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**INDEPENDENCE AND INNOVATION POLICY IN SCOTLAND: WHAT IMPACT ON THE
SCOTTISH INNOVATION SYSTEM?**

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The Need for Information in the Independence Debate, and How We Get There

Introduction

This paper outlines the perception of Scotland as an innovative society, and the related economic and policy goals required to realise that image. It then poses the question of whether an innovative Scotland can be best achieved in combination with an independent Scotland. The paper will briefly outline the images of Scotland as a region and nation that have been put forward, both as a region distinct from England in culture and attitude, and as a participant in the knowledge economy. It will summarise the strengths and weaknesses that have been perceived and measured in its innovation system, briefly recount policy initiatives to date to improve the innovation system, then outline the main arguments made by the current Scottish Government regarding how independence could lead to a more prosperous Scotland.

Both research and interview data reveals that many of the challenges facing the Scottish innovation system now would persist in the future, but there could be new dynamics arising around labour mobility, financial union, status in the EU, to name a few examples, that would have to be addressed by universities and businesses attempting to innovate. One key problem is that reliable, empirically documented scenarios for independence or continued union are lacking. What appears to be the most pressing challenge for the business community is not that a 'yes' or 'no' vote will trigger structural changes and introduce new dynamics to the Scottish economy, but that there is a tremendous information deficit. The business community therefore finds it difficult to respond to the referendum, as summarised by one of our interviewees:

...I'm not sure how much value there is in speculating but I'm happy to try and answer any question I think I can answer. I suppose I'm just not comfortable answering questions which are so speculative. Not because I feel it'll come back to bite me, it just doesn't seem fruitful when there's no hard information. It just seems tough to really form any reasonable opinion.

Another respondent went further, saying that it wasn't just a lack of information, but that the information being used to discuss business' stake in the referendum was often confusing:

So the Scottish government is saying that the current system isn't working for Scotland, focuses heavily on our poor business R&D investment, whereas the UK government has used in its paper, broader definitions of innovation including investment in technology and marketing and all these other kind of areas as well. So there's a bit of apples and bananas going on in terms of comparisons.

The paper will outline the different concerns and opinions of the business community regarding Scotland's innovation system, and it will summarise the questions being posed by different stakeholders regarding independence and its possible impact on the Scottish Innovation System (SIS).

This study is based on more than twenty interviews with senior business leaders, policymakers and academics undertaken in December 2013 and January-February 2014. The interviewees work in a variety of key industrial sectors of the Scottish

Economy – such as Life Sciences, Information and Communication Technology (ICT), Engineering, Food/Drink, and Financial Services. The study also relies on a wide range of policy documents and available data regarding the Scottish science base, innovation infrastructure, and structural features of the economy. Finally, a workshop was held under Chatham House rules in March 2014.

The Image of Scotland as an Innovative Society

The concept of an Imagined Community, initially described by Anderson (1991), is useful to outline the different characteristics that a community describes as being shared among its members and the accompanying expectations of that community. Regarding Scotland, the concept has been used by different authors to discuss its national image, and its regional distinctiveness in Britain; Macleod (1998) for example, argues that there was early retention of Scottish cultural autonomy and symbols after the 1707 union through the legal, religious and educational institutions that it held onto, which differed from those of England. The more modern image of Scotland, however, has many times been expressed in a series of statements that indicate a “have not” status or a “have but denied” (i.e. not being able to take advantage of) status from the late 1970s to now. This Scottish image grew based on differences and inequalities with other regions in the UK, the discovery of oil and increased devolution. Beland and Lecours (2005) state that a very important factor in modern Scottish nationalism is the perception of Thatcher’s neoliberal policies as an attack on institution important to Scotland, as well as demonstrating the inability of Scotland to stop them; Scotland’s national identity is linked in this sense with notions of egalitarianism and social policy preferences (see also Scott and Wright, 2012; Bond et al, 2013).

Scotland as an innovative nation/region has also been an established image, held up as an example of scientific excellence within an ancient university tradition, which has also been put forward as a source of potential economic strength. The strength of Scottish science and industry was lauded during the Edwardian era, and continued up to the Second World War, from which point a narrowing of performance between English and Scottish science occurred, and industrial fortunes began to shift (Edgerton and Hughes, 1993). Despite these changes during the 20th century, Scotland in the 1980s was still described as “an economy carrying out substantial levels of research in both the private and public sectors, with a total R&D intensity significantly higher than that for economies of comparable size” (Edgerton and Hughes, 1993; pg. 11). Yet the scientific strength, R&D capacity, and innovative activity were mostly concentrated in the universities, and in the subsidiaries of large multinational companies (MNCs). While Edgerton and Hughes (1993) argue that innovation spill over from MNCs to Scottish firms was minimal, they also note that high value activity was carried out in Scotland by these companies and therefore was beneficial.

