Innovation in Scotland:

Analysis of the Community Innovation Survey 2009

CONTENTS

Executive Summary

Innovation is an important driver of productivity and economic growth, and is a much wider measure of activity than R&D alone. The UK Innovation Survey results for 2009 covered the period 2006 to 2008. Compared to the previous survey there was a fall in the proportion of firms that were innovation active in Scotland and in the UK, which may have been due to the recession. Nevertheless, the proportion of innovation active firms in Scotland has tended to lag the UK over the last three surveys.

Regional patterns and rankings can generally be explained by differences in industrial composition and business size. Innovation activity levels tend to increase as the size of the business increases, reflecting the pattern shown in previous surveys, and large firms in Scotland outperformed the rest of the UK against most indicators. Most innovation active firms have expenditure associated with innovation activities and there was less engagement by Scottish firms in non-technological innovation. Firms in Scotland tend not to change behaviours or business strategies as an independent means of improving competitiveness. Rather, they tend to introduce strategic, organisational, marketing or management changes in conjunction with other technological innovations.

Firms in Scotland invested a higher proportion of their total innovation expenditure in bought-in technology and training than the UK, indicating a greater tendency in Scotland for firms to introduce new products on the market or new processes without necessarily performing R&D, but this produced a higher return on investment, particularly in the largest firm size band. Comparing the performance of innovation active and innovation inactive firms, turnover growth rates were significantly higher for innovation active firms. There was also some growth in employment, and as the proportionate increase in turnover was greater than the increase in the number of employees, this suggests innovation active businesses became more competitive than their non innovation active counterparts. Innovation active firms were also more likely to be exporters and collaborate with others on innovation. Large firms in particular were more likely to collaborate internationally, allowing them to gain access to a broader pool of knowledge.

Analysis of Scotland's survey results by sector help to explain why Scotland tends to have a lower proportion of innovation active firms relative to the UK. Although in most sectors covered by the survey the proportion of innovation active firms in Scotland is around the UK average, there are two sectors with large gaps in performance compared to the UK. Traditional manufacturing performs above the UK average while wholesale & retail perform below the UK average. As Scotland has a smaller proportion of traditional manufacturing firms in the business base than the UK and a higher proportion of retail, the relative size and performance of these sectors will negatively affect Scotland's overall innovation performance.

Innovation investment is more widespread across sectors than R&D expenditure, and includes sectors not traditionally associated with R&D such as wholesale & retail and hotels & restaurants. Against most types of innovation expenditure, Scotland had a slightly higher proportion of firms with expenditure than the UK and innovation investment may be one of the reasons why the productivity gap between Scotland and the top quartile of OECD countries has improved in recent years.

Introduction

Strengthening levels of innovation is one of the cornerstones of the Scottish Government's Economic Strategy[1]. Innovation is a key catalyst for productivity growth as new ideas drive enterprise, create new products and markets and improve efficiency, delivering benefits to firms, customers and society. It is a crucial factor in determining competitiveness and national progress [2].

Until recently, the most common and well known measure of innovation has been the ratio of national expenditure on R&D to GDP[3]. Data shows that there has been a significant gap in business research and development (R&D) expenditure between Scotland and the UK, EU and OECD averages in recent years. Scottish Business Enterprise R&D (BERD) expenditure was 0.56% of Scottish GDP in 2009, lower than the rate for the UK as a whole (1.11%) and the EU (1.17%)[4]. Compared to other UK Government regions, Scotland ranked in 10th place out of the 12 regions.

However, while R&D is useful for measuring technology-based activities, it is increasingly recognised that this is only one element of the broader concept of innovation and is frequently more relevant for manufacturing than for services[5]. Evidence shows that firms introduce new products and services onto the market without necessarily performing R&D. A lot of innovation activity is based on (or embodied in) advanced machinery and computer systems purchased to implement new or improved processes and deliver new products and services. Innovation can also be purchased through rights to use patents, licences, trademarks and software, and can encompass training and new design and marketing processes[6]. Evidence also shows that many firms adopt multiple, complementary innovation strategies, with the most innovative firms introducing both product and process innovations as well as marketing or organisational innovations. Therefore, productivity growth can be achieved through advances in technology combined with new approaches to creating and delivering of goods and services.

There is now a solid body of evidence describing the relationship between research, innovation and economic development[7]. The evidence suggests that investment in 'intangible assets' that give rise to innovation (R&D, software, human capital and new organisational structures) now accounts for up to 12% of GDP in some countries and contributes as much to labour productivity growth as investment in tangible assets such as machinery and equipment. According to OECD estimates, investment in intangible assets accounted for around a quarter of labour productivity growth in the UK and other countries between 1995 and 2006[8].

The Community Innovation Survey (CIS) allows an assessment of business innovation performance, wider than just R&D expenditure, across European Union countries. CIS collects a range of information from businesses on the types of innovation they are involved in,

[1] The Government Economic Strategy, The Scottish Government, 2011
[2] Innovation and Growth: Rationale for an Innovation Strategy, OECD, 2007
[3] European Commission Staff Working Document: A Rationale for Action, European Commission 2010.
[4] Innovation and Research & Development - R&D Business Expenditure, The Scottish Government, 2010
[5] Measuring Innovation: A New Perspective, OECD, 2010
[6] European Commission Staff Working Document: A Rationale for Action, European Commission, 2010
[7] European Commission Staff Working Document: A Rationale for Action, European Commission, 2010
[8] Ministerial Report on the OECD Innovation Strategy: Innovation to strengthen growth and address global and social challenges, OECD, 2010

motivation for innovation, spending on a range of innovation activities beyond R&D, collaboration and linkages between businesses or with public research organisations, as well as data on sales from product innovations[9]. In light of the growing recognition that innovation encompasses a wider range of activities, and that broader metrics are required to reflect this, the Innovation Survey provides a key data set to measure innovation within businesses[10].

UK Innovation Survey, Scottish Sample and Analysis

This paper presents an analysis of the Scottish results of the 2009 UK Innovation Survey. The 2009 survey is the third bi-annual survey, and this analysis focuses on Scottish trends over time and provides comparisons with the UK as a whole.

The UK Innovation Survey is a voluntary survey of a sample of firms with 10 or more employees. It has been conducted every two years by the Office for National Statistics (ONS) on behalf of the Department for Business, Innovation & Skills (BIS) and its predecessors since 2005. Earlier surveys were undertaken every four years[11]. The results feed into the Community Innovation Survey (CIS), which allows Europe's progress in the area of innovation to be monitored.

Both across the UK as a whole, and specifically in Scotland, the 2009 survey achieved a response rate of 49%. In Scotland, 2,393 enterprises were surveyed and 1,184 questionnaires were returned. To compensate for the firms that did not respond to the survey and those not selected for the sample, BIS developed weightings so that the results are representative of the population of firms as a whole. On average each respondent represents 13 enterprises in the population[12]. If firms were part of a larger enterprise group, their answers related to that firm only, excluding subsidiaries or parent enterprises. This allows a spatial understanding of innovation activity across the UK.

The analysis in this paper is based on microdata sourced from ONS[13]. Scotland's performance is compared over time and to the UK by business size band. It focuses on innovation activity indicators and innovation 'inputs' and 'outputs', and compares performance differences between innovation active and inactive businesses. Analysis of the data at sector level explores the relationship between Scotland's overall innovation performance and the structure of business base.

Analysis of the main innovation and broader indicators in this paper are based on weighted data. In line with the Scottish CIS3, CIS4 and CIS5 analyses, however, the remaining analysis is based on un-weighted data. The rationale for using un-weighted data was outlined in the 2005 report published by the Scottish Government in 2007[14].

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[9] Measuring Innovation: A New Perspective, OECD, 2010

[10] Annual Innovation Report, BIS, 2010

[11] UK Innovation Surveys were carried out in 1993 for the period 1990-1992, in 1997 for the period 1994 to 1996, and in 2001 for the period 1998-2000.

[12] UK Innovation Survey 2009 Statistical Annex, BIS, 2010

[13] This contains statistical data from ONS which is Crown copyright and reproduced with the permission of the controller of HMSO and Queen's Printer for Scotland. The use of the ONS statistical data does not imply the endorsement of the ONS in relation to the interpretation or analysis of the statistical data. This work uses research datasets which may not exactly reproduce National Statistics aggregates.

[14] The Community Innovation Survey 4: Profiling Scotland's Innovation Performance, Dr. Mark Freel and Prof. Richard Harrison, The Scottish Government, 2007, Weights which are incorporated in the data can only be correctly scaled where information is given by all respondents, however, some respondents may only partially

1. Main Indicators

'Innovation active' firms are defined as enterprises engaged in any of the following[15]:

- Introduction of a new or significantly improved product (goods or service) or process;
- Engagement in 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.

Broader areas of innovation include the introduction of innovative business practices and organisational structures:

- 'Wider innovators' are firms that have introduced new and significantly improved forms of organisation, business structures or practices aimed at improving internal efficiency or effectiveness of approaching markets and customers;
- 'Broader innovators' are firms that are either innovation active or wider innovators, or both.

1.1 Innovation Active Businesses in Scotland

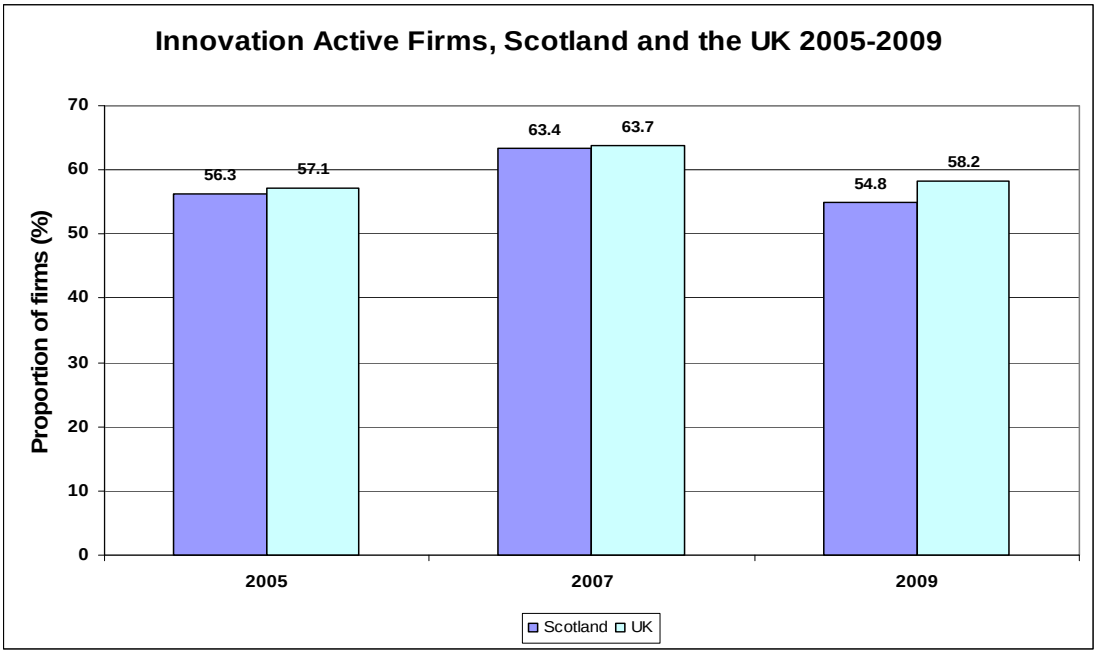
In the 2009 survey, in Scotland and the UK, the proportion of innovation active firms was 54.8 per cent and 58.2 per cent respectively, lower than in the 2005 and 2007 surveys. The 2009 survey covered the period 2006 to 2008, and by the end of 2008 the Scottish and UK economies were in recession. This is likely to have had an impact on the number of businesses starting innovation activities in 2008 and affect the overall number of innovation active firms in the survey period[16]. The fall in innovation activity levels between the 2007 and 2009 surveys was slightly greater in Scotland than the UK and, since 2005, Scotland has tended to lag the UK as a whole (figure 1).

complete a questionnaire. In addition, the survey contains filter questions, inviting only enterprises fulfilling certain criteria to answer parts of the questionnaire and the relevant population for weighting purposes would not be all firms in the IDBR

[15] First findings from the UK Innovation Survey 2009, Stephanie Robson and Martin Kenchatt, Economic & Labour Market Review, Vol 4 , No 3, March 2010

[16] First findings from the UK Innovation Survey 2009, Stephanie Robson and Martin Kenchatt, Economic & Labour Market Review, Vol 4 , No 3, March 2010

