Research Bulletin 19/5 | Northern Ireland's International Competitiveness – Innovation and Research

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Summary

Competitiveness remains the international benchmark against which Small Advanced Economies (SAE) are measured. Northern Ireland's draft Industrial Strategy aims to put Northern Ireland in the top three most competitive small advanced economies by 2030. In order to deliver against this target, accelerating innovation and research is highlighted as a key pillar within the strategy.

The most recent data available shows that Northern Ireland (NI) performs reasonably well in terms of Gross Expenditure on Research & Development, Business Expenditure on Research & Development and the percentage of personnel employed in Research & Development. However, NI performs poorly in terms of the level of innovative enterprises within NI. Indeed, over time NI has consistently performed below the SAE group average across all indicators and more work will be needed if Northern Ireland is to meet the draft Industrial Strategy's ambitious target.

Introduction

Improving competitiveness is a key objective within the draft Industrial Strategy for Northern Ireland.[i] In seeking to become a leading competitive economy, the strategy highlights the importance of benchmarking Northern Ireland against other Small Advanced Economies (SAEs) to learn from their success.

This research bulletin provides an assessment of NI's international competitive position on a range of innovation and research indicators, establishing NI's relative position against 16 other SAEs - which are used as benchmarks based on their size and competitiveness rankings. Indicators examined include the following:

- Gross Expenditure on Research & Development (R&D);
- Business Expenditure on R&D;
- R&D employees in the Business Enterprise Sector; and
- Innovative Enterprises.

Innovation, and in particular business innovation, is a vital ingredient in raising the productivity, competitiveness and growth potential of modern economies. It is a key objective for the Northern Ireland Executive to encourage Northern Ireland businesses to become more innovative and the key actions to achieve this are set out in the Innovation Strategy for Northern Ireland 2014-2025[ii]. The importance of business innovation is also reflected in the Draft Programme for Government Framework 2016-21[iii].

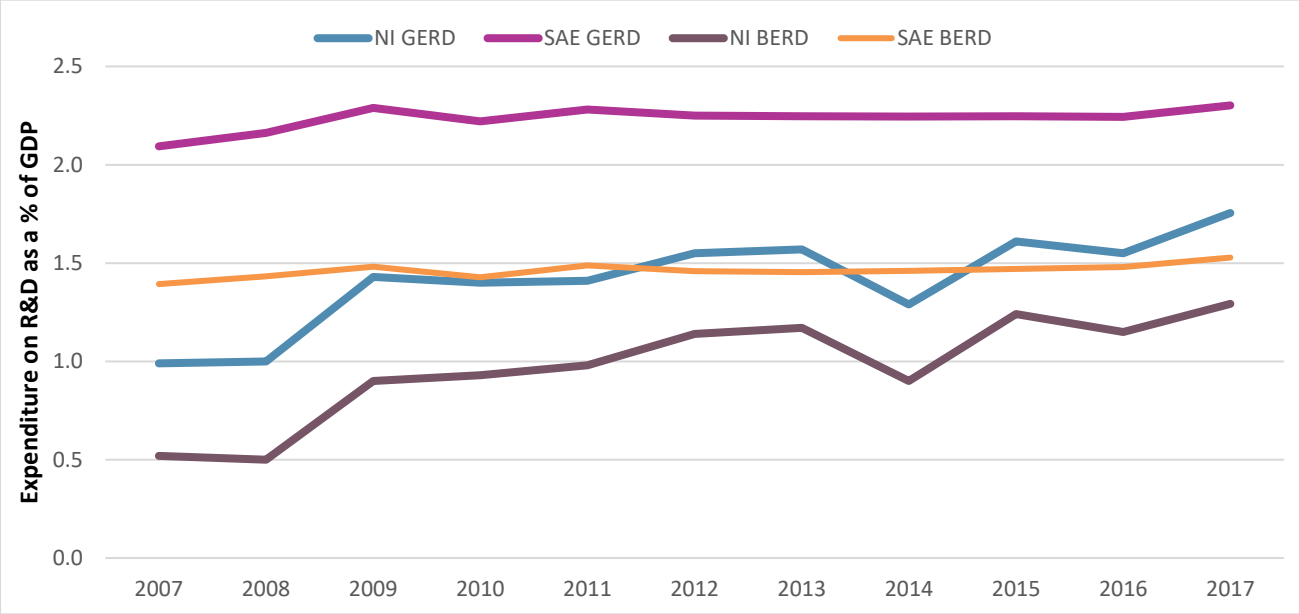
Gross Domestic Expenditure on Research & Development

Gross domestic expenditure on Research & Development (GERD) is defined by the OECD as the total expenditure on R&D carried out by all resident companies, research institutes, university and government laboratories, etc., in a country[iv]. GERD is the preferred measure of R&D intensity of an economy for use in international comparisons. However, expenditure on R&D by the business sector is a closely watched indicator of an economy's R&D intensity as it is the main R&D performing sector and thus directly impacts productivity, and GDP growth.