Policy and the System of Innovation in Scotland

The role of the Scottish Development Agency (SDA) from 1975 to 1991, and of Scottish Enterprise (SE) afterwards, are important to note as they play an important role both as actors in Scotland’s current innovation system and also as shapers of that system. The SDA was created in the 1970s as a reaction to the industrial decline of Scotland, though its existence has been perceived to have been helped along by the rise of the Scottish National Party (SNP) and the Labour government’s reaction to this surge of popularity

while leading a minority government. Regardless, the SDA's activities evolved from supporting large but suffering industrial firms between 1975 and 1979, then switching to a more venture capitalist type of role in terms of focusing on new high tech firms, as well as running the Locate in Scotland programme to attract greater foreign direct investment (Halkier, 1992). Part of SDA's activities helped make the Silicon Glen image of Scotland a reality as it managed to attract 568 million between 1981 to 1984 (Moore and Booth, 1986). Significantly, despite changes in government in Westminster, the level of expenditure in SDA's activities remained fairly steady throughout its lifetime (Halkier, 1992).

The particularities of Scotland's innovation challenge, the strength of research and the difficulty of translating this to direct economic/commercial advantage, were outlined by the Monitor Group (1993), and later by the Royal Society of Edinburgh's Commercialisation Enquiry (1996). The strength of the university sector was again acknowledged across a range of disciplines, but both reports noted the difficulties of transferring the knowledge generated in universities to Scottish firms. Both noted the strength of sectors such as oil and gas, finance, chemicals, electronics, food and drink, and some initial research oriented activity in the life sciences. From these assessments, Scottish Enterprise (SE) took on a cluster development strategy in the early to mid-1990s based on Porter's theory of clusters (1991) and the recommendations of the Monitor report, and sought to build the networks and support structures to carry out the strategy. The cluster strategy aimed to build on the areas of knowledge strength, and Scotland's image as a producer of good science; for example, the biotechnology sector was identified by SE as a high priority mostly based on the research capacity in Scotland's university sector rather than any actual industrial presence.

With this policy approach shaping SE's activities, Scotland demonstrated a high degree of originality in its policy and "diverged considerably long before political devolution commenced in 1999," (Ashcroft *et al*, 2006). SE pursued its innovation strategy with the Technology Ventures Initiative (TVI) and later as outlined in *Smart, Successful Scotland*, published in 2001. This involved a Business Growth Fund, Proof of Concept Fund, and Scottish Co-Investment Fund, creating the Edinburgh-Stanford link, and creating and investing in the Intermediary Technology Institutes (these were later closed and re-absorbed into Scottish Enterprise). It also involved programmes, such as Careers Scotland for skills and learning, and the creation of programmes to attract FDI and talent to Scotland, such as the creation of Scottish Development International and the Global Scot network. SE programmes have been very successful in creating a funding base for new firms, including the creation of an extensive business angel network; encouraging growth in the number of organisations across different technology sectors; facilitating spin-outs from universities; and raising Scotland's profile as a participant in the knowledge economy.

Several reviews of the Scottish innovation system have been published over a number of years (e.g. Roper *et al*, 2007; Coad and Reid, 2012; and Levie *et al*, 2013), and while each continues to praise Scotland's scientific R&D performance in the universities, they also continue to highlight a number of bottlenecks throughout. The most notable is the disconnect between the scientific knowledge and innovations created in Scottish universities and the knowledge demands and capacities of local Scottish firms; barring university spin-outs, very few Scottish firms form a clientele for this knowledge and much of it is passed on to firms outside of Scotland. Business R&D by Scottish firms is lower

than that of foreign subsidiaries. There is a lower propensity towards entrepreneurialism amongst the Scottish population, or to “recognise opportunities” (Levie *et al*, 2013, pg. 6). While there is now venture capital in Scotland, it is mostly made up of public funding and business angels rather than large private investors. Furthermore, there is a continuing lack of managerial and sales skills in the Scottish high-tech sector, despite high quality science (Danson, 1995; Roper *et al*, 2007; Freel and Harrison, 2007; Coad and Reid, 2012; Levie *et al*, 2013). Other issues are also pointed out in the literature. For example, a need for stronger networks, and for them to become more established within Scottish policy circles in order to coordinate programmes and objectives; a learning process not yet completed (Lyall, 2007).

Where does this leave Scotland?

In *Building Security and Creating Opportunity: Economic Policy Choices in an Independent Scotland* (2013), the Scottish Government under the SNP claims that independence will lead to a stronger Scottish economy, because it will allow Scotland to control its fiscal and monetary policy, and thereby be able to provide a more business and innovation friendly environment. It argues that a more “coherent framework for supporting innovation across the economy” would be possible, and that it could be targeted specifically at key areas of strength and weakness (pg. 111). It argues that it would be better able to use specific policy levers, including “financing levers such as the provision of loans and guarantees, competitive grants, innovation vouchers, the establishment of an Innovation Agency or Institute” or the indirect levers of tax-based incentives (pg. 111).