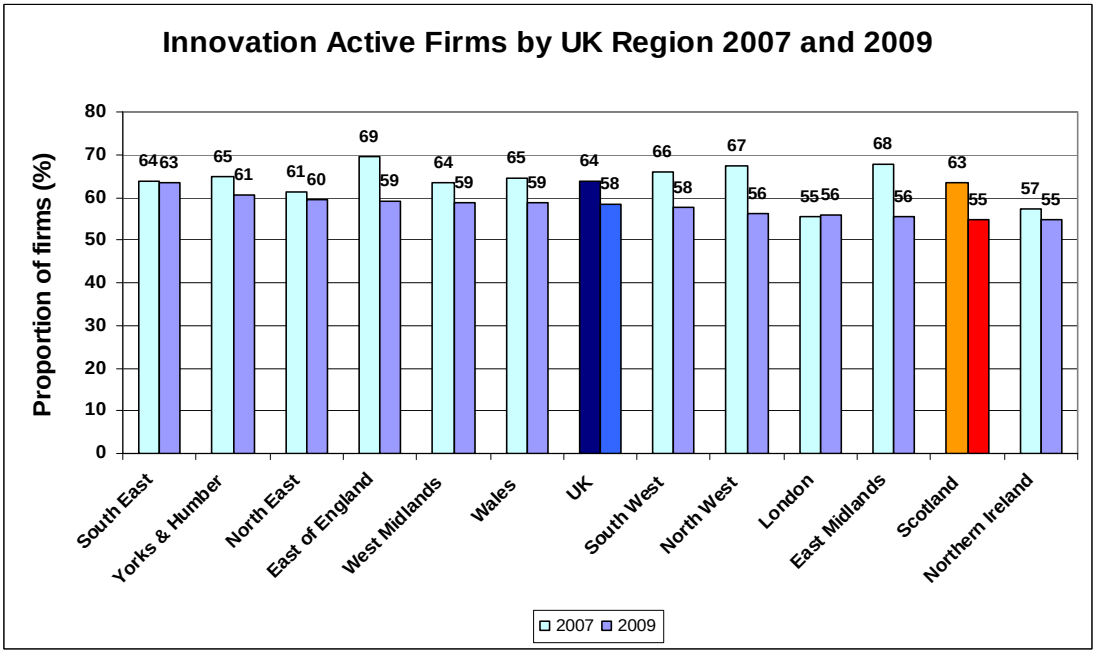
Figure 1: Proportion of Innovation Active Firms in Scotland and the UK, 2005-2009



Source: ONS

Scotland ranked in 11th place out of the 12 UK Government Office Regions in the 2009 survey, although since 2007 the gap in performance between the lowest and highest regions has narrowed. It is also worth highlighting that smaller sample sizes for the regions leads a bigger standard error in the results than for the larger UK sample[17]. Therefore, the differences between regions may not be significant.

Figure 2: Innovation Active Firms by Government Office Region 2007 and 2009



Source: ONS

[17] The standard error is used to calculate the confidence interval for the range of values in which the population mean is expected to lie. Given the larger range of values for Scotland the Scottish population mean might not be very different from the UK population mean.

Figure 2 shows the proportion of innovative active firms ranged from 63 per cent in South East England to 55 per cent in Northern Ireland and Scotland in 2009. The regional patterns and rankings can generally be explained by differences in industrial composition and business size, and variations in sectoral business cycles and product life cycles[18]. This suggests levels of innovation activity differ depending on firm size and sector. Table 1 summarises the results for Scotland by size band and table 2 indexes these results relative to the UK = 100.

The results show that innovation activity levels tend to increase as the size of the business increases, reflecting the pattern shown in previous surveys. In 2009, the UK had a higher proportion of innovation active firms in the small and medium size-bands than in Scotland. However, Scotland had a greater proportion of large firms that were innovation active. Compared to 2007, the proportion of innovation active small and medium sized firms fell more in Scotland than the UK (falls of -4.7 and -13.8 percentage points compared to -1.4 and -10.3), but less in large firms (-8.7 compared to -14.8).

Table 1: Innovation Indicators by Firm Size Band, Proportion of Firms (%), Scotland 2009

Activity	10 to 49 employees	50-249 employees	250+ employees	All 10+ employees
Innovation Active	53.8	58.2	67.1	54.8
Product Innovator	20.4	25.2	28.7	21.3
Process Innovator	11.8	14.2	22.9	12.5
Ongoing/abandoned activities	7.0	9.9	20.2	7.8
Innovation Expenditure	40.7	46.4	53.6	41.9
Wider Innovation:	23.5	34.8	45.6	25.9
• Corporate Strategy	14.0	16.9	24.4	17.1
• Management Techniques	9.4	15.4	26.0	14.6
• Organisational Structure	17.4	23.8	31.5	22.2
• Marketing Concept	13.5	15.1	21.3	15.6
Broader Innovation	54.9	66.9	71.8	57.3

Table 2 highlights the effect of this on all firms with 10 or more employees in 2009. Compared to the UK, large firms in Scotland outperformed the rest of the UK against most of the indicators, while the UK outperformed Scotland in product innovation in each size band.

[18] UK Innovation Survey 2009: Science and Innovation Analysis, BIS, 2010

Table 2: Main Innovation Indicators by Firm Size Band,
Scotland relative to UK = 100 2009

Activity	10 to 49 employees	50-249 employees	250+ employees	All 10+ employees
Innovation Active	94	93	110	94
Product Innovator	89	89	91	89
Process Innovator	99	92	121	99
Ongoing/abandoned activities	84	79	128	86
Innovation Expenditure	97	94	118	97
Wider Innovation	96	95	117	97
• Corporate Strategy	109	97	130	110
• Management Techniques	103	96	142	111
• Organisational Structure	109	101	120	109
• Marketing Concept	89	78	120	92
Broader Innovation	93	100	110	95

Note: If the figure for Scotland relative to the UK is less than 100, then the proportion of firms engaged in that innovation activity in Scotland was less than the proportion in the UK. Conversely, if the figure is greater than 100, then the proportion of firms engaged in that activity in Scotland was higher than in the UK.

New or Significantly Improved Products

The ONS report, "First findings of the UK 2009 Survey", notes that the increased investment in innovation activity reported in the 2007 survey in many cases may have resulted in product and process innovations during the period 2006-2008. Although still lagging the UK average of 23.9 per cent, the proportion of firms introducing new or significantly improved products in Scotland increased by almost two percentage points to 21.3 per cent, with product innovation activity almost returning to 2005 survey levels[19]. Nevertheless, despite an overall improvement, Scotland ranked in 10th place out of 12 UK regions. The performance gap between Scotland and the UK has remained broadly the same over three consecutive surveys and in 2009 only the North East and Northern Ireland had lower product innovation levels.

Scotland has had a smaller proportion of product innovators than the UK average in every business size band over the last three surveys, the only exception being in the 2005 survey, when there was a tendency for large firms in Scotland to have slightly higher product innovation activity. This could be due to differences in the sector breakdowns between Scotland and the UK or influenced by weightings. For example, the UK Innovation Survey Report 2009 showed that the highest proportions of product innovators were in engineering-based manufacturing, other manufacturing and knowledge-intensive services such as financial services.

[19] The OECD Glossary of Statistical Terms defines product innovations as the introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses. This includes significant improvements in technical specifications, components and materials, incorporated software, user friendliness or other functional characteristics.

As Scotland has a smaller proportion of firms in these sectors in its business base than the UK as a whole (around 34 per cent compared to 42 per cent[20]), then this is likely to reduce the overall proportion of firms that are product innovators when weightings are applied to the sample distribution. Similarly, the UK Innovation Survey 2009 analysis[21] shows that a higher proportion large firms were product innovators than small or medium sized firms. As, there is little difference in the distribution of firms by size band between Scotland and the UK, with small businesses having the largest share of the business base and large firms have the smallest share in each, it suggests that industry structure is the main influence on differences between the UK and Scotland in overall product innovation performance.

New or Significantly Improved Processes

In terms of process innovation, Scotland's performance relative to the UK is slightly better, with the proportion of firms around the UK average over the last three surveys. The proportion of process innovators increased between 2007 and 2009 in both Scotland and the UK, however, activity levels were still lower than those reported in the 2005 survey. In 2005, both Scotland and the UK had 16 per cent of firms that were process innovators compared to 12.5 per cent and 12.6 per cent respectively in 2009. The proportion of process innovators ranged from 14.2 per cent in the South East of England to 10.6 per cent in Northern Ireland in 2009. At 12.5 per cent, Scotland was close to the UK average, and ranked in 7th place out of 12 regions. Both product and process innovators are more likely to be larger firms. In the last three surveys a higher proportion of large Scottish firms were process innovators than across the UK as a whole.

Expenditure on Innovation

Most innovation active firms have expenditure associated with innovation activities. In 2009, 55 per cent of firms were innovation active in Scotland, 76 per cent of which had innovation expenditure. Firms reported a range of investments, including R&D, training and the acquisition of equipment and software. Although the proportion of firms reporting expenditure fell in 2009 compared to the previous two surveys, this may partly have been due to the economic downturn. Once again, Scotland's overall performance was broadly similar to the UK (42 per cent compared to 43 per cent across the UK). For the third consecutive survey, Scotland remained in 8th place out of the 12 regions.

Over the last three surveys, a higher proportion of firms in the largest size band have had innovation-related expenditure in Scotland than in the UK. The effect of this, combined with the proportion of large firms with ongoing activities, could lead to an increase in large firms' innovation activity levels in the next survey.

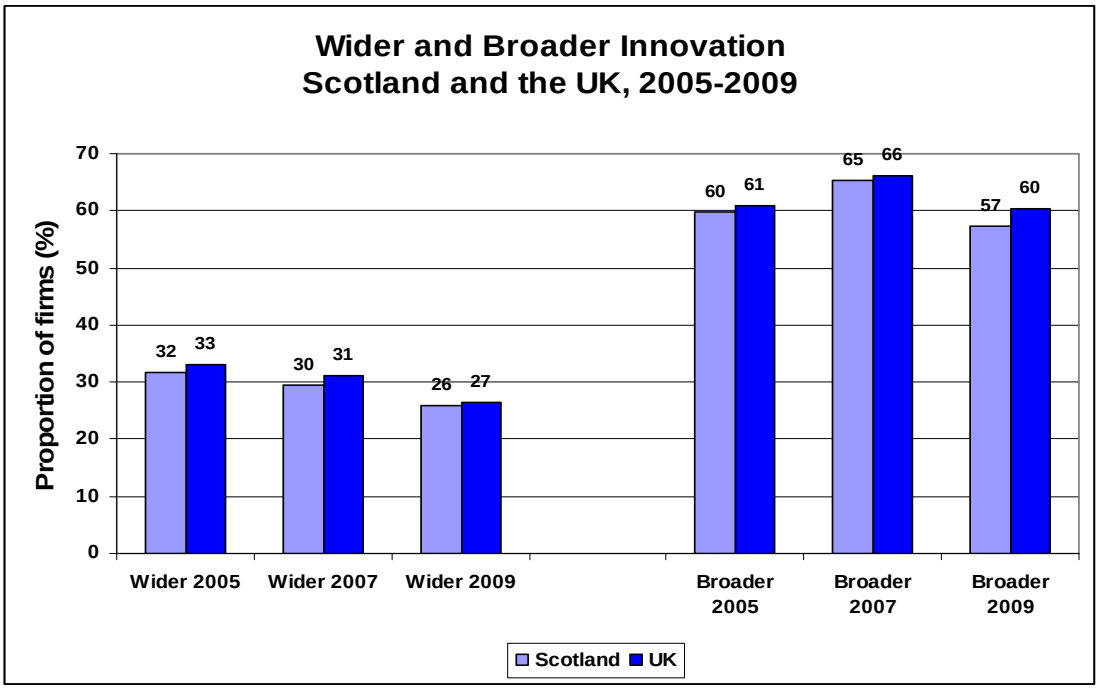
Wider Innovation

In addition to technological development and investment in innovation-related activities, strategic innovations are also important in terms of improving firms' competitiveness and growth opportunities. Wider innovation indicators are used to measure this. Wider innovators are those firms that have undergone strategic, organisational, managerial techniques and marketing changes to achieve efficiencies or improvements to service. The proportion of firms

[20] Innovation Survey weighted and non-weighted sector data provided by BIS
[21] UK Innovation Survey 2009 Statistical Annex, BIS, 2010

reporting wider and broader innovation activity fell between 2007 and 2009 in Scotland and the UK (figure 3).

Figure 3: Wider and Broader Innovation in Scotland and the UK, 2005-2009



Source: ONS

Firms were asked if they had made any major changes to their business structure or practices over the survey period. As in the rest of the UK, there was less engagement by Scottish firms in non-technological innovation than in the previous survey, continuing the decline from 2005. Scotland ranked in 6th place out of the 12 UK regions. The proportion of wider innovators in the largest size band fell to 46.5 per cent in 2009 from 52.5 per cent in 2007. Smaller firms also recorded a fall and remain less likely than large firms to engage in wider innovation.