As a result, this research bulletin in the first instance will discuss GERD as a share of GDP, however there will also be analysis of Business Expenditure on Research & Development (BERD)[v]. BERD is essentially a component of GERD.

Figure 1 shows total R&D expenditure (GERD) and R&D expenditure by the Business Sector (BERD), as a percentage of GDP from 2007-2017, between NI and the SAE group. It is evident from this graph that both follow a very similar trend, highlighting the significance the business sector has on total R&D expenditure.

Figure 1: GERD/BERD as a % of GDP 2007-2017



Source: OECD, Office for National Statistics, New Zealand Statistics

GERD as a percentage of GDP in NI was 47% of the SAE group average in 2007. The SAE group average was supported by high R&D expenditure in economies such as, Israel (4.4%), Sweden (3.3%) and Finland (3.4%). The gap between NI and the SAE group narrowed slightly by 2009 (62%) when GERD increased in NI whilst showing very little movement across the SAE group.

Similarly, in 2007, as a share of GDP, BERD in NI was 0.87 percentage points lower than the SAE group average. BERD increased steadily in NI over the following years, however the SAE group average continued to outperform NI.

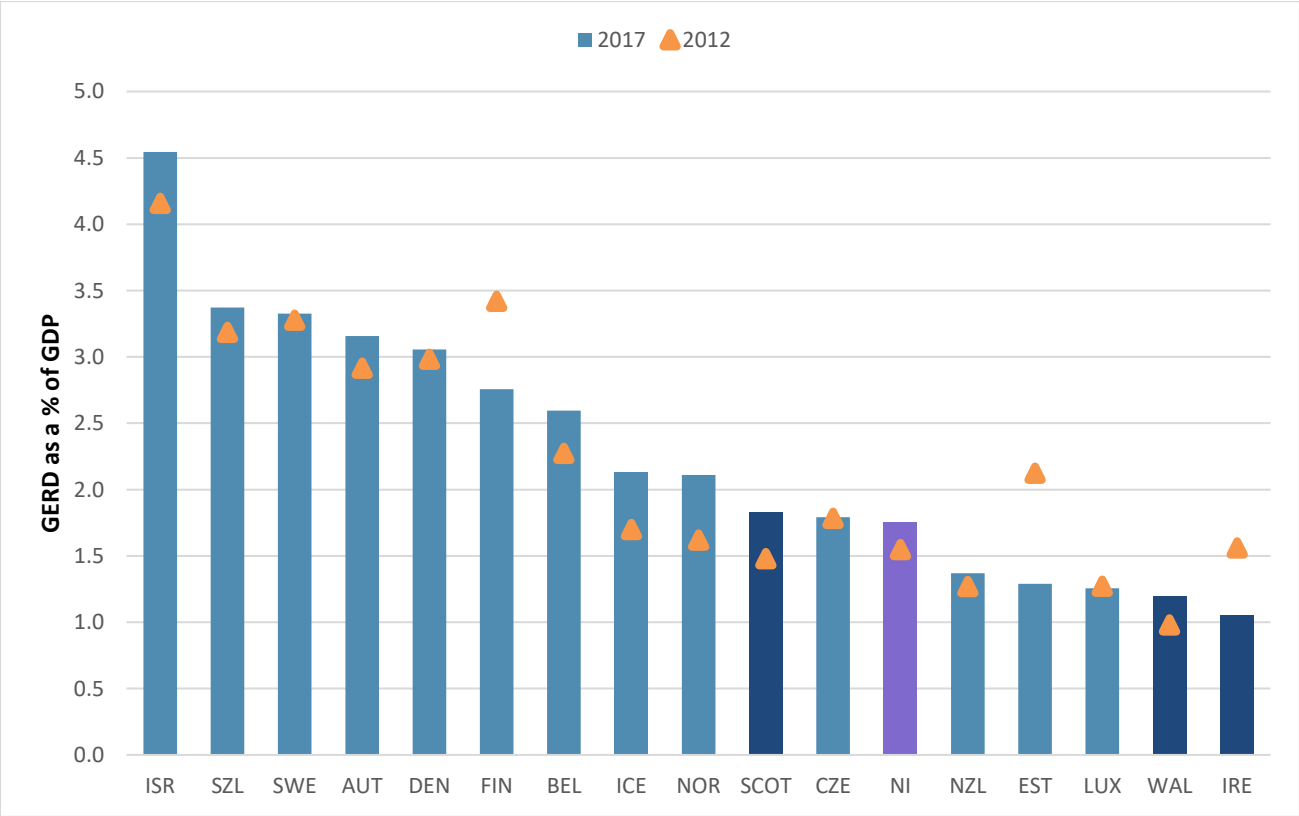
Both NI and the SAE group experienced a resilient investment environment during and after the financial crisis, which began in 2008. However, GERD as a percentage of GDP in NI fell during 2014 by 0.27 percentage points – driven by a decrease in expenditure on R&D by the business sector. Indeed, this decrease was the largest percentage decrease across all of the UK regions during that year[vi]. Nevertheless, this rebounded quickly in 2015, to the highest rate recorded at that time (1.24%).