While tax policy and monetary policy *could* be different, there are questions of whether they *would* be much different. Economists such as McCrone (2013) or political scientists such as Keating and Harvey (2014) outline the challenges to answering this: for example, that the European Union (EU) could exert pressure on maintaining a common level of corporate tax, or that either the EU or the Bank of England could make a truly independent monetary policy difficult if Scotland wanted to be a part of either currency zone. Some scholars also question the effectiveness of R&D tax credits in creating more innovation, arguing that it rewards those firms that would innovate anyway (Keating and Harvey, 2014; Abreu *et al*, 2008); and that low corporate tax rates create greater pressures in society in terms of inequality.

Furthermore, how would the results in a fully independent science and innovation funding environment for Scotland differ from those under the current dual system with which Scottish universities and firms interact? In other words, would Scottish universities, which do well in the UK funding structure, receive more from (or better shaped) funding from an independent Scottish funding council, and would the risk capital market change and provide more funds for indigenous firms? Other scholars also point to on-going societal issues that would need to be addressed. A lower incidence of human capital building, higher rates of public spending in areas such as disability services, benefit payments (though this has been converging with the rest of the UK), and transportation (Crawford and Tetlow, 2014).

Given the dual images of Scotland promoted not only by the SNP today but, according to the literature, since at least the late 1970s, what does independence mean for Scotland and its system of innovation? Can a Scotland with a continued (if not increased)

emphasis on social equality be reconciled with the business friendly, low-taxation policies that are being put forward to promote innovation and entrepreneurship? Will there be more cohesion in innovation policy, and will it address the bottlenecks in the system? Will the changing boundaries of markets and policy regions have a positive, negative or no effect on Scotland's ability to be innovative?

With the above discussion in mind, we raise three major questions:

1. What impact will independence have on the ability of Scottish businesses to absorb knowledge and apply it to their own innovative activity?
2. What impact will independence have on the organisations that support Scottish businesses in their innovation activities, R&D, technology transfer, commercialisation, and finance?
3. What impact will independence have on Scotland's economy in terms of diversity of industry, specialisation, and resilience?

Impact of Independence On Scientific Research and Industry

Various policy reports and currently available data regarding the Scottish Innovation System point at a set of key features.

The first is a strong concentration of high quality research across academia, with a disproportionately high level of funding relative to the rest of the UK, with Biology and Medical Science attracting over 55% of the research funds. Performance in publication and academic measures is very good. Evidence suggests, however, that the academic base is not a major source of innovation. The life sciences industry is mostly focused on human healthcare (70%) and represents roughly 1.2% of GDP. There is a clear discrepancy between the disciplinary focus of the research base, and the structural features of the local industry. Evidence from the Community Innovation Survey suggests that for the vast majority of Scottish firms, interaction with universities is not a major source of innovation. In total, 55% of Scottish businesses are 'innovation active' and of these only 13.5% co-operate with universities (compared to 14.8% for UK as a whole). Only around 10% view HEIs as 'medium-to-high' in terms of level of importance for their innovation sources and requirements.

The data also suggests that there is ample volume of high technology spinouts across a range of technology areas. During the 2000s, Scottish Higher Education Institutes (HEIs) had a consistently higher spin-out rate relative to its population than countries, such as Canada, the US, and indeed the rest of the UK. Scotland is the leading British region for the number of spin-outs from HEIs it produces: between 2000 and 2012 Scotland produced 172 new spin-outs from HEIs compared to 115 in London and 85 in the South East of England. In 2009-2010, Edinburgh University produced forty spin-outs – the highest number ever produced by a UK academic institution in a single calendar year. Spin-outs, however, have little impact on the economy. The latest data shows that there were 3,315 staff (FTE) employed in companies spun out from Scottish universities in 2008/09, with a turnover of £200 million, and the majority of them employ less than 10 people (Targeting Innovation, 2008).

Overall, performance in Business Enterprise Research and Development (BERD) within the company base, which is seen as a key measure of innovation performance, is

generally low, although there is wider variation across different sectors. The absorptive capacity in the local business base is weak. There is modest interaction between larger Scottish-based international firms and the research base, but growth of indigenous technology firms remains weak. Compared to the UK average, there is an increased inward focus on local markets and on driving income through efficiency gains rather than on establishing a culture of business growth and new product development.

To move into the top quartile of UK regions on proportion of 'innovation active' businesses, Scotland would require another 10,000 active. A £700m increase in expenditure levels would be required to match UK average BERD, or £740m and £1,300m to meet EU and OECD averages respectively. *"Substantial Resources, a highly skilled workforce, a long-standing reputation for innovation, and internationally-recognisable brand, and companies that are internationally competitive"* (Building Security and Creating Opportunity: Economic Policy Choices in an Independent Scotland – The Scottish Government, November 2013).