Broader Innovation

Broader innovators are those firms that are either innovation active or wider innovators, or both. Broader innovation gives an overall picture of the level of innovation, both technological and non-technological. Broader innovation levels in Scotland rose between 2005 and 2007 before falling back in 2009 by almost nine percentage points to 57.3 per cent, increasing the gap with the UK. Ranked in 11th place out of the twelve UK regions, this mirrors Scotland's overall innovation activity performance. Only Northern Ireland had lower proportions of 'broader' and 'innovation active' firms.

Scotland did have a higher proportion of broader innovators in the largest firm size band than the UK in 2009. Given that the broader innovation indicator includes firms that are innovation active, the high proportion of large innovation active firms in Scotland is likely to explain the high proportion of large firms that are broader innovators.

Based on the above definitions of wider and broader innovation, the broader innovation indicator can be used to illustrate the extent to which firms engage in wider (strategic) innovation only. This is calculated by subtracting the proportion of innovation active firms from

the proportion of broader innovators. Across all the UK regions the proportion of firms engaging only in strategic innovation activity is very low at around 2.3 per cent. The figure for Scotland sits at around 2.5 per cent. This suggests that firms in Scotland tend not to change behaviours or business strategies as an independent means of improving competitiveness. Rather, they tend to introduce strategic, organisational, marketing or management changes in conjunction with other technological innovations.

The results outlined so far have shown that, generally, any differences between the results for Scotland and the UK are relatively small, particularly when considering the narrow range of performance across the UK regions for many indicators. However, there are differences in performance at firm size band level[22]. Small and medium sized firms in Scotland underperform relative to the UK while large firms do better, and, for Scotland (and for the UK as a whole), innovation activity increases with firm size.

1.2 Innovation Inputs and Outputs

There are several types of innovation expenditure that firms may undertake, such as bought-in machinery, equipment, software, knowledge and expertise. Impact on turnover is a measure of the effects, or outputs, of innovation. This is important since, for businesses, the value of innovation is the financial return. This section reviews:

- Forms of innovation expenditure (inputs);
- Turnover from innovation (outputs)

The 2005 and 2007 surveys highlighted that R&D accounts for only a small proportion of total innovation spend and total innovation outcomes, and that low levels of formal R&D may not necessarily result in low levels of innovation. In terms of how well Scotland performs using innovation expenditure as a measure instead of Business R&D as a percentage of GDP, Scotland performs fairly well compared to the UK as a whole. Calculating total innovation expenditure per employee for all innovation active firms with 10 or more employees, Scotland ranks in 4th place out of 12 UK regions. Scotland had average expenditure of £3,268 compared to £3,018 across the UK as a whole. Therefore, although a slightly lower proportion of Scottish companies invested in innovation they tended to invest more than the UK average. Measuring innovation in this way, Scotland performs better relative to the UK than when measured using Business Enterprise R&D (BERD) figures. BERD data for 2009 shows that Scotland ranks in 10th place among UK regions for expenditure per employee, with average expenditure of £592 compared to a UK average of £1,037[23].

The Innovation Survey 2009 results showed that across Scotland and the UK, bought-in technology was the most frequently cited type of innovation expenditure across most business size bands; although there were differences in the distribution of firms' actual expenditure (figures 4a and 4b). Firms in Scotland had invested a higher proportion of their total innovation expenditure in bought-in technology and training than the UK overall. Other notable differences include marketing and external R&D, where UK firms as a whole invested a higher proportion of innovation expenditure Scottish firms.

[22] Although, as noted earlier, margins of error are an issue.
[23] Innovation and Research & Development - R&D Business Expenditure, The Scottish Government, 2010

Figure 4a: Scottish Expenditure in 2009

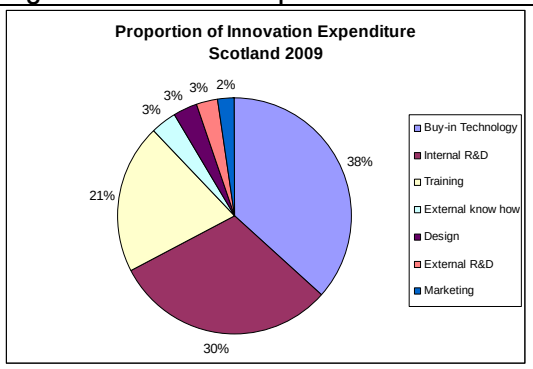
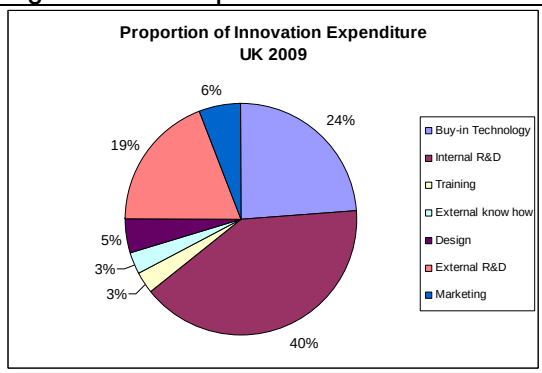


Figure 4b: UK Expenditure in 2009



Source: ONS

Compared to the UK, large firms in Scotland had a greater proportion of expenditure on bought-in technology such as machinery, equipment and software and firms in each size band had a greater proportion of expenditure on training. This indicates a greater tendency in Scotland for firms to introduce new products on the market or new processes without necessarily performing R&D. Considering trends by size band, large firms in Scotland were more likely to spend on in-house R&D, external R&D, bought-in technology and marketing. In medium sized firms, design and marketing accounted for the greatest proportions of expenditure and in small firms buying in external know-how and training were important. It is likely that the sector breakdown will also influence these results. For example, the UK Innovation Survey 2009 statistical annex shows that financial and business services had the highest proportion of expenditure in internal R&D while manufacturing had the highest proportion on external R&D and transport and logistics had a high proportion of expenditure in training. This area requires further research and analysis to understand the implications for Scotland.

Affect on Turnover of Product Innovations

The 2005 and 2007 surveys noted that the biggest proportion of firms' turnover was generated from products that were wholly unchanged during the survey period. Less than 40 per cent of turnover was attributed to new or improved products. However, between 2007 and 2009 the proportion increased by almost 9 percentage points in Scotland and by 2009 almost half of turnover was attributed to new or improved products in innovation active firms with 10 or more employees. The biggest increase was due to 'new to the market products', although the percentage of turnover from improved products also increased by two percentage points. This is illustrated in figures 5a and 5b.

Figure 5a: Turnover in Scotland 2007

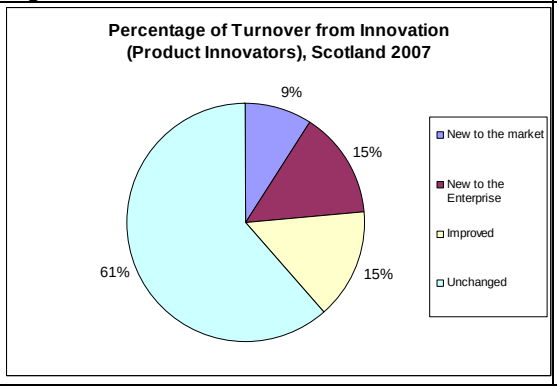
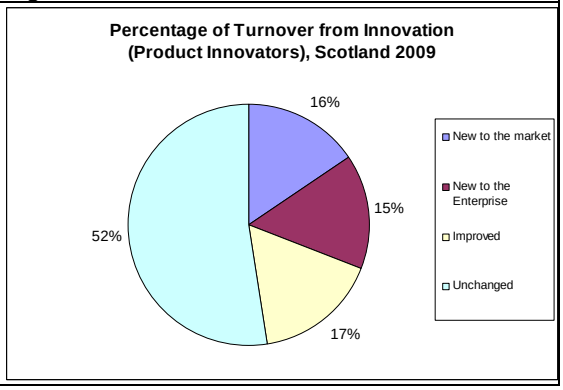


Figure 5b: Turnover in Scotland 2009



Source: ONS

Small firms in particular had a higher proportion of turnover from 'new to market' and 'new to business' products than medium and large sized companies (table 3), and a higher proportion of firms in Scotland in every business size band had a greater proportion of their turnover from new and improved products than in the UK (table 4).

Table 3: Percentage of Turnover by Product/Service Type and by Firm Size Band, 2009

Product/service	10-49 employees	50-249 employees	250+ employees	All 10+
New to market	18.5	13.4	11.2	15.7
New to business	16.7	13.1	14.6	15.3
Significantly improved	16.1	16.2	17.8	16.5
Unchanged/modified	48.7	57.2	56.5	52.6

Table 4: Percentage of turnover by Product/Service Type and by Firm Size Band relative to UK = 100, 2009

Product/service	10-49 employees	50-249 employees	250+ employees	All 10+
New to market	112	113	132	117
New to business	112	109	118	113
Significantly improved	105	113	113	109
Unchanged/modified	91	93	89	91

Calculating the returns from innovation expenditure in turnover terms, table 5 estimates how much turnover (£) is generated for every £1 of innovation expenditure. Clearly, large firms' expenditure on bought-in technology and in-house R&D has produced a higher return on investment in Scotland.

Table 5: Estimated £s of turnover relative to £1 of expenditure, 2009

	10-49 employees	50-249 employees	250+ employees	All 10+
Scotland	£3	£13	£35	£23
UK	£3	£9	£12	£12

Potentially, some of the difference between Scotland and the UK may be explained by the extent to which products are new to the market, or any differences in the sector breakdowns between the Scottish and UK samples. Previous reports have shown that some sectors are more innovation active than others. For example, the 2007 results showed that Scottish manufacturing firms were more innovation active while financial and business services firms were less innovation active than the UK average. Some increase in turnover could also be due to the increased investment in the previous survey period since, over the last three surveys, a higher proportion of firms in the largest size band have had innovation-related expenditure in Scotland than in the UK.

1.3 Differences in Performance: Innovation Active and Inactive

Evidence suggests that innovation has a major impact on productivity at the level of the firm and that innovating businesses are more likely to grow. BIS have reported that firms that innovate do better than those that do not and that innovation drives productivity growth.[24] This section compares the performance of innovation active and inactive business to determine:

- Growth in turnover and employment
- Propensity to export to the UK and internationally
- Extent of co-operation and collaboration

Growth Performance for Turnover and Employment

Innovation contributes to increased productivity and competitiveness, and innovative businesses are more likely to achieve growth when new innovations are exploited to develop competitive advantage.[25] According to NESTA[26], innovation was responsible for two-thirds of the UK's private-sector labour productivity growth between 2000 and 2007, and innovative firms grow twice as fast, both in employment and sales, as firms that fail to innovate.[27]

The 2009 survey results show that both innovation active and inactive businesses grew in terms of turnover and employment over the survey period. However, turnover growth rates were significantly higher for innovation active firms while employment growth rates were slightly higher for inactive firms.

Growth in Turnover

The estimated increase in total turnover for innovation active firms between 2006 and 2008 was more than £18 billion compared to just over £1 billion for non innovation active firms. The

[24] Innovation and Research Strategy for Growth, BIS, 2011
[25] The 2008 Productivity and Competitiveness Indicators, BERR
[26] The Innovation Index, Measuring the UK's investment in innovation and its effects
[27] The vital 6 per cent How high-growth innovative businesses generate prosperity and jobs, NESTA 2009

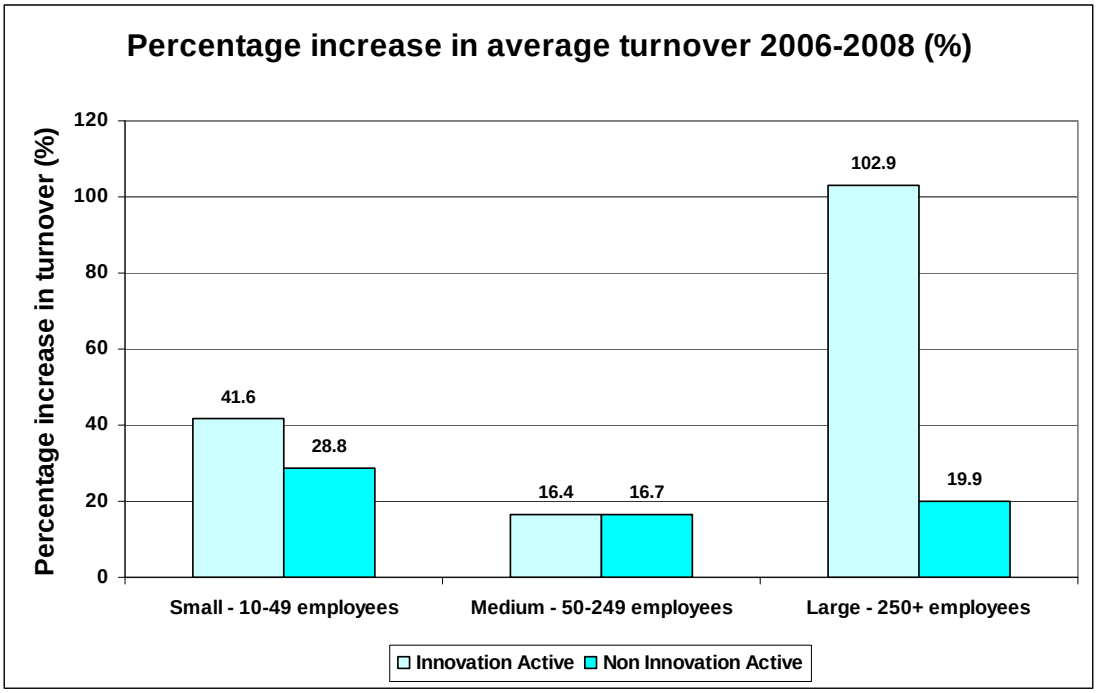
average increase per firm over the period was also greater for innovation active firms. Table 6 shows turnover growth of 87% for innovation active compared to 20% for inactive firms.