This positive trend for NI continued, with BERD reaching a value of 1.3% of GDP in 2017. This increase can be attributed to NI's disproportionate share of small and medium sized enterprises (SMEs), which make up around two-thirds of businesses in NI. Figures show SMEs spent £173m on R&D in 2012, increasing to £304.4m in 2017[vii].

This resilience is also illustrated throughout the time series by the SAE group who did not experience any significant volatility. NI continues to spend less on R&D than the SAE group average, however it is encouraging to see that the gap has been narrowing in recent years, with NI total expenditure on R&D averaging 76% of the SAE group in 2017, increasing from a low of 47% in 2007.

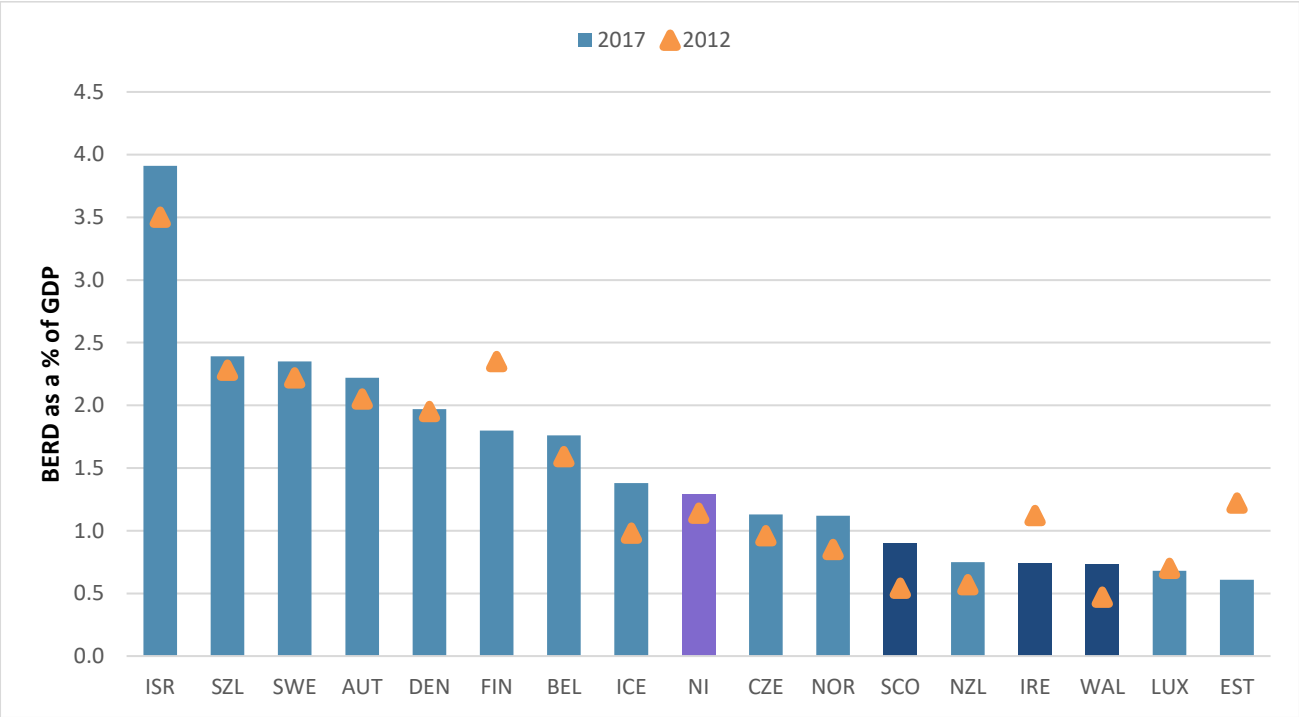
Despite NI lagging behind the SAE group average in both GERD and BERD as a share of GDP, Figure 2 demonstrates that NI positions ranks 12th out of the 17 economies analysed in terms of GERD, whilst Figure 3 reflects a rank of 9th in 2017 for BERD. On both indicators NI outperforms economies such as New Zealand, Luxembourg, Ireland and Wales.

Figure 2: GERD as a percentage of GDP in SAEs, 2017 vs 2012



Sources: OECD, Eurostat, New Zealand Statistics, Office for National Statistics

Figure 3: BERD as a percentage of GDP in SAEs, 2017 vs 2012



Sources: OECD, Eurostat, New Zealand Statistics, Office for National Statistics

Across the SAE group; Israel, Switzerland and Sweden had the highest levels of GERD and BERD, as a share of GDP in 2017. Factors which help explain the higher than average expenditure on these indicators for these particular economies include the following:

- **Israel –** The government programme that facilitated Israel's growth in BERD, and moreover total GERD, is called "Initiative." This programme invested in new venture capital funds and attracted foreign investors by offering them insurance on risk, resulting in Israel spending more on R&D as a share of GDP, than any other advanced economy[viii].
- **Switzerland –** A study by EY[ix] found that eleven of the world's 500 largest R&D investors come from Switzerland. In addition, Switzerland has a substantial pharmaceutical sector, with multinationals such as Roche and Novartis - who invested approximately €18 billion of the €23 billion invested in R&D in 2017.
- **Sweden –** Swedish R&D-intensive industry is dominated by large manufacturing firms in electronics, pharmaceuticals, automotive, aerospace and utilities. The telecommunications equipment company Ericsson, stands out as the Swedish company with the heaviest investment in R&D, earning the 28th position among the most R&D-intensive companies in the world measured in real terms[x].