"Scotland's innovation performance can be summed up as a form of dichotomy with a relatively strong higher education and public research performance contrasting with business innovation and entrepreneurial activity lagging far behind other small Northern European countries" (A Smart Sustainable Nation? A Review of Scottish Research and Innovation Policy in the context of the Smart Specialisation Agenda, August 2012, Technopolis).

Our interviews initially focused on whether independence would make any substantial difference in terms of the local firms' ability to absorb knowledge and skills from local sources and/or external sources – with a specific emphasis on HEIs. The issues of 'learning' and 'absorptive capacity' (Cohen and Levinthal 1998) are seen as crucial in the systems of innovation and knowledge-based view of the firm literatures. The system itself is often depicted as a complex configuration of knowledge assets and cognitive networks, whose architecture and internal routines shape research/industrial activities *vis-à-vis* processes of knowledge creation, transfer and exploitation, as well as determining asymmetries in knowledge endowments which ultimately lead to competitive advantage (Antonelli 2011).

To begin with, our interview data expose the concern that independence may jeopardise the ability of Scottish HEIs to attract funding from a variety of UK sources, including research councils, UK government and charities. A similar conclusion was reached by the report 'Scotland Analysis: Science & Research' presented in November 2013 to the UK Parliament by the Secretary of State for Business, Innovation and Skills. It is argued that overall, in 2012 Scotland received £307 million from UK Councils and an additional 13% of £1.1 billion invested in research by other UK bodies. Furthermore, Scotland is seen as benefiting from the UK-wide support infrastructure and networks, which allow local HEIs to expand their networks throughout the UK and beyond. A variety of centres of UK research excellence, such as the Scottish Marine Institute, are also located in Scotland (a comprehensive list is available on p. 61-68 of the November 2013 report). While our interviews include representatives from five different industrial sectors, fears seem particularly acute in the life sciences area, where local players sense that Scotland is yet to reach a critical mass of firms, individuals and accessible capitals to be internationally and sustainably competitive. While markets and opportunities for strategic collaborations are clearly global, the industry appears to be partly reliant on UK-wide

scientific and financial networks. Similar – albeit milder – concerns were expressed for the ICT sector.

On the contrary, training and absorption of skills (including graduates) are not seen as a problem – whether or not Scotland will become independent. In fact, some interviewees felt that independence could provide the tools for developing further programmes (e.g. more investment in vocational training or studentships aimed at acquiring practical skills), with the needs of the key sectors of the Scottish Economy in mind. It should be noted that training is already part of the devolved powers, and the current *Scottish Economic Strategy* (September 2011) already aims to create an education system that is “responsive and aligned to demand”, i.e. “...to support employers by better understanding and assessing the skills required for future success and ensuring that the supply of skills, training and qualifications is sufficiently responsive”.

As noted above, interviewees from both the life sciences and ICT sectors – which constitute some of the strategic foci of the *Scottish Economic Strategy* and are directly targeted by the support services/financial products offered by the Scottish Enterprise – lament a lack of critical mass and soft infrastructure (e.g. financial networks) for cluster emergence. Reflecting on the possible impact of independence, key factors to consider are: access to quality human resources (experienced managers, as well as scientists and technicians), access to local and international markets and access to financial resources. Access to managerial skills is an ongoing problem for the emerging sectors of the Scottish economy (already highlighted in reports such as Rosiello 2005). The problem is caused by the absence of large, anchor private organisations, as well as an insufficient rate of entrepreneurial successes, which would lead to incremental dynamics. In this regard, one interviewee expressed the following view:

It strikes me that the funding of science is an easily solved thing. You just stick your hand in your pocket and you can fund the science. Not a difficult thing to do, you just make the decision. What is missing is absorptive capacity, and that's the bit about what companies do you actually have today, or you might develop within, say, two years' time.

Some of the research-intensive fields in Scotland do attract significant research funding and are highly competitive, but a stronger industrial base is needed to retain the graduates of these programmes, and, as a consequence, Scotland is a net exporter of this talent. One interviewee noted that “... while it's acknowledged that we do have the world class research base, there's a real and persistent challenge about absorption of that knowledge particularly among our SMEs.” Another interviewee added that:

...the issue on management talent is we do not have multi-nationals running the business from here. We have satellite R&D teams, not complete bits of the business, so we don't have managerial training effectively on taking risk and getting product definition right, and that's one of the big inhibitors on the whole management stream, and the ICT space, I think the management skills issue is the biggest issue we have, not finances.

Policy programmes to tackle this issue are already in place, but the issue continues to represent a serious systemic blockage. It is unclear whether independence could be beneficial or detrimental. Some interviewees feel that independence would jeopardise

the UK networks that local research institutes and firms currently rely on. The links with networks of venture capitalists in Oxford and Cambridge's high tech clusters and larger financial players in London are seen as being particularly important. It is feared that having to operate in the context of different fiscal and legal regimes (and possibly monetary frameworks) would hinder inward investment.