Table 6: Growth in Turnover 2006-2008, Scotland

All 10+ Firms	Innovation Active	Innovation Inactive
Total turnover increase 2006-2008 £m	18,198	1,139
Average turnover per firm in 2006 £m	29.1	12.4
Average turnover per firm in 2008 £m	54.4	14.9
Percentage increase in average turnover 2006-2008 (%)	86.7	19.8

Figure 6 shows that large innovation active firms experienced the highest increase in turnover. In the smallest size band innovation active firms' turnover increased by almost 50% more than inactive firms, however, there was little difference in growth for firms in the medium size category.

Figure 6: Percentage increase in average turnover by size band, Scotland 2006-2008



Source: ONS

Growth in Employment

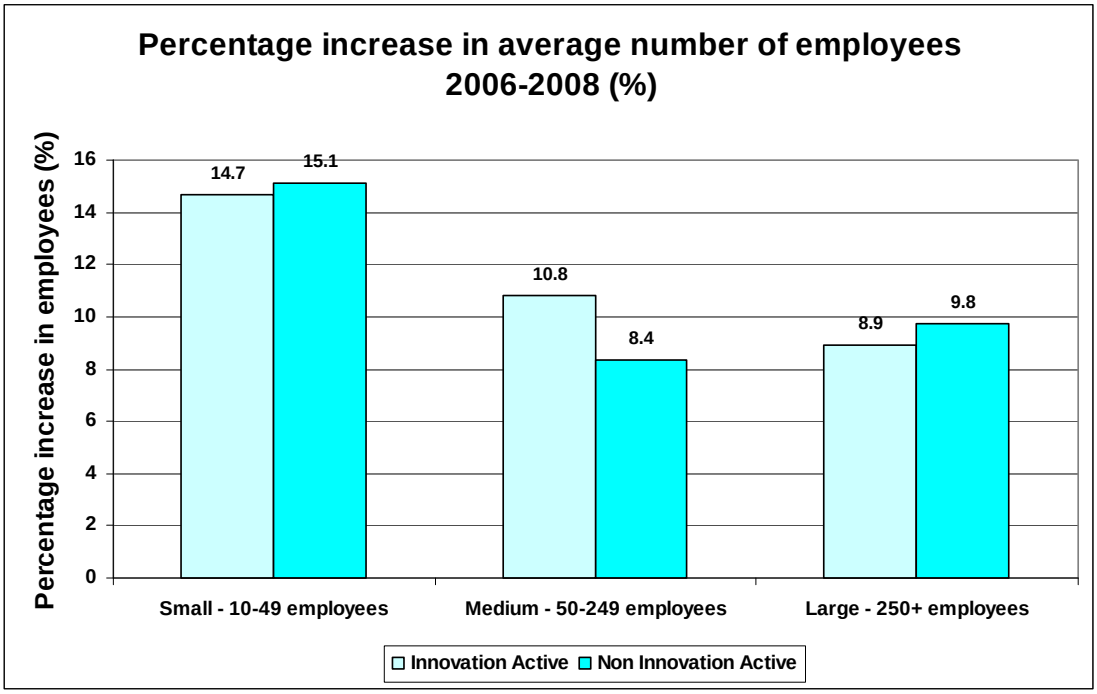
The average number of employees per firm grew faster in non innovation active businesses between 2006 and 2008; although in absolute terms the greatest increase was in innovation active businesses. Table 7 shows that on average increase innovation active firms increased their headcount by 21, almost double the increase of 11 people in inactive firms on average.

Table 7: Growth in Employees 2006-2008, Scotland

All 10+ Firms	Innovation Active	Innovation Inactive
Total increase in employees	14,818	5,107
Average number of employees per firm in 2006	218	112
Average number of employees per firm in 2008	239	123
Percentage increase in average number of employees	9.4	9.9

In both innovation active and inactive firms, the biggest increases were in the smallest size band. The largest and smallest innovation active firms had slightly lower percentage increases in the number of employees (figure 7).

Figure 7: Percentage increase in employees by size band, Scotland 2006-2008



Source: ONS

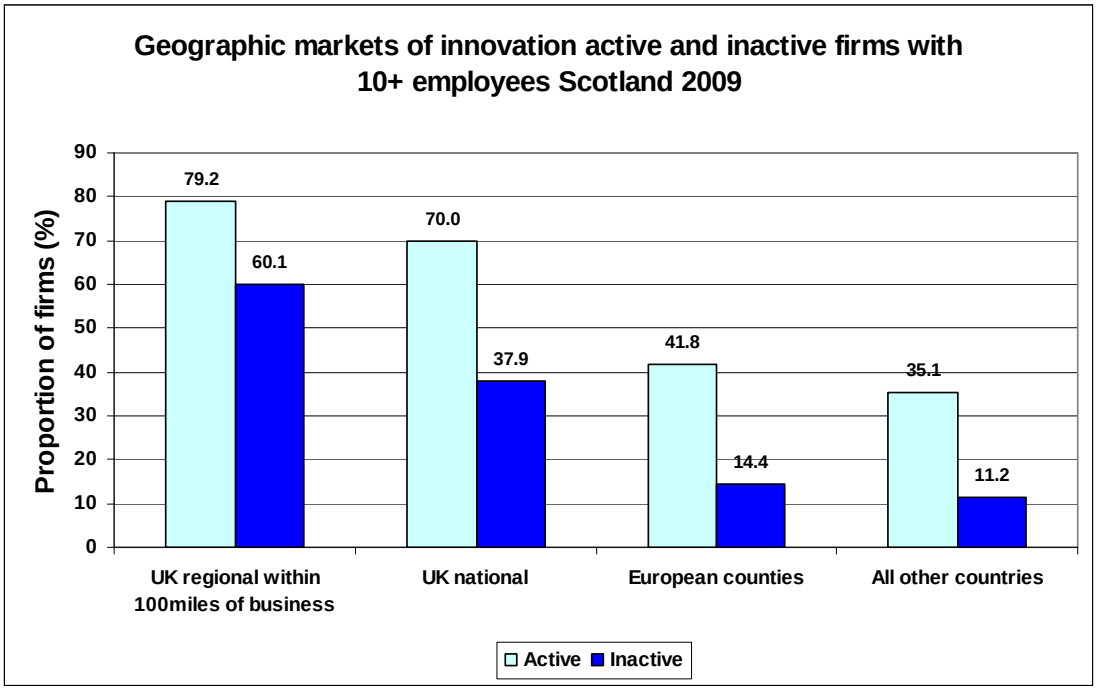
These results indicate that, generally, innovation active businesses became more competitive than their non innovation active counterparts given that, in the smallest and, in particular, the largest sizes, the proportionate increase in turnover was greater than the increase in the number of employees.

Markets

According to BIS, evidence on the economic benefits of exporting suggests that achieving greater export potential would bring substantial benefits. It is a powerful driver of productivity growth since market competition allows exporters to grow and gain market share while weaker firms shrink, enabling innovative and high productivity firms to achieve a level of growth not otherwise attainable. [28]

Exports have been contributing to Scotland's recovery from the 2008/09 recession, acting as one of the driving forces behind growth in manufacturing output and employment during 2010. Data from CIS6 on markets suggests that innovation active firms are more likely to export than their inactive counterparts. Almost double the proportion of innovation active firms had markets across the rest of the UK than inactive firms, and innovation active firms had around three times the proportion of inactive firms with markets in European and other countries (figure 8).

Figure 8: Geographic Markets of Innovation Active and Inactive Firms, Scotland 2009

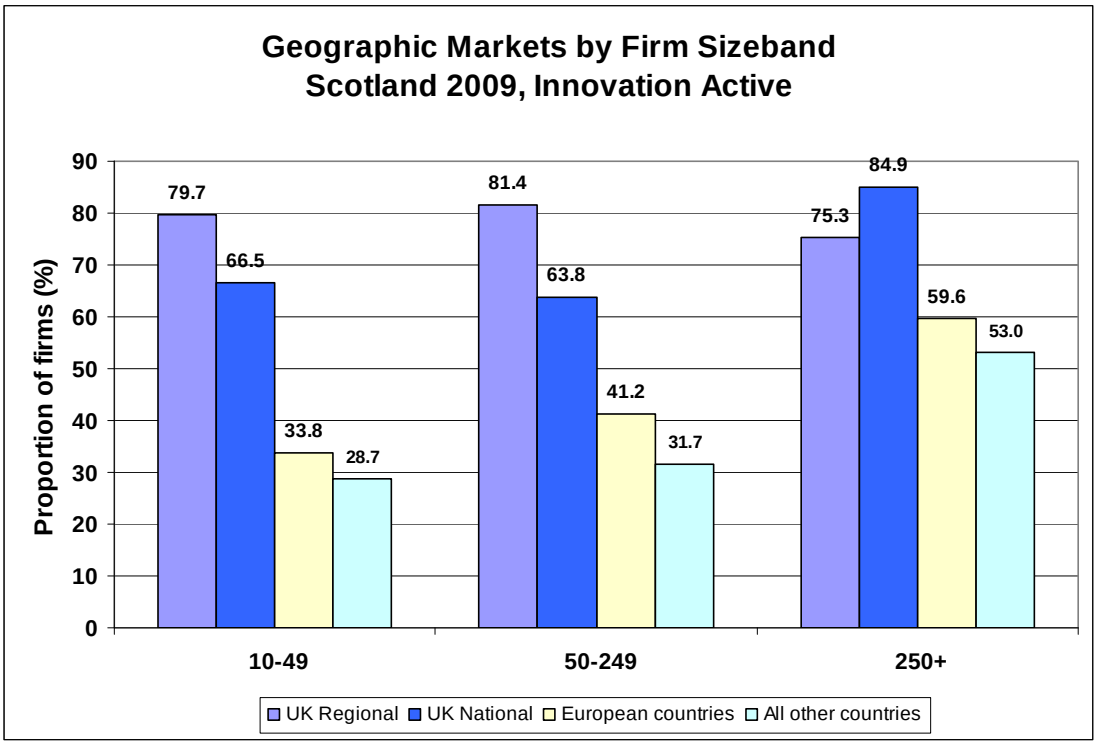


Source: ONS

Of firms that were innovation active, a higher proportion of those in the largest firm size band had markets outside the UK (figure 9).

[28] International Trade and Investment - the Economic Rationale for Government Support, BIS, 2011

Figure 9: Geographic Markets by Size Band, Innovation Active Only, Scotland 2009



Source: ONS

Collaboration

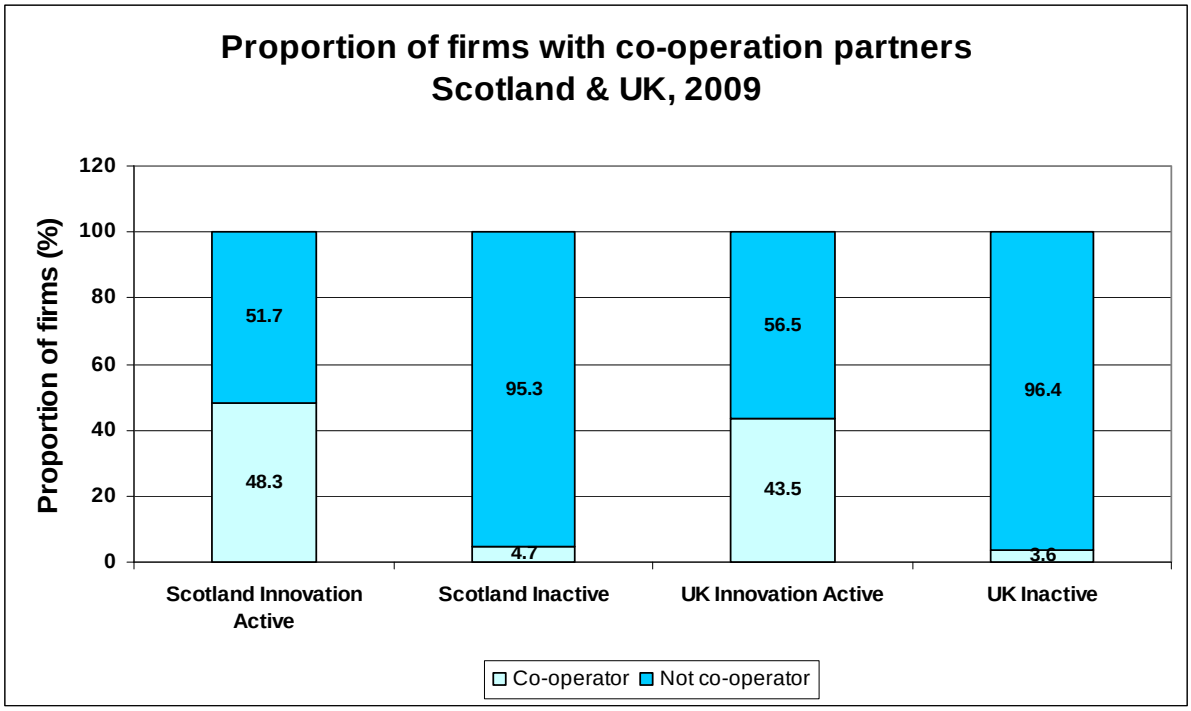
Research by NESTA has shown that collaborations between businesses, suppliers, contractors and (in some cases) clients and customers generate the majority of successful innovations.[29] For example, the UK Continental Shelf is mainly a mature area in which off-shore oil production requires constant innovation to locate and extract new reserves, and this depends on collaboration between production and service companies to develop and prove new technologies and techniques.