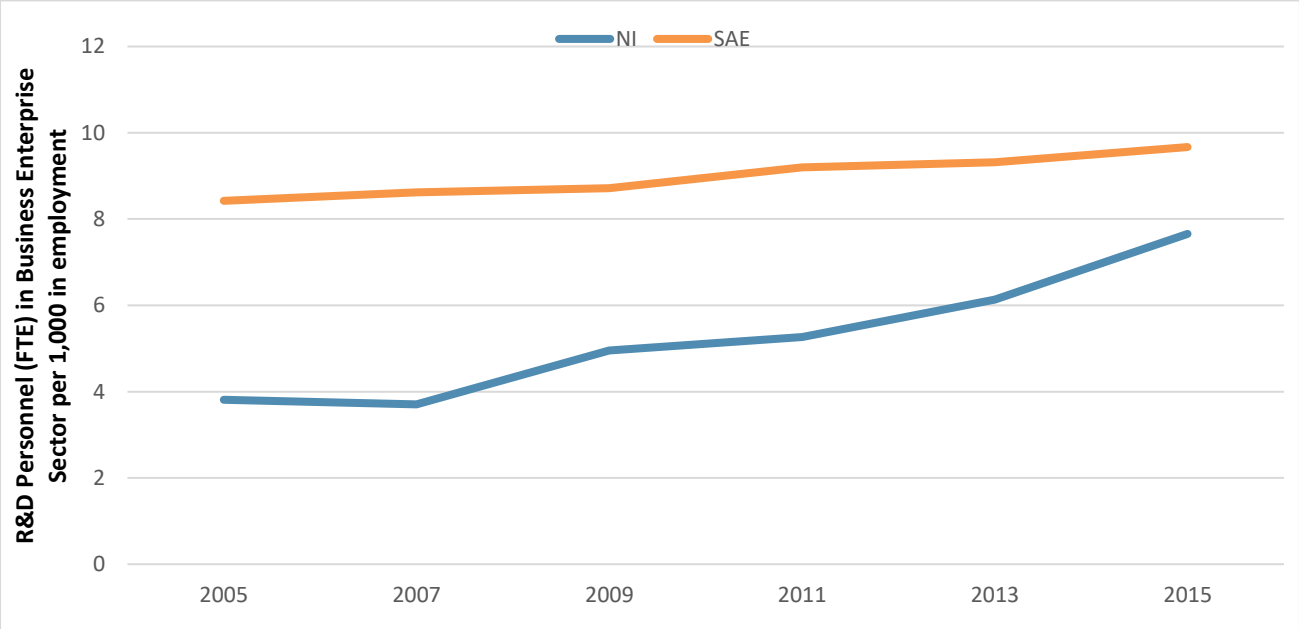
Whilst the majority of countries in the SAE group all experienced an increase in the intensity of GERD and BERD from 2012 to 2017, Finland, although still higher than many OECD economies was the 2nd most BERD and GERD intense economy in 2012, but by 2017 they had fallen to 6th place. Estonia experienced a dramatic fall in its BERD ranking position, falling nine places, from 8th in 2012, to 17th in 2017. This in turn impacted on GERD, however the fall was not

as severe (6 positions). This suggests expenditure on R&D by other sectors such as Government remained stable over these years[xi]. Whilst NI GERD improved slightly over the years 2012 to 2017, BERD as a share of GDP maintained its position of 9th across both years. In contrast, one of NI's closest competitors, Ireland, experienced a fall in its ranking across both indicators over the same time period[xii]. Overall NI, supported by a large proportion of SMEs, perform reasonably well on both GERD and BERD indicators compared to the SAE group.

R&D Employees in the Business Enterprise Sector

R&D within the business enterprise sector accounts for the largest share of R&D expenditure and also the largest share of R&D personnel[xiii]. Whilst government and higher education sectors also carry out R&D, business sector R&D is more closely linked to the creation of new products and production techniques, as well as to a country's innovation effort.[xiv] Therefore in analysing this sector we are able to get a better reflection of R&D activity across the SAE group.