Oil/gas and financial services are key sectors of the economy that seem less reliant on the local research base and training institutions. Interviewees from these sectors feel that processes of cluster emergence, cumulative learning and competence/skills development have occurred over the past decades within the business environment. The oil/gas cluster located in Aberdeen and the financial services industry situated around the city of Edinburgh have nurtured the production of personal skills and technological capabilities that are deeply anchored within the local economies. Companies of different sizes rely on such skills and competences. It is, therefore, important that capital investments and the development of a physical infrastructure are continued, as this will lead to an increase in the number of innovative businesses and private investment in R&D.

Impact of Independence On the Innovation Infrastructure

According to our interview data, keeping successful industries competitive and promoting the emergence of fully-fledged high-tech clusters depends on a number of different factors that shape the innovative capacity of local firms and their ability to export products/services that generate high Gross Value Added (GVA): (i) preservation and expansion of the existing infrastructure for supporting innovation; (ii) [changes in] the tax regime; (iii) [changes in] the regulatory environment; and (iv) preserving excellence in the HEI system.

While the issue of the potential impact of independence on HEI's excellence has already been discussed in the previous section, the second part of our survey looked at potential changes in the system of support for innovation. As noted earlier, many of the powers necessary to support innovation have already been devolved. The activities currently undertaken include:

- Horizontal support of innovation and its commercialisation, such as the SMART: Scotland grant, the Proof of Concept Programme, or the financial products available to local businesses.
- Tailored support to key sectors – creative industries, energy (including renewables), financial and business services, food and drink (including agriculture, and fisheries), life sciences, sustainable tourism, and universities.
- Development of a skills base that is responsive to the needs of business.
- Support of innovative low carbon technology to assist transition to a low-carbon economy. Low carbon is represented in the economic development agencies strategies and their sectorial focus.
- Support for innovation and research activity in the health sector. While it benefits patient care it also has a part to play in broader innovation: the life science and assisted living sectors are actively engaged with the NHS Scotland as a source of commercialisation and research resource.
- The Scottish Department for Enterprise, Energy and Tourism, the Government department responsible, had a budget of £410.7m in 2011. This included an

allocation of £45.2m for the industry and technology grants, part of which was allocated to the SMART Scotland grant scheme, a £283.4m allocation to the enterprise bodies (SE & Highlands and Islands Enterprise) and an Innovation & Industries budget of £5.8m.

In spite of the currently devolved powers, the Scottish Government argue that a more effective policy mix is required to support innovation.

“Independence would provide an opportunity to [...] develop a more aligned and coherent framework for innovation in Scotland. A key goal must be to develop a virtuous cycle of activity with close collaboration between key partners in the innovation system – including universities, funding providers, firms and public sectors agencies – behind coherent strategic priorities linked to additional economic levers.” (Building Security and Creating Opportunity: Economic Policy Choices in an Independent Scotland – The Scottish Government, November 2013).

To be exact, a more comprehensive strategy could also involve various forms of regulation of research and industrial activities, tax incentives for innovation, an immigration policy aimed at attracting skilled workers, and a more active role for the public sector in promoting innovation (e.g. a model that has been considered is the Finnish Agency for Technology and Innovation – Tekes). This line of reasoning seems consistent with the OECD *Innovation Strategy* (2011) report focusing on innovation policy mix for regional governments, as well as the recent stream of research on *Smart Specialisation* (Foray *et al* 2009; Mastroeni *et al* 2013; McCann and Ortega 2013) that is currently shaping the European Commission approach to regional and cohesion policy. Both approaches stress the importance of a strategy that is shaped around the structural features of the local innovation system and economy, with a view to develop a strategy that is able to guarantee sustainable growth. In this respect, one interviewee made the following observation:

If I can take you back a moment to the early days of North Sea oil and gas development, at the time, Scotland and England were characteristically different, because around Charlotte Square just up the road here, there used to be a group of financial institutions that were essentially investment trusts. They were not in the short-term markets of the City of London. They were in for long-term capital growth. And what was interesting about that phase was that many new funds were created, over-subscribed, many of them, because they were able to persuade the investment community that there was long-term potential that was capable of being realised, but you had to be patient. Now it seems to me there's an element of that in the current debate about what happens next. Scotland is wealthy in a lot of resources, it's land-rich, huge potential in terms of the next 100 years when land is going to be at a premium, wherever you look anywhere in the world.

With respect to whether an independent Scotland would provide a more coherent and, therefore, effective policy mix - compared to the one currently offered by a combination of UK-wide and Scottish agencies - our interview data does not offer a clear-cut viewpoint. Opinions tend to diverge between those interviewees who express concerns regarding the potential loss of support from organisations such as the Technology Strategy Board (TSB) and UK Trade and Investment (UKTI) (as well as the potential

disconnect from UK-wide scientific networks), and those who think that a single strategy developed by the Scottish Government and delivered by Scottish agencies would be preferable.