Collaboration with foreign partners can also play an important role in the innovation process by allowing firms to gain access to a broader pool of resources and knowledge at lower cost and to share the risks.[30] Large firms have a much higher propensity to collaborate internationally than SMEs.

The 2009 survey showed that, as well as a greater proportion of innovation active firms having international export markets, a greater proportion of innovation active firms co-operated with others on innovation (figure 10).

[29] Hidden Innovation How innovation happens in six 'low innovation' sectors, NESTA, 2007
[30] International collaboration on innovation, OECD

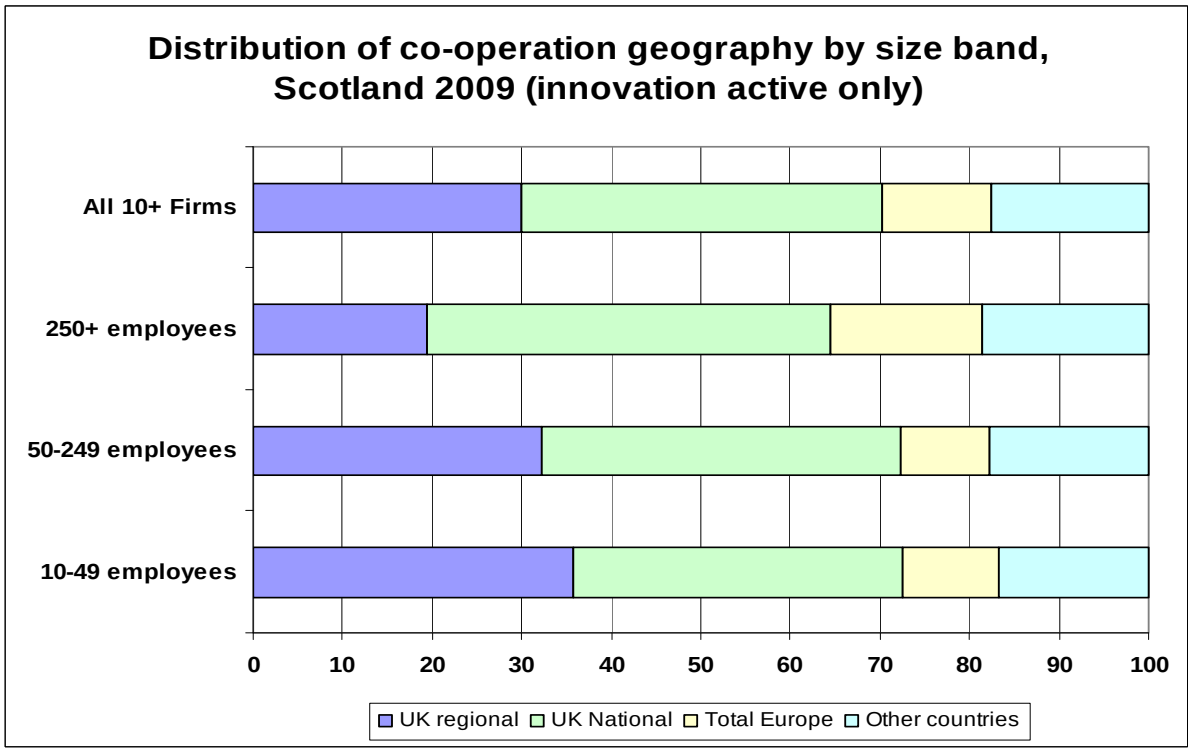
Figure 10: Proportion of Firms with Co-operation Partners, Innovation Active and Inactive 2009



Source: ONS

Figure 11 shows the distribution of market by firm size band for innovation active firms only. This highlights that the larger the firm size, the greater proportion of firms have non local markets.

Figure 11: Geography of Co-operation by Firm Size Band, Innovation Active Only, 2009



Source: ONS

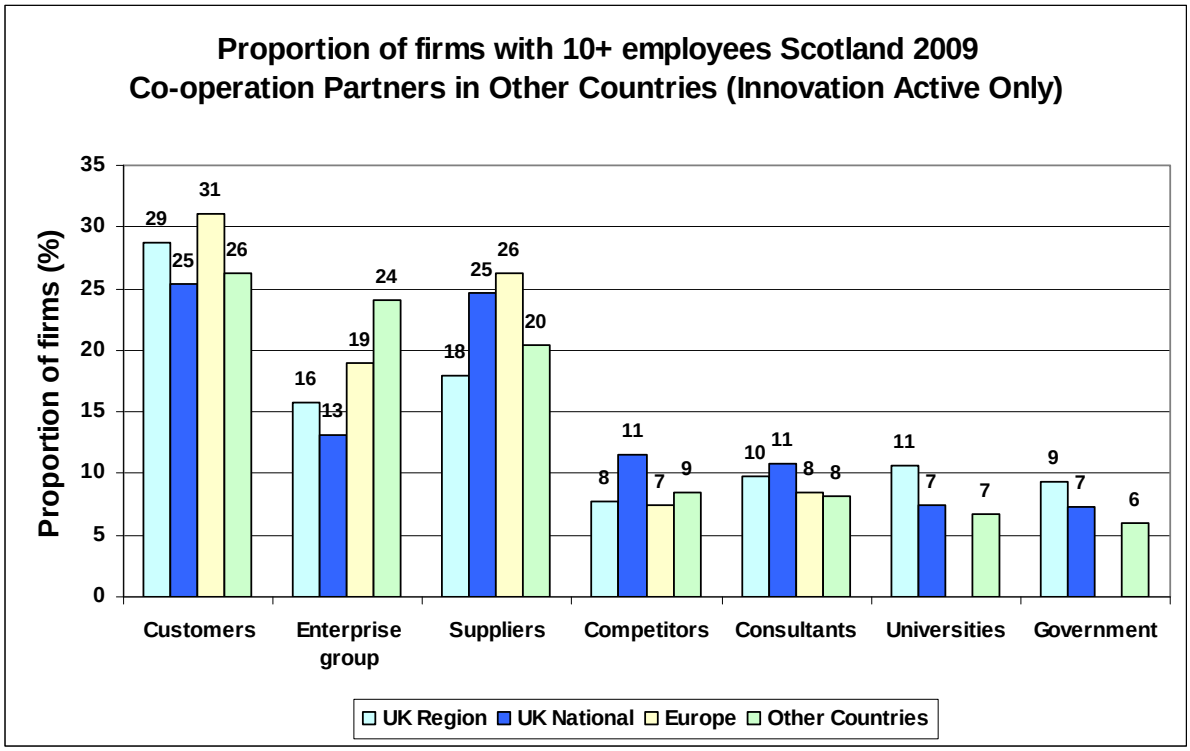
This is highlighted when the three size bands are indexed relative to all innovation active 10+ firms = 100 (table 8).

Table 8: Geography of Co-operation indexed to all 10+ Innovation Active Firms = 100

Markets	10-49 employees	50-249 employees	250+ employees
UK Regional	119	107	65
UK National	92	100	112
Total Europe	87	81	137
Other countries	95	101	107

At each level of geography customers, other firms in the company and suppliers were the most frequently cited co-operators (figure 12).

Figure 12: Co-operation Partners by Geography, Innovation Active Only, 2009



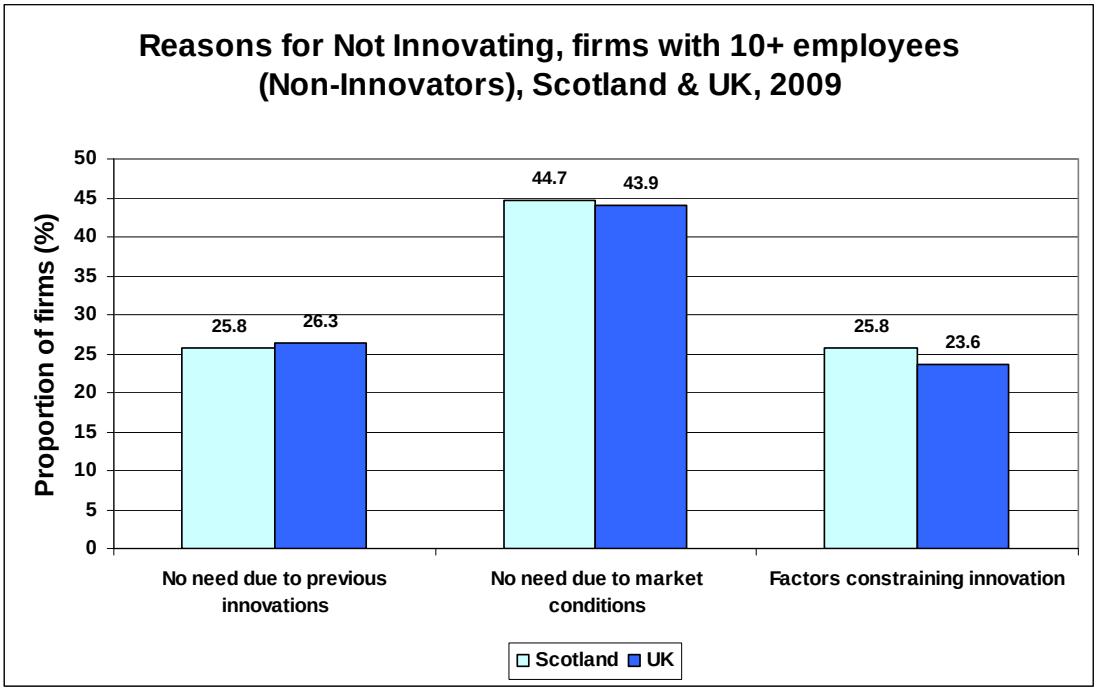
Source: ONS

1.4 Barriers and Constraints on Innovation

Reasons for not innovating

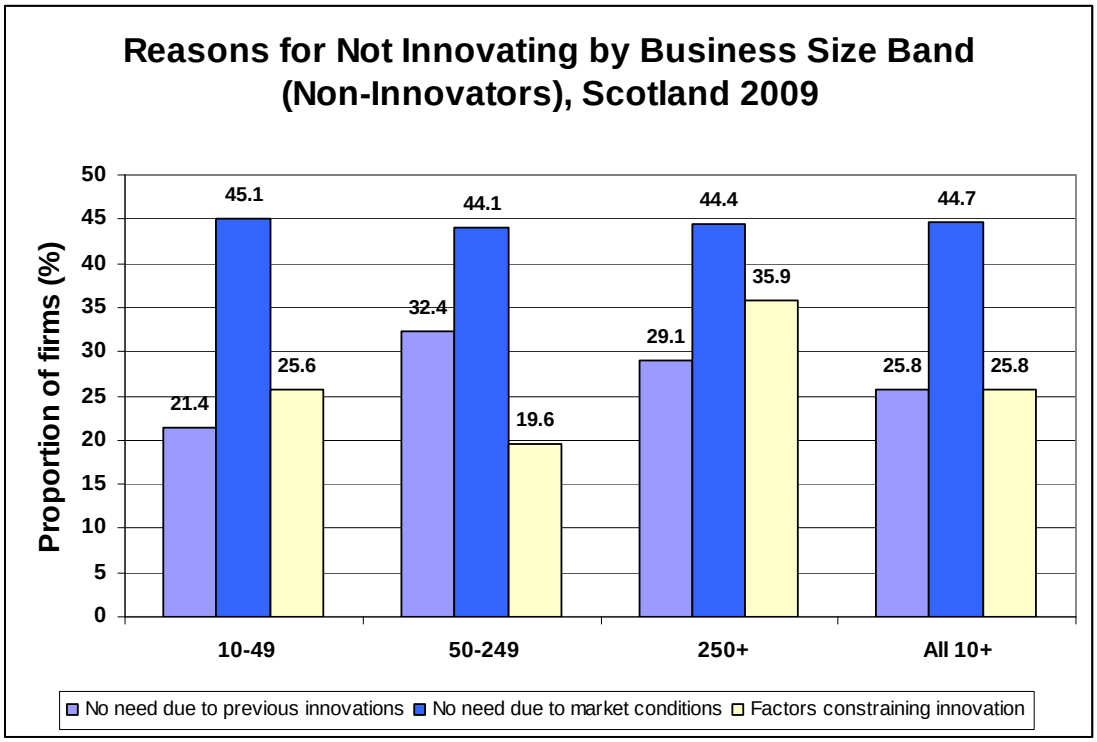
There was little difference in either the results for Scotland and the UK, or by business size band within Scotland as figure 13 illustrates. 'No need due to market conditions' was the most frequently cited reason for not innovating in Scotland and the UK in every size band. Figure 14 details the results for Scotland.