Figure 4: R&D Personnel within the Business Enterprise Sector



Sources: ILO, Office for National Statistics, Eurostat and DfE calculations[xv]

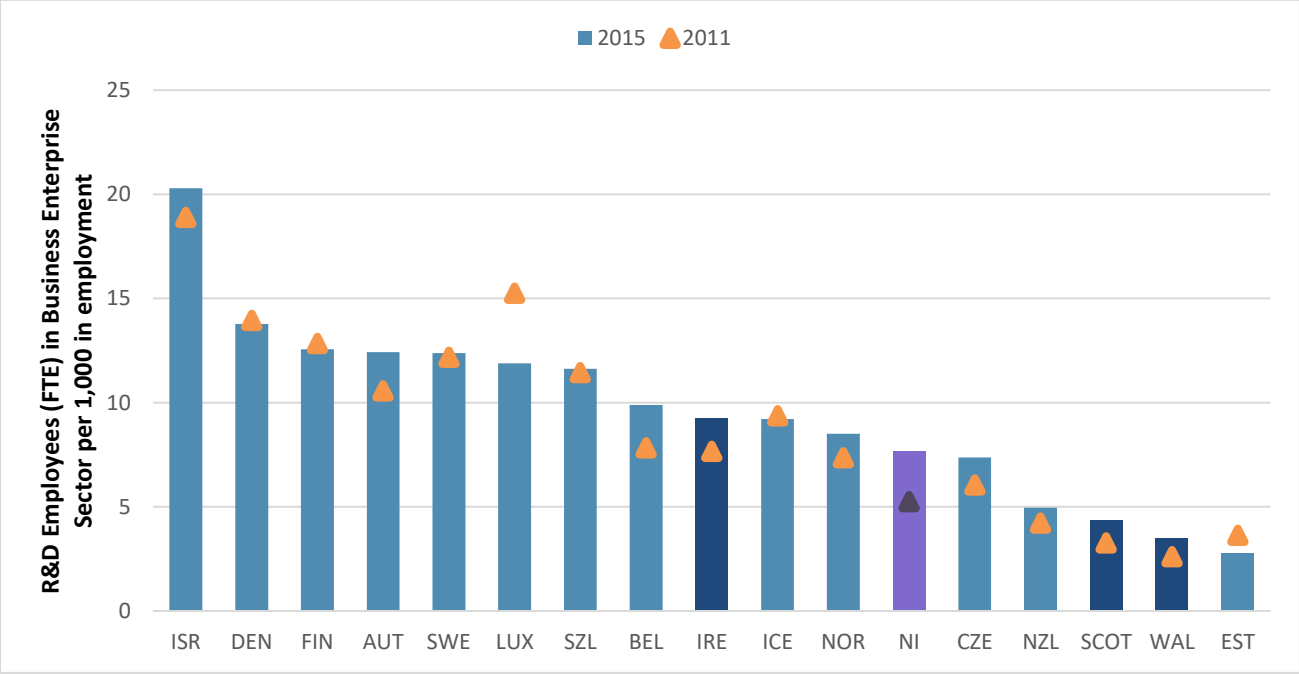
Figure 4 illustrates over time, a comparison of NI and the SAE group R&D personnel levels, per 1,000 in employment within the Business Enterprise sector. The number of personnel employed in R&D within the business enterprise sector in NI has lagged behind the SAE average throughout the time series- indeed, at no point has NI exceeded the SAE group average. At the beginning of this time series, the SAE average was more than double that of NI however, other than a slight fall in 2007 (which can be partially attributed to a reduction of R&D expenditure by the manufacturing sector[xvi]) it is encouraging to see that in recent years the gap between NI and the SAE group average has narrowed considerably, with 2015 data highlighting a difference of only 2 employees per 1,000 in employment between NI and the SAE group average.

Looking closer at the SAE group (Figure 5), we can see that NI lags behind most other economies within the SAE group - ranking 12th in 2015 out of the 17 economies analysed, above just Czech Republic, New Zealand, Scotland, Wales and Estonia.

Israel, Denmark, Finland, Austria and Sweden are the top performers on this indicator. A high expenditure on GERD and BERD (discussed elsewhere within this research bulletin) would have a direct link to the level of employee numbers in R&D, and therefore explains why top performing economies in GERD and BERD also rank within the top performing economies on R&D personnel. Israel, for example have approximately 344 R&D centres. Between 2014 and the first half 2018, 117 R&D centres were opened by multinationals from 21 countries[xvii].

Similarly, Sweden is home to Europe's largest tech companies and its capital is second only to Silicon Valley when it comes to the number of "unicorns" – billion-dollar tech companies – that it produces per capita[xviii].

Figure 5: R&D Personnel within the Business Enterprise Sector - Rankings



Sources: ILO, Office for National Statistics, Eurostat and DfE calculations

When comparing data from 2015 to those in 2011, we can observe very little movement in the number of R&D personnel per 1,000 in employment across the SAE group. A notable selection of economies experienced an increase in the number of R&D personnel, including NI- indeed, NI experienced the largest absolute increase of 2.4 over this period. Belgium and Austria followed close behind with an increase of 2.1 and 1.9 respectively. In contrast, Luxembourg experienced the largest absolute decrease in R&D employees per 1,000 of employment, falling by 3.4 personnel over this time period.