Sceptics of an independent Scottish strategy pointed out that some sectors of the economy are currently reliant on the support offered by the TSB. TSB has taken on a role in delivering collaborative R&D programmes, the management of SMART from (which was previously administered by the English Regional Development Agencies - RDAs) and the delivery of novel SMART, the management and delivery of Small Business Research Initiative (SBRI) programmes and a wide range of innovation support. TSB spans a greater policy and delivery range than Scottish Enterprise, acting as a more equal partner to funding councils and medical charities in UK science and innovation policy. TSB also facilitates the delivery of Knowledge Transfer Networks (KTNs) and a variety of *Catapult* sectorial activities. They also show significant availability of funding having some £1B spend per annum. Scotland received some 10% of TSB funding in 2012 and the Bioscience KTN and Offshore Renewable Catapult provide UK support from a Scottish base.

Concerns were also raised about the role played by UKTI *vis-à-vis* Scottish Development International (SDI). While both institutions aim to promote UK/Scottish companies abroad and support their export activities, some interviewees stressed that UKTI rely on a much more widespread infrastructure and team of industrial sector specialists. SDI's network is perceived as more limited and their personnel composed of generalists. Finally, some interviewees felt that the UK Government has a much more prominent role to play in public procurement than an independent Scottish one, for instance in terms of being able to guarantee defence-related contracts to Scottish engineering companies. On the other hand, the cases of Norway, Switzerland and Denmark were also cited as examples of small countries with a framework of support for innovation that over the years has been strategically and coherently developed according to the evolving needs/priorities of the local economies. One interviewee observed that:

I think there's every reason to suppose that it won't be easy, it might be a messy period for a while. So, the whole of the Scottish economy might not do very well for 10, 15, 20 years. Hopefully not longer than 10 years. But then, I do think there's no reason on earth why Scotland couldn't configure its economy to be more like a Scandinavian country, which actually... These are among the most prosperous countries in the world and the quality of life in them is very good, there's no particular reason why we shouldn't be in that situation.

A frequently cited example of dysfunctional elements within the Westminster/Edinburgh multi-layer system of governance is the current immigration policy framework. Some interviewees feel this is preventing the Scottish economy from attracting much needed skilled workers. The managerial skills shortage has been acknowledged by various studies, although the actual size/features of the problem have yet to be ascertained and programmes, such as Global Scot are already active to deal with it.

An alternative view is that removing the ability to easily move between Scotland and the rest of the UK might aggravate existing difficulties in retaining business and scientific talent. As it stands, management talent is difficult to recruit, and one person commented

that attempts to get Scots to return to Scotland could be more difficult if independence meant that the labour market appeared to be more restricted.

One interviewee referred to the '1996 Commercialisation Enquiry Final Research Report' and noted that

...it's worth reading it again and seeing what the position is compared to the early 90s. The companies have changed position, the tools are better. There's more availability of venture capital, there's definitely more availability of business angels, you can fund businesses to a certain extent, but there's less public companies. Now we all know why the issue is, because of the marketplace, but the ability to raise money and float a company is seen as another tick in your management expertise. There are very few people in Scotland, particularly within the life science sector, that have actually done that in the last 15 years. So we've effectively no flotation. So that's a key management skill that does not exist in the community in Scotland; you would have to go outside to find those sorts of things.

On the related issue of mobility, another interviewee said the following:

I think the question is on what terms Scotland would be admitted [into the EU] because there's the Schengen Agreement to allow people to move around without any kind of border controls which the UK isn't in. The UK government has said that it's not compatible to be in Schengen and part of the UK's common travel agreement. If you speak to different people and they say this is just a complete red herring or others will say, actually it is an issue. The SNP has said it will not go into Schengen and it will remain part of the common travel. The UK government has said, well, basically that means that you have to have the same immigration policy as us and there's not much room for flexibility at all.

On the same subject, another interviewee commented that their business perspective was already international, and that they make investments and draw on talent outside of Scotland's borders. Independence might cause some operational changes, but the strategy would stay the same. An internationally focused Scottish could end up cultivating dynamic capabilities and absorptive capacity outside of Scotland's borders. Not only are Scottish firms in need of support from SDI/UKTI to access global value chains, networks and markets, but horizontal connectivity between Scottish firms also remains weak. As noted earlier, lack of absorptive capacity and a mismatch between the scientific focus of HEIs and firms constitute unresolved issues. Around ten years ago, the Intermediate Technology Institutes (ITIs) were seen as a potential solution to this, and although they no longer exist their function may be replaced in some way by the TSB's Catapults/KTN Centres. However, their location across the UK shapes their centre of influence and activity, with no evident benefit for Scotland in various industrial sectors. TSB decisions seem to have focused on UK nodes of activity and potential.