Figure 13: Reasons for Not Innovating, Scotland & UK, 2009



Source: ONS

Figure 14: Reasons for Not Innovation by Size Band, Scotland, 2009

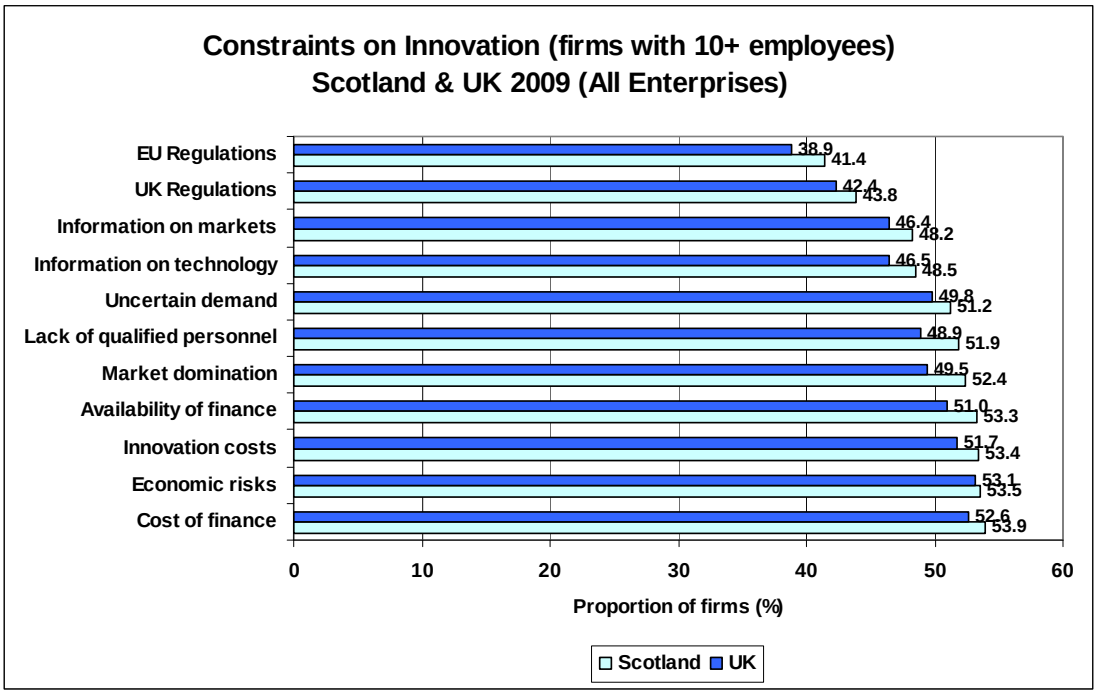


Source: ONS

Constraints on Innovation

Firms were asked about the importance of a number of factors in constraining their innovation activities, by ranking each factor as high, medium, low or not applicable. The results for firms with 10 or more employees in Scotland were broadly the same as in the UK as a whole for constraints of some importance. The cost of finance, economic risks, innovation costs and availability of finance were the most frequently cited constraints (figure 15).

Figure 15: Constraints on Innovation, Scotland & UK, 2009



Source: ONS

Large firms were more concerned about innovation costs than small and medium sized firm, but large firms were less concerned about the availability of finance than smaller firms. Perceived economic risk was most frequently cited for small firms while medium sized firms reported the market domination of established businesses as the main constraint (table 9).

Table 9: Top 5 constraints ranked by business size band, Scotland 2009

Constraints	10-49 employees	50-249 employees	250+ employees	All 10+
Cost of finance	2	2	2	1
Excessive perceived economic risks	1	5	3	2
Direct innovation cost too high	4	4	1	3
Availability of finance	3	2	6	4
Market dominated by established businesses	6	1	3	5

Indexing the results relative to all 10+ employee firms = 100, a higher percentage of large firms reported any of the top five factors as constraints than small, and in particular, medium sized firms, as detailed in table 10.

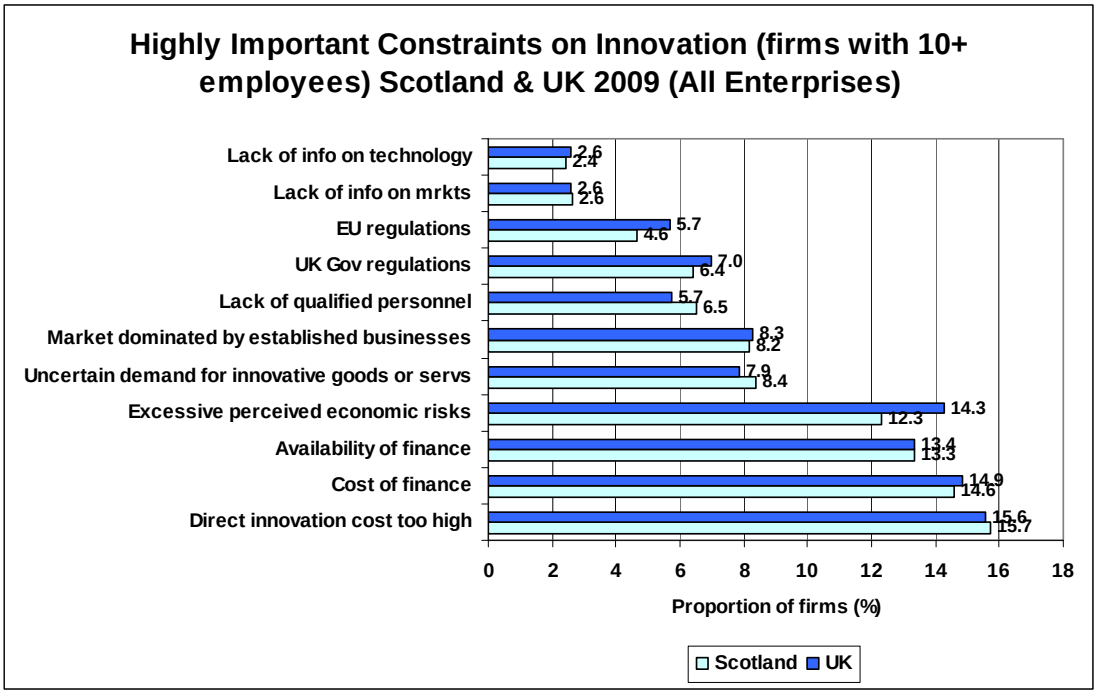
Table 10: Top 5 constraints relative to all 10+ firms = 100, Scotland 2009

Constraints	10-49 employees	50-249 employees	250+ employees
Cost of finance	100	94	107
Excessive perceived economic risks	101	92	107
Direct innovation cost too high	99	93	111
Availability of finance	101	95	105
Market dominated by established businesses	97	99	109

Comparing Scotland to the UK, slightly higher percentages of small and large sized businesses and smaller percentages of medium sized businesses reported constraints in Scotland than in the UK.

The proportion of firms citing factors as highly important constraints on innovation in Scotland was broadly similar to the UK as a whole, as figure 16 illustrates. Within Scotland, 4 of the top 5 highly important constraints are the same as constraints of any importance (table 11).

Figure 16: Highly Important Constraints on Innovation, Scotland & UK, 2009



Source: ONS

Table 11: Top 5 highly important constraints by business size band, Scotland 2009

Highly Important Constraint	10-49 employees	50-249 employees	250+ employees	All 10+
Direct innovation cost too high	1	1	1	1
Cost of finance	2	3	2	2
Availability of finance	3	4	4	3
Excessive perceived economic risks	4	2	3	4
Uncertain demand	5	6	5	5

However, relative to all 10+ firms a higher proportion of firms in Scotland in the smallest size band report these as highly important, as table 12 shows. There is a similar picture across the UK as a whole.

Table 12: Top 5 highly important constraints relative to all 10+ firms = 100, Scotland 2009

Highly Important Constraint	10-49 employees	50-249 employees	250+ employees
Direct innovation cost too high	117	79	88
Cost of finance	122	72	84
Availability of finance	128	77	65
Excessive perceived economic risks	114	90	80
Uncertain demand	108	86	99

Examining the detail of all highly important constraints in small firms, a smaller proportion of Scottish firms reported perceived economic risks as a highly important constraint than across the UK, as well as UK and EU regulations.

A higher proportion of Scottish firms cited lack of qualified personnel, despite firms in all size bands having higher proportions of employees holding degrees in science or engineering subjects, or in other subjects. This may indicate that large firms are able to attract more graduates than small firms if applicants believe their career prospects are greater in larger firms.

Generally, however, the broad picture overall is fairly similar for Scotland and the UK. Table 13 details the proportions of firms in the smallest firm size band.

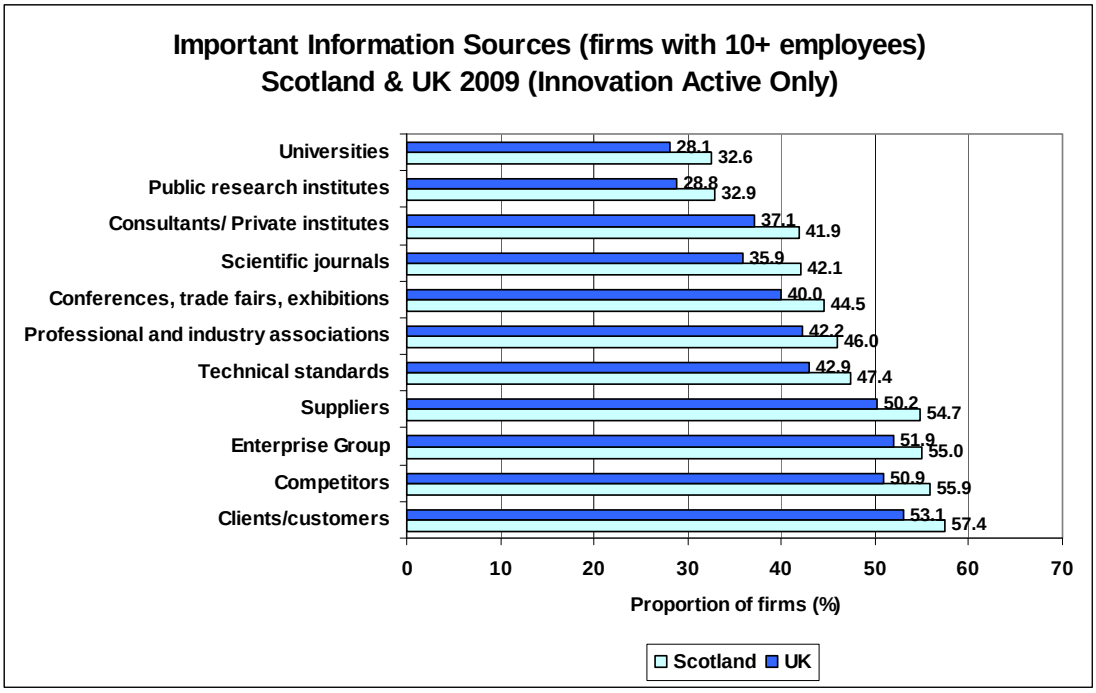
Table 13: Proportion of small firms reporting factors as constraints on innovation

10-49 employees	Scotland	UK	% difference
Direct innovation cost too high	18.4	17.6	4.4
Cost of finance	17.9	18.2	-1.9
Availability of finance	17.1	16.6	2.8
Excessive perceived economic risks	14.0	16.4	-16.5
Uncertain demand	9.0	8.8	2.8
Market dominated by established businesses	8.7	8.9	-2.2
Lack of qualified personnel	8.4	6.8	19.2
UK Gov regulations	7.4	8.6	-17.3
EU regulations	6.0	7.3	-20.6
Lack of info on markets	3.0	3.0	1.0
Lack of info on technology	2.8	2.8	0.1

Information Sources

Information on markets and information on technology were among the least cited constraints by all 10+ firms. In terms of the importance of information sources, there was little difference either between Scotland and the UK (figure 17), or between business size bands in Scotland.