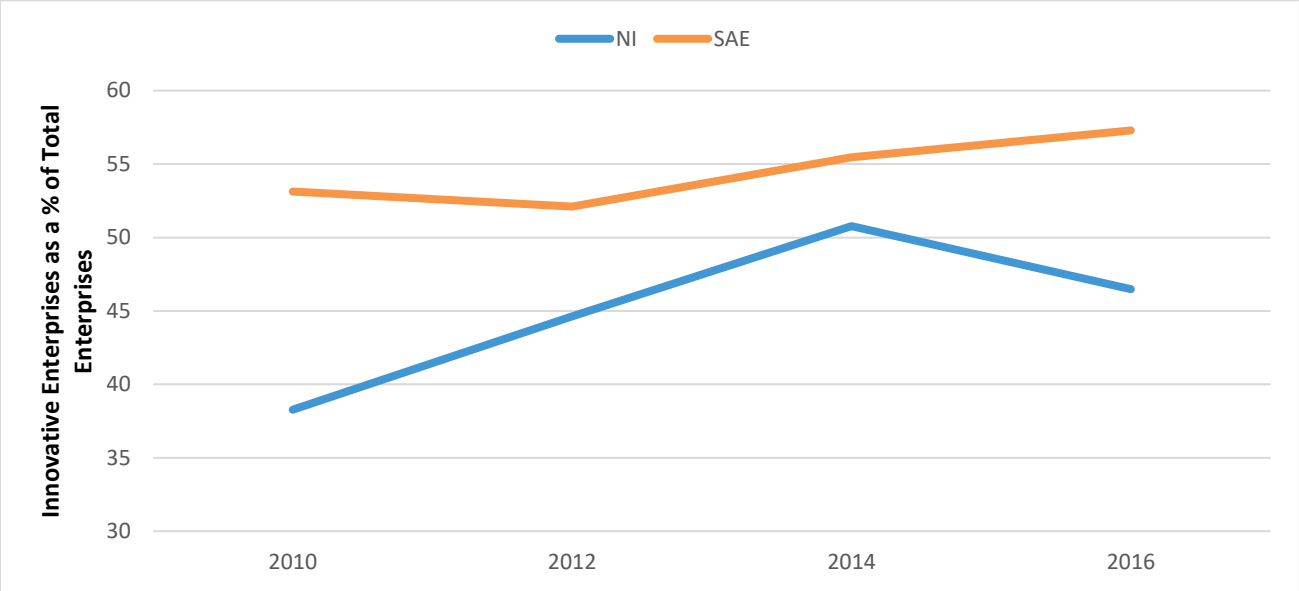
As a result, there was very little movement in the ranking positions of the SAE group across these two years. Although still positioned high, Luxembourg fell from 2nd to 6th position. Estonia, who in 2011 already ranked low (15th), fell to

last place with only 2.8 personnel employed in R&D per 1,000 in employment. Whilst only a small shift and in the right direction, NI increased its rank by one position (13th to 12th).

Innovative Enterprises

Innovation is defined as a new or significantly improved product (good or service) introduced to the market, or the introduction within an enterprise of a new or significantly improved process[xix]. Innovation boosts economic growth, drives access to new markets and creates jobs. Using data from the Eurostat Community Innovation Survey (CIS), we assessed the level of innovative enterprises as a proportion of total enterprises across the small advanced economy group in order to gauge which economies are performing well. Figure 6 illustrates how NI and the SAE group perform over the period 2010-2016.[xx]

Figure 6: Innovative Enterprises as a % of Total Enterprises



Sources: Eurostat, Office for National Statistics, NZ Stats, Central Bureau of Statistics Israel

Note: Eurostat innovation survey results for the UK differ slightly to the UK Innovation Survey results (UKIS) due to the fact that UKIS includes some sectors (eg construction, accommodation and food services etc) that are not covered by Eurostat.

The percentage of innovative enterprises as a share of total enterprises in NI has lagged behind the SAE group average over the period 2010-2016. At the beginning of this time series, the SAE group average was 14.9 percentage points above that of NI. However, NI did significantly reduce the differential in years leading up to and including 2014, when the gap between the SAE group average and NI was reduced to 4.7 percentage points.