Impact of Independence: Diversification of the Industrial Structure

Many interviewees highlighted the dangers associated with the very high proportion of Scottish GDP generated by two industrial sectors, financial services and oil/gas. While these are historical examples of endogenously grown areas of excellence and

competitive advantage, the risk of bankruptcy experienced by large financial institutions in 2008 and the declining output from the North Sea suggest that structural change is required for long-term economic prosperity.

Nevertheless, financial services and oil/gas ought to continue to thrive. In this respect, different views have been expressed regarding the potential impact of independence. In relation to the financial sector, sceptics point out that uncertainties exist regarding the ability of a new Scottish Treasury to rescue financial institutions in the same way the UK Treasury saved them in 2008. On the other hand, it was also remarked that these institutions have become increasingly less focused on local markets, and continuing to operate in a newly formed country where they are already present, would not represent a problem.

In the oil/gas sector, uncertainty surrounds the new tax regime and regulatory framework. Investment decisions are based on economic calculus that relies on assumptions regarding tax rates and fiscal rules. Areas of specific concern for this sector are ring-fenced rates on revenues from oil extraction, field allowances and tax breaks for decommissioning. Other emerging sectors that are key to the future of the Scottish economy voiced different concerns: for instance, research-intensive industries, such as ICT and life sciences are more interested in R&D tax credits, grants for innovative projects, and private equity/credit available for risky projects/entrepreneurial ventures. In this sense, the existence of a Scottish Investment Bank is seen as a positive feature of the Scottish innovation system. Indeed, the recession of the past five years has created profound challenges for many companies in accessing capital beyond the early stage equity market. In response to these broader funding challenges, the Scottish Executive rebranded Scottish Enterprise's investment team as the *Scottish Investment Bank* in December 2010, and crucially expanded its remit to supporting the development of Scotland's private sector SME funding market to ensure that both early stage and established companies with growth and export potential have adequate access to growth capital. Some of our interviewees saw this as a very important development, a model of supporting investments in local ventures that should be preserved and possibly extended in an independent Scotland – alongside tax reliefs such as the 'Enterprise Investment Scheme' or 'R&D Tax Credits'.

The Scottish Government white paper *Scotland's Future* (2013) refers to a possible reduction of the Corporation Tax (CT), which most Scottish businesses would welcome. This could have a very strong impact on Scotland's ability to attract foreign investment. Four main concerns have been expressed in relation to such proposal. First, depending on negotiations with the UK Government, Scotland may be left with a problematic debt/GDP ratio, which would make it difficult to reduce CT. Second, various interviewees stressed that a monetary union would necessarily mean less fiscal autonomy. The *Fiscal Commission Working Group Report* (Scottish Government, 2013) agrees that whether or not Scotland remains part of a monetary union with the rest of the UK, a set of credible fiscal rules will need to be defined and implemented. If Scotland will remain part of the UK monetary system, strict fiscal rules will be imposed by the UK Treasury – similar to what happened in the Euro-zone in 2013 in coincidence with the introduction of the 'Fiscal Compact'. In this respect, one interviewee noted that:

...I think it's also worth noting that in any transition to independence that the atmosphere within the UK treasury towards the negotiations will not be benign.

I've run a finance division in the old Scottish Office and we used to encounter huge hostility on points of detail, and these had to be very carefully managed and negotiated every year. This was never straightforward. And I think the suspicion over the allocation of the Barnett formula will die immediately when any independence vote is confirmed. It will be extremely difficult to negotiate from that point on the basis of any formula.

Thirdly, various interviewees feared that a reduction of CT in Scotland would determine a similar measure by the UK Governments, promoting a 'race to the bottom'. Finally, it was also generally agreed that the socially progressive agenda proposed by the white paper may be at odds with CT reduction.

Very similar considerations were expressed in relation to the creation of a Special Fund using revenues from North Sea Oil – which in the future could be used to promote innovation and economic growth. In this respect, one interviewee made the following comment:

... in Norway, many of their economists are also criticising the government for stashing away almost all the money in an oil fund, saying that that's practically the same as an individual does, which is fine from the standpoint of an individual, but for a whole country, their future, forging independence on their innovation and their firms and so on, and they're saying, well, we should be using much more of this to support local innovation and local firms. So it's a line that has been going on for the last 30, 40 years, the line of criticism which has had practically no impact on public policy, but it's been there.

According to our survey data, innovation and structural change will take time in that emerging sectors, such as life sciences and renewable energies are in an embryonic stage of development, whilst ICT has not yet reached critical mass in the number/size of the firms created or the inward investment attracted. Further, they not only depend on increased investments, but also on crucial factors in the regulatory environment. Economic activities in sectors such as Oil/Gas, financial services, ICT and Bio-Pharmaceuticals are critically dependent on rules dictating how natural resources can be extracted/handled, drugs can be safely and effectively produced, financial services prudently and transparently offered, and intellectual property used. Some interviewees raised the issues of the characteristics of the new frameworks, how long it will take for them to be developed, and whether Scotland will be equipped with the financial/human resources required to put them in place. One interviewee argued that:

...we've moved on from the situation 20 years ago in this room, when it is almost impossible to get the intellectual property out of university, protect it and move it on. [...] The issue in terms of regulation I think is the really interesting one; currently in the healthcare system for example, when you invest in a company in the UK that's got a UK market, you deal with the MHRA. You know how the process works. In an independent Scotland the regulator is not based in Scotland. You may contract with the MHRA, but how does that work? My biggest concern is anything that creates doubt in the venture capital organisation's mind is a gross against it.