Figure 17: Importance of Information Sources for Innovation, Scotland & UK, 2009



Source: ONS

Section 1 Summary and Implications

The proportion of innovation active firms in Scotland has tended to lag the UK over the last three surveys, which may be explained by differences in industrial composition and business size. Large firms in Scotland outperformed the rest of the UK against most indicators while small and medium sized firms in underperformed. The tendency for smaller firms to be less innovation active in Scotland than the rest of the UK will have some impact on Scotland's overall results given that small businesses have the largest share of the business base while large firms have the smallest.

Innovation active firms outperformed their non-innovation active counterparts on a number of measures, including competitiveness, turnover growth and propensity to export and collaborate. Scottish firms tended to engage less in non-technological innovation, introducing strategic, organisational, marketing or management changes in conjunction with other technological innovations, but enjoyed good returns on investment.

Given the benefits gained from innovation and the fact that the reasons firms gave for not innovating were the same in Scotland and the UK, as were the factors placing constraints on innovation, this suggests that industry structure is the main influence on differences between the UK and Scotland's innovation performance. This has implications for Scotland's competitiveness and overall prosperity; therefore, it is necessary to gain a better understanding of Scotland's industrial structure and how this impacts on levels of innovation activity.

2. Relevance of Industry Sectors in Scotland's Innovation Performance

Innovation activity is not confined to high-tech sectors.[31] However, innovation intensity varies substantially depending on sector. Therefore, this section considers the extent to which Scotland's overall innovation performance is affected by the structure of the business base by analysing the survey results by size band and sector to identify potential sectoral influences.

Analysis of innovation active firms in Ireland found that the highest proportions of innovators were in the manufacturing and information & communication sectors, and the proportion of innovating firms in each was higher than the average for the economy as a whole. Some types of innovation are more suited to some sectors than others, and are frequently a reflection of the goods and services that firms in these sectors provide.[32]

Results for the UK also show that there are substantial differences in the proportion of firms that are innovation active depending on sector. The sectors with the highest proportions of innovation active firms are in traditional, minerals and other manufacturing, with lower proportions in construction, services and transport. Table 14 details the proportions of innovation active firms by sector and UK region.

Table 14: Proportion of Innovation Active Firms by Sector and Government Office Region

UK Region	Traditional Mfg	Minerals Mfg	Other Mfg	Construction	Wholes & Retail	Hotels & Restaurants	Transport & Storage	Finance & Business
North East	70.8	78.6	73.3	41.9	54.7	56.8	59.6	60.9
North West	68.1	60.9	67.7	56.7	57.1	52.3	63.6	62.2
Yorks & Humber	64.0	80.0	72.5	51.5	60.8	52.8	47.6	65.4
East Midlands	70.9	77.8	65.9	42.5	56.8	44.6	49.5	62.8
West Midlands	62.4	69.0	69.2	48.4	61.2	48.6	47.8	60.6
East of England	75.9	78.8	73.7	57.3	52.5	49.1	59.8	64.8
London	65.8	*	72.3	62.0	54.8	52.0	57.5	51.7
South East	62.5	64.9	75.7	52.9	55.6	57.1	58.7	56.4
South West	66.0	68.6	69.6	45.5	50.6	54.1	47.6	62.8
Wales	71.3	74.0	80.0	48.6	61.0	49.2	61.5	60.6
Scotland	83.7	70.4	75.6	50.5	48.4	50.6	58.0	59.2
Northern Ireland	76.4	78.4	74.5	55.8	52.3	44.2	53.2	69.4
UK	69.6	73.1	72.1	51.1	55.5	51.2	55.6	60.2

Although there are innovations taking place across every sector, the traditional, minerals and other manufacturing sectors drove overall performance during the survey period. Within the sectors, there are substantial differences by UK region. Table 15 highlights that the lowest

[31] ibid

[32] Analysis of Ireland's Innovation Performance, Forfas, 2011

proportion of innovation active firms in the traditional manufacturing sector at 62.4 per cent is not far behind the highest performing region for financial and business services at 69.4 per cent.

Table 15: Highest and Lowest Proportions of Innovation Activity across UK Regions

UK Region	Traditional Mfg	Minerals Mfg	Other Mfg	Construction	Wholes & Retail	Hotels & Restaurants	Transport & Storage	Finance & Business
Minimum	62.4	60.9	65.9	41.9	48.4	44.2	47.6	51.7
Maximum	83.7	80.0	80.0	62.0	61.2	57.1	63.6	69.4
Range	21.4	19.1	14.1	20.1	12.8	13.0	16.1	17.7

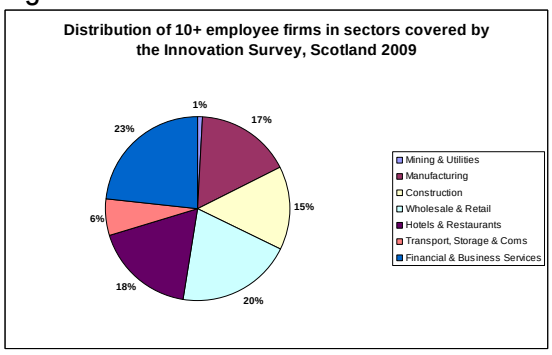
These results help explain Scotland's lower proportions of innovation active firms compared to the UK. Table 16 shows Scotland's rank out of the 12 regions. This highlights that Scottish traditional manufacturers are the most innovation active in the UK while wholesale & retailers are the least innovation active.

Table 16: Scotland's Performance by Sector relative to UK Regions

Scotland relative to 12 UK Regions	Traditional Mfg	Minerals Mfg	Other Mfg	Construction	Wholes & Retail	Hotels & Restaurants	Transport & Accoms	Finance & Business
Rank out of 12	1	7	3	7	12	7	6	10

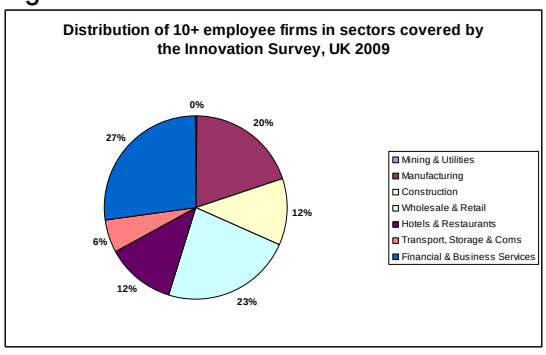
However, as figures 18a and 18b illustrate, Scotland had a smaller proportion of traditional manufacturing firms in the business base than the UK (17 per cent compared to 20 per cent). Scotland's poorest performing sectors relative to the UK were wholesale & retail and financial & business services. Although financial & business services was the biggest sector in Scotland and the UK economies in 2009 (representing 23.4 per cent of the sectors covered in the innovation survey in Scotland and 27.3 per cent in the UK), with Scotland ranking in 10th place out of 12 regions, the impact of this below average performance reduces Scotland's overall performance. The sector in which Scotland performs least well compared to the other regions is wholesale & retail, which also accounts for a significant proportion of the business base covered by the Innovation Survey (20.3 per cent).

Figure 18a: Scotland's Business Base



Source: BIS

Figure 18b: UK's Business Base

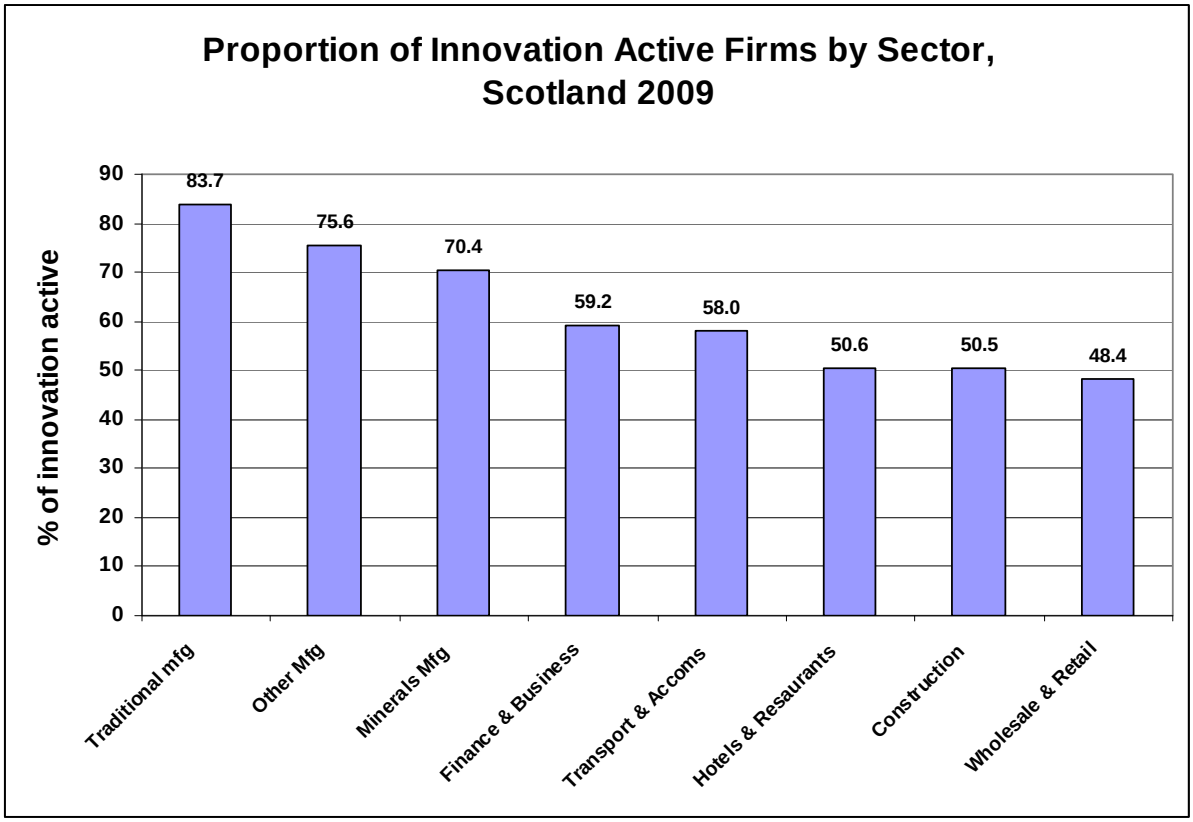


Source: BIS

2.1 Performance of Firms in Scotland by Sector

Within Scotland, traditional manufacturing is the sector with the highest proportion of innovation active firms and wholesale and retail has the lowest (figure 19).

Figure 19: Proportion of Innovation Active Firms by Sector, Scotland, 2009



Source: ONS

Innovation Activity in Scotland by Sector and Firm Size Band

To avoid disclosure issues[33] the sector and firm size band analysis in this section aggregates the traditional and minerals manufacturing sectors. Detailed results by sector and size band are provided in Appendix 2. This analysis examines some of the main indicators to identify how innovation activity is distributed across different size bands by indexing their relative performance compared to all 10+ firms = 100.