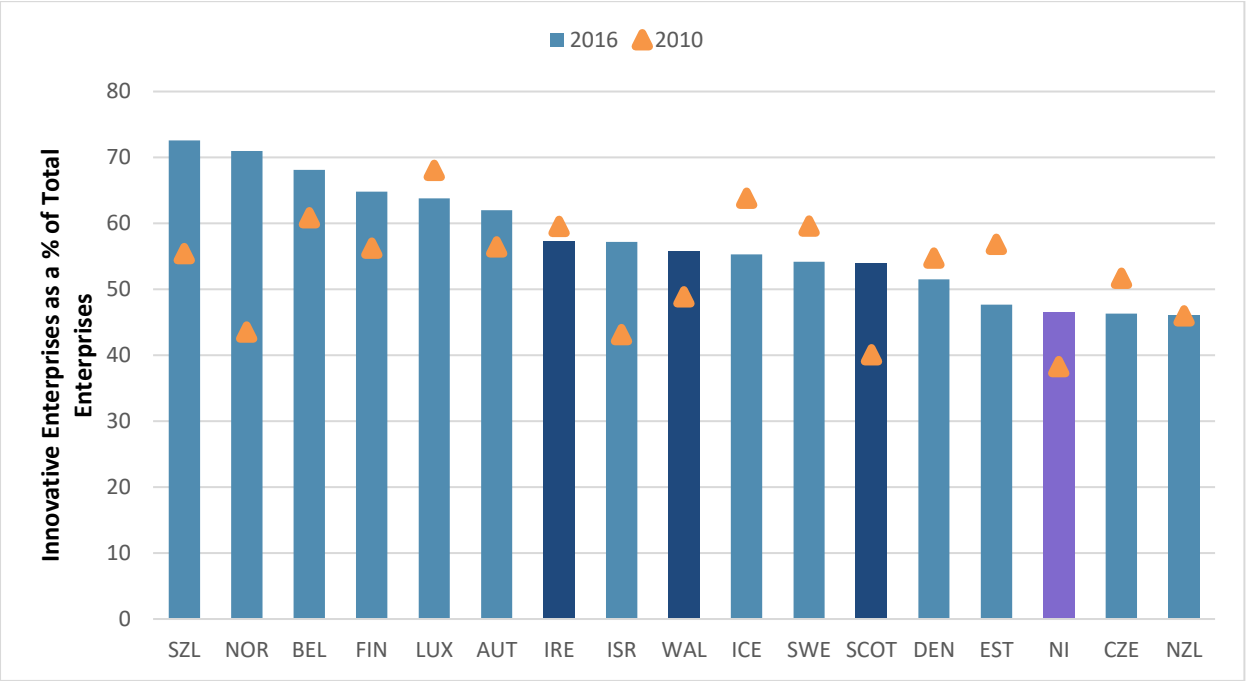
However, this performance was short lived with data from the 2016 Eurostat CIS showing the percentage of innovative enterprises in NI falling to 46.5%, resulting in the differential between NI and the SAE group average increasing to 10.8 percentage points.

A potential explanation for this drop in NI may be explained by the wider UK findings. In 2016, SMEs were found to be losing ground to larger firms in terms of innovation. The 2016 figure for the UK as a whole was 58.7%, down from 60.2% in 2014. The number of innovative large firms rose marginally whereas innovative SMEs fell sharply across the UK[xxi]. As NI has a disproportionate share of smaller firms, the sharp decline observed at national level filtered through to NI, resulting in a greater impact.

Across the SAE group we can see a number of economies perform considerably well relative to NI (Figure 7). Looking at the 2016 results, the highest proportion of enterprises engaged in innovative activity were recorded in Switzerland (73%). This economy, which tops a range of innovative indicators, attracts corporations due to generous tax regimes and the supply of highly-educated technicians. The success of their innovation strategy can be seen with over one thousand multinationals having regional or global headquarters in the country. Bühler have invested in a $51.4m innovation campus in Uzwil and Google has its largest R&D centre outside the US in Zurich, employing over 1,500 people[xxii].

Strong performance in Switzerland is followed by Norway (71%) and Belgium (68%) representing the top three performing economies across the SAE group. Over the same period, the share of innovative enterprises was below 50% in NI (47%), Czech Republic (46%) and New Zealand (46%) positioning NI in the bottom three, across the SAE group.

Figure 7: Innovative Enterprises across the SAE group



Sources: Eurostat, ONS, New Zealand Statistics, Central Bureau of Statistics Israel, DfE Calculations [xxiii]

Note: Eurostat innovation survey results for the UK differ slightly to the UK Innovation Survey results (UKIS) due to the fact that UKIS includes some sectors (eg construction, accommodation and food services etc) that are not covered by Eurostat.

Comparing data from the 2010 survey with the 2016 survey shows that the share of innovative enterprises in economies such as Norway, Switzerland and Israel has increased considerably relative to other economies in the SAE group. For example, in 2010 Norway's share of innovative enterprises was 43.5%, increasing to 71% in 2016 behind only Switzerland. Whilst the number of innovative enterprises in NI is lower than most other economies across the SAE group – performance has also improved, moving from a rank of 17th in 2010 to 15th in 2016.

Conclusions

Northern Ireland's performance across the indicators discussed within this Research Bulletin Article varies (Table 1), however it is encouraging to see that when compared with data from the previous five years its position has remained stable or has improved. Nevertheless, if NI is to meet the ambitious target set within the draft Industrial Strategy for NI to be in the top three most competitive economies by 2030, continued progress is needed.