In terms of the general institutional and regulatory frameworks – as well as access to markets and FDI – it was generally agreed that it is absolutely vital that Scotland remains a member of the European Union.

Moving forward, the Scottish Government has highlighted that nurturing and promoting an entrepreneurial culture would constitute a strategic priority, to boost competitiveness and reindustrialise the new country. Many interviewees agreed that this constitutes a desirable target, very much in line with the existing economic literature, which shows that the combination of innovative investment and entrepreneurial capacity is a key driver of growth in developed economies (e.g. Corrado et al 2009).

Opportunities are perceived in all of the surveyed sectors, and especially in the emerging ones such as ICT, life sciences and renewable energy. Sectors such as renewable energy could benefit from processes of *smart specialisation*, deploying competencies and skills accumulated in the oil/gas sectors for new purposes. Policy programmes could be developed/implemented to support such transformation. Crucially, if Scotland becomes independent, the current infrastructure that supports innovation and entrepreneurship would have to be maintained and possibly improved. Some interviewees felt that independence would push local economic agents to take more direct responsibilities and expect policymakers to develop the conditions for the development of a stronger entrepreneurial culture. Others objected that this goal may not be compatible with the socially progressive agenda contained in the White Paper. In this respect, one interviewee asked

... what is definition of entrepreneurial culture here? Because there's some common teachers that would say an over-emphasis on small high growth spinout companies is never going to make the broader impact on the economy that you want. So your entrepreneurial culture needs to be embedded across the range of things and looking at the Mittelstand-type companies, that's where you really need to be focusing your efforts.

A last set of viewpoints is related to the emergence of trade barriers between the UK and Scotland. In the international trade literature, such emergence is seen as dependent on various factors, such as differences in legal systems, policy/regulatory frameworks, tax regimes, languages etc. Given the paucity of similar processes taking place in the past, it is extremely difficult to predict the actual significance of such barriers to trade and growth. One would expect some sectors to be more affected than others. For instance, one respondent stressed that the UK government would no longer be keen on subsidising electricity production from renewables in Scotland, and wondered whether the Scottish Government would be willing and/or able to provide the same set of incentives.

Conclusions

The views on Scottish independence and its possible impact were varied and highlighted the uncertainty of the process. Many interviewees pointed out that more information is required regarding possible changes to the tax and currency regime, regulatory frameworks, innovation policy, and institutional settings in order to predict what might happen should Scotland decide to become independent.

The interviews and workshops showed that the desire for a more aligned and coherent innovation policy is generally shared among the business community; however opinions diverge as to whether such strategy could be more effectively delivered by an independent Scottish Government, or through a realignment of the responsibilities and powers within the UK-wide system of innovation.

Regarding the potential impact of independence on the scientific community and industry, many fear a reduction of investment in scientific research and a possible disconnection from UK-wide networks. However, there is also a general awareness of the current disconnect between the science base and the industrial sectors of the Scottish economy.

An essential topic within this debate relates to possible changes to the tax regime. In this respect, views tend to vary dramatically depending on the needs of different industrial sectors. Notwithstanding that future settlements will depend on the outcome of the negotiations between different Governments, there seems to be general consensus about the fact that a number of factors may limit the set of options available to the Government of an independent Scotland.

Whatever the outcome of the referendum, there was also a general consensus that structural change within the Scottish economy is required to secure long-term prosperity. The emergence of a stronger entrepreneurial culture is seen as a *sine qua non* condition to take advantage of the potential for innovation that resides within/at the interfaces of emerging sectors of the economy such as life sciences, ICT, renewables and engineering, but also food/drinks and tourism. Some interviews wondered whether this objective (alongside the design of a more competitive tax regime) is compatible with the very progressive social agenda contained in the white paper presented in 2013 by the Scottish Government. Concerns were expressed in relation to the trade barriers that may emerge between Scotland and the rest of the UK if Scotland were to become independent, which may hinder some innovative sectors on the Scottish economy.

Many interviews also felt that radical changes will also be likely if Scotland remains part of the UK: (i) the credible threat of breaking away from the Union has favoured Scotland regarding various economic policy choices, which will no longer be the case post-September 2014; (ii) more fiscal autonomy will be granted in any case from 2015; and (iii) Westminster is planning a referendum that could sanction the exit of the United Kingdom from the European Union in 2017, which many business leaders conceive as a negative perspective.

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