of commercialisation activities in the university, funding of R&D and radical innovation for SMEs, development of international innovation networks, raising awareness of the importance of research and innovation for economic growth and prosperity. At the regional level, VINNOVA's triple-helix initiatives are complemented and strengthened by regional programmes.

A number of factors have contributed to the high innovation performance of West Sweden. First it has adopted a bottom-up approach to policy with different options for different regions. In most cases, it is up to local innovation system players to choose sectors and the geographical boundaries for innovation support programmes. Second, successful Triple Helix collaborations have been implemented across sectors and geographies with a requirement for an active involvement of all key innovation system players such as businesses, universities and government. Third, there is successful foresight strategy with scanning of the local economy and science base for promising and competitive opportunities, approaching individual companies to assess and solve their innovation related needs, and supporting early stage start-ups.

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