Table 1: Northern Ireland performance against Small Advanced Economies

Measure	Most Recent Position Rank	Five Year Rank
Gross Expenditure on Research & Development	12th	13th
Business Expenditure on Research & Development	9th	9th
Research & Development Personnel within the Business Enterprise Sector	12th	13th
Innovative Enterprises	15th	17th

NI continues to lag behind the SAE group average on all of the selected indicators. The overall innovator leaders are Switzerland, Israel, Norway and Sweden. These economies demonstrate strong innovation strategies and performance which will be important to investigate, in order to identify any lessons to be learnt which can be applied to NI.

This research bulletin has focused on four different indicators however other potential indicators could conceivably include STEM subjects, PhD graduates, Higher Education Expenditure on R&D (HERD) which DfE will continue to take forward in order to draw a clearer picture of competitiveness across this pillar.

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For further information or queries please contact Analyticalservices@economy-ni.gov.uk

[i] https://www.economy-ni.gov.uk/sites/default/files/consultations/economy/industrial-strategy-ni-consultation-document.pdf
[ii] https://www.nisra.gov.uk/sites/nisra.gov.uk/files/publications/UK-Innovation-Survey-2015-Northern-Ireland-Results-Bulletin.pdf
[iii] https://www.northernireland.gov.uk/sites/default/files/consultations/newnigov/draft-pfg-framework-2016-21.pdf
[iv] https://data.oecd.org/rd/gross-domestic-spending-on-r-d.htm
[v] https://www.conferenceboard.ca/hcp/Details/Innovation/berd.aspx?AspxAutoDetectCookieSupport=1
[vi] https://www.nisra.gov.uk/sites/nisra.gov.uk/files/publications/2014-RD-detatiled-results.pdf
[vii] https://www.belfasttelegraph.co.uk/business/northern-ireland/research-and-development-investment-by-northern-irelands-smaller-firms-rises-75-in-five-years-37575342.html
[viii] https://www.ft.com/content/546af0b2-ede5-11e6-930f-061b01e23655
[ix] https://www.ey.com/Publication/vwLUAssets/ey-news-release-worldwide-swiss-companies-invest-most-in-research-and-development/$FILE/ey-news-release-worldwide-swiss-companies-invest-most-in-research-and-development.pdf
[x] https://rio.jrc.ec.europa.eu/en/country-analysis/Sweden/country-report
[xi] https://www.stat.ee/news-release-2017-128
[xii] The fall in the Republic of Ireland's R&D intensity is partly due to a significant increase in GDP, GNP and GNI in recent years. https://dbei.gov.ie/en/Publications/Publication-files/The-R-D-Budget-2017-2018.pdf
[xiii] https://www.oecd-ilibrary.org/docserver/9789264239012-9-en.pdf?expires=1555341982&id=id&accname=guest&checksum=C1399576715BE8BC33236E4536309B8D
[xiv] https://books.google.co.uk/books?id=ktXVAgAAQBAJ&pg=PA56&lpg=PA56&dq=Total+R%26D+Personnel+%26+Researchers+(FTE)+Business+Enterprise+per+1000+of+employment&source=bl&ots=TiAWcTSXXj&sig=ACfU3U1ttoLnelqMXsbFXRQcDL2wlvH8Lw&hl=en&sa=X&ved=2ahUKEwj_i8_B2KLiAhVFtnEKHauJDEg4ChDoATAAegQICRAB#v=onepage&q=Total%20R%26D%20Personnel%20%26%20Researchers%20(FTE)%20Business%20Enterprise%20per%201000%20of%20employment&f=false
[xv] Due to insufficient data available across all economies within the SAE group, data was analysed every two years rather than annually.
[xvi] https://www.nisra.gov.uk/sites/nisra.gov.uk/files/publications/2007-rd-publication.pdf
[xvii] https://www.haaretz.com/israel-news/business/multinationals-open-over-20-r-d-centers-a-year-in-israel-on-average-1.6436189
[xviii] https://www.weforum.org/agenda/2018/02/south-korea-and-sweden-are-the-most-innovative-countries-in-the-world/
[xix] https://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Innovation
[xx] For an explanation of adjustments made for comparability purposes, see final endnote below.
[xxi] https://www.enterpriseresearch.ac.uk/smes-losing-innovation-race/
[xxii] https://www.redherring.com/startups/big-corporations-made-switzerland-worlds-innovation-capital-can-become-startup-hub/
[xxiii] To ensure UK regional results are more comparable with Eurostat, DfE has constructed a scaling adjustment (upwards) for Northern Ireland, Scotland and Wales (based on regional to UK percentage differentials from the UK Innovation Survey results for each year). This was applied to the Eurostat figures for the UK for the purposes of this Bulletin. Slight differences between the Eurostat innovation survey results for the UK and the UKIS results are due to the fact that UKIS includes some sectors (eg. construction, accommodation and food services etc) that are not covered by Eurostat. The innovation figures used in Figures 6 & 7 are used for illustrative purposes only – in order to aid comparison internationally. The original UKIS results are available on the DfE website, at the following link:
https://www.economy-ni.gov.uk/articles/theme-1-innovation