[33] Where there are small sample sizes ONS will not release data that is potentially disclosive (i.e. data with the potential to identify individual respondents)

Traditional & Minerals Manufacturing

Indicator	Small 10-49 employees	Medium - 50-249 employees	Large - 250+ employees
Innovation Active	96	86	117
Product Innovator	86	120	106
Process Innovator			138
New or improved goods	80	120	116
New or improved services	116		
Wider Innovation	87	98	122
Broader Innovation	94	93	114
Co-operator	74	98	142
Expenditure	90	92	122

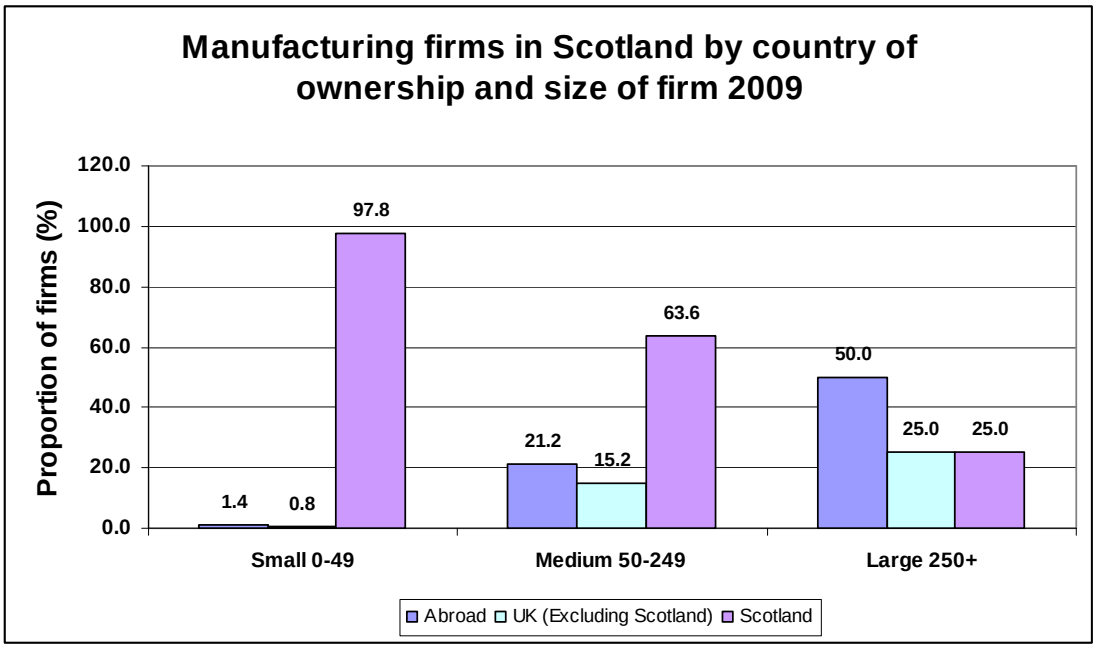
Manufacturing generally in Scotland had highest proportion of innovation active firms in the UK and in Scotland. In traditional and minerals manufacturing, firms in the largest size band had the most intense levels of activity against most of the main indicators. In particular, they reported a high level of co-operation while the smallest firms were less likely to co-operate. A similar picture was reported in other manufacturing, in which large firms had particularly strong performance against the process and wider innovation indicators as well as co-operation.

Other Manufacturing

Indicator	Small 10-49 employees	Medium - 50-249 employees	Large - 250+ employees
Innovation Active	99	87	116
Product Innovator	98	88	118
Process Innovator			190
New or improved goods	87	94	137
New or improved services	114		
Incomplete activities	80		
Wider Innovation	65	104	179
Broader Innovation	96	93	117
Co-operator	86	86	148
Expenditure	99	81	121

The fact that half of the largest manufacturing firms were in foreign ownership during the survey period (figure 20) and a quarter owned in the rest of the UK may account for this. International firms transfer innovation and technology through internal networks, which can result in positive spillovers in regional economies.

Figure 20: Ownership of Manufacturing Firms in Scotland 2009



Source: Scottish Corporate Sector Statistics

Construction

Indicator	Small 10-49 employees	Medium - 50-249 employees	Large - 250+ employees
Innovation Active	96	102	103
Broader Innovation	90	109	102
Co-operator	151		
Expenditure	101	95	106

The construction sector had the second lowest proportion of innovation active firms in Scotland in 2009, although it performed relatively well compared to the other UK regions (ranked at 7 out of 12 regions). Due to the small sample size, there is little data available for most indicators. The most striking result for indicators where data is available by size band is that for co-operation: 30.8 per cent of firms in the smallest size bands reported they were co-operators compared to 20.4 per cent for all 10+ firms. However, this did not result in a higher proportion of small firms reporting as innovation active than larger firms.

The characteristics of the construction sector in Scotland are quite different from manufacturing. More than 90 per cent of construction firms are very small workplaces and have 4 employees or fewer compared to almost 75 per cent of manufacturing firms. Almost 99 per cent of construction firms are Scottish owned businesses compared to 90 per cent in manufacturing. Consequently, fewer construction firms will have access to internal networks.

According to a recent report published by Europe INNOVA, construction companies are typically structured as project-based organisations that supply clients with custom-designed products and services, making firms suffer from a short term perspective and possibly leading them to suboptimal behaviours. The sector has a number of technically interdependent but organisationally dependent trades and specialties, many of which are well known for the

relatively low educational background of their workforce, and for the fact that learning is neither organised nor widespread. Regulations affect almost every activity, and can be safety, energy, or environment-related. The use of materials is also regulated in terms of their specification and standard test methods and environmental regulations govern finished products. Although standardisation and regulations may enable the widespread deployment of novel technologies and processes, the system may be hindering innovation.[34]

Wholesale & Retail

Indicator	Small 10-49 employees	Medium - 50-249 employees	Large - 250+ employees
Innovation Active	94	114	94
Broader Innovation	92	113	99
Co-operator	86		
Expenditure	82	132	93

The wholesale & retail sector had the lowest proportions of innovation active firms of all sectors covered by the survey in Scotland and had the lowest ranking of the 12 UK regions. Within Scotland, medium size firms had the highest proportion of innovation active firms: 55.1 per cent compared to 48.4 per cent for all 10+ firms.

Traditionally, wholesale & retail is considered to be a poor innovator, but within the sector, innovation seems to be more frequent in the wholesale trade sub-sector whereas the retail trade sub-sector shows a more modest level of innovation activities.[35] However, in Scotland, the relative size of the wholesale and retail sub sectors are different from the UK. Scotland has a bigger retail sector and a smaller wholesale sector than the UK when measured against three main economic indicators: the number of firms, turnover and gross value added (GVA). Within the more innovation active wholesale sector Scotland has a smaller proportion of firms, which produce lower proportions of the sector's total turnover and GVA (table 17). Therefore, the size of Scotland's retail sector may help to explain why Scotland is the worst performing region in the wholesale & retail sector.

Table 17: Distribution of firms, turnover and GVA within the Wholesale & Retail Sector 2009 (%)

	Retail		Wholesale	
	Scotland	UK	Scotland	UK
Firms	72.0	64.2	28.0	35.8
Turnover	50.9	68.8	49.1	68.8
GVA	64.8	49.8	35.2	50.2

Source: Annual Business Survey 2009, UK Business: Activity, Size and Location, 2009

[34] Sectoral Innovation Performance in the Construction Sector, European Commission Enterprise and Industry, 2010

[35] Sectoral Innovation Performance in the Wholesale and Retail Trade Sector, European Commission Enterprise and Industry, 2010

Research suggests that innovation in retailing has several distinctive characteristics which are not easily captured by conventional measures of innovation.[36] Retailers may be acting as innovation hubs, identifying consumer needs and communicating them to upstream suppliers, and a lot of retail innovation may be non-technological in nature. In addition, in terms of measuring performance, retailers tend to focus on more conventional cost benefit measures rather than the longer term commercial impact of innovation as a value added activity.

Hotels & Restaurants

Indicator	Small 10-49 employees	Medium - 50-249 employees	Large - 250+ employees
Innovation Active	107		
Wider Innovation	107		
Broader Innovation	100		
Expenditure	94		

Again, due to the small sample size, there are few indicators for which there is data available for the hotels & restaurants sector. Ranking in 7th place out of 12 UK regions, Scotland is just below the UK average for this sector (50.6 per cent innovation active in Scotland compared to 51.2 per cent across the UK).

Transport & Storage

Indicator	Small 10-49 employees	Medium - 50-249 employees	Large - 250+ employees
Innovation Active	94		
Product Innovator	88		
New or improved services	93		
Wider Innovation	70		
Broader Innovation	91		
Co-operator	80		
Expenditure	88		

Scotland ranked in 6th place out of 12 UK regions for transport & storage innovation activity in 2009. At 58 per cent compared to a UK proportion of 55.6 per cent, Scotland was just above the UK average. Again, data by size band is limited for this sector, but it suggests that medium or large firms are driving performance. High proportions of medium and large size transport & storage companies in Scotland's business base are either UK or foreign owned (67 per cent of medium sized companies and 83 per cent of large companies), which will have access to internal networks.

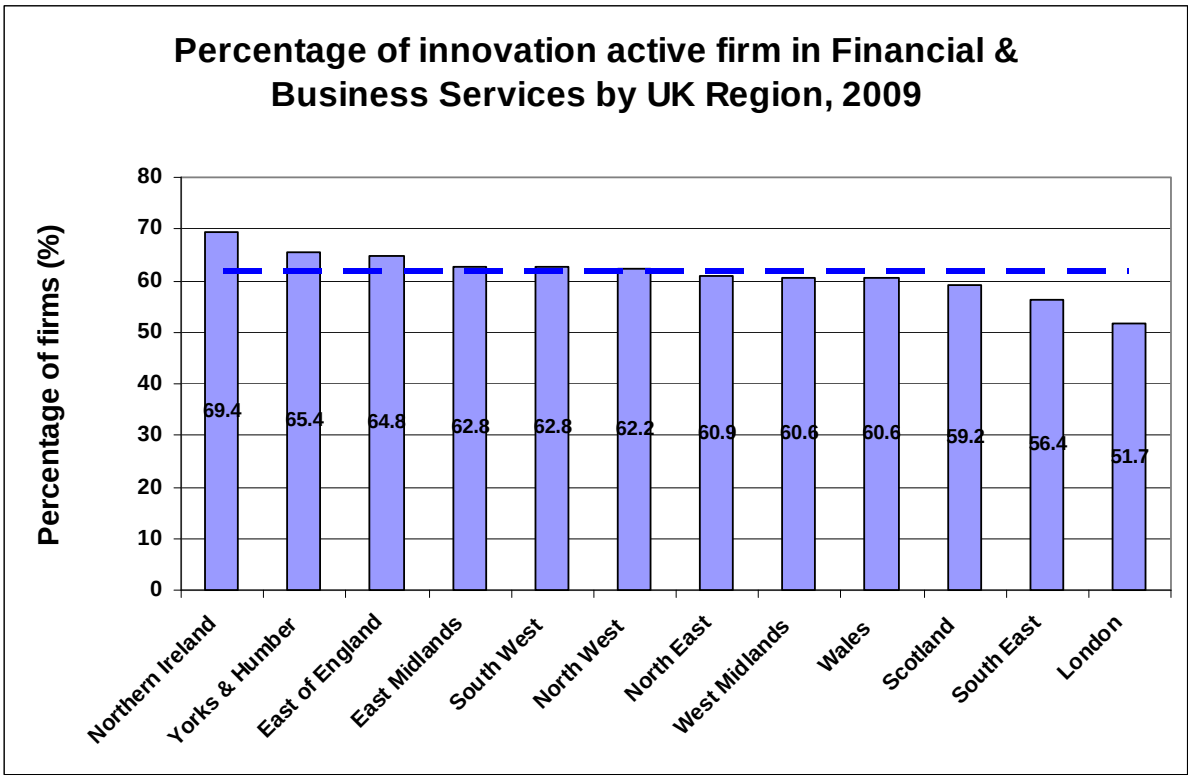
[36] Innovation in the UK Retail Sector, Report for NESTA by the Oxford Institute of Retail Management 2007

Financial & Business Services

Indicator	Small 10-49 employees	Medium - 50-249 employees	Large - 250+ employees
Innovation Active	97	105	100
Product Innovator	102	115	73
Process Innovator	97	108	96
New or improved goods	108		
New or improved services	100	111	83
Wider Innovation	107		
Broader Innovation	97		
Co-operator	88	121	104
Expenditure	101	99	97

Although ranked in 10th place against the 12 UK regions, with the proportion of innovation active firms in financial & business services was 59.2 per cent in Scotland, which was just below the UK average of 60.2 per cent. However, most regions, including Scotland, were close to the median proportion (figure 21).

Figure 21: Innovation in Financial & Business Services by UK Region, 2009



Source: ONS

There is limited data available for the financial and business services sub sectors, although it is possible to compare the proportions of innovation active firms for all 10+ employee firms in Scotland and the UK. Table 18 shows a very slightly higher proportion of innovation active

businesses in the business services sector than in financial services in Scotland while the UK had a slightly higher proportion in financial services.

Table 18: Proportion of Innovation Active Firms in Financial Services and Business Services, Scotland & UK 2009

	Financial Services	Business Services
Scotland	57.9	59.3
UK	61.6	60.0

Comparing the results for Scotland and the UK with the 2007 survey, the gap in performance narrowed, as table 19 details.

Table 19: Financial & Business Services Performance Gap 2007 & 2009

	2007		2009	
	Financial services	Business services	Financial services	Business services
Scotland	62.5	68.3	57.9	59.3
UK	68.4	69.9	61.6	60
% performance gap	-9.4	-2.3	-6.4	-1.2

Next to manufacturing, financial & business services was Scotland's highest performing sector in 2009. Small and medium sized firms in Scotland drove performance in the sector, and the business services sector in particular. Compared to other service sectors, it includes the most concentrated, knowledge-intensive, and IT-intensive sectors in modern industrial economies.[37] These firms are intensive users of high technology and/or have a relatively highly skilled workforce that is required to benefit fully from technological innovations.[38]

Generally, Scotland's innovation performance was around the UK average for most of the sectors covered by the survey; only two which did not follow this pattern. Scotland's manufacturing sector had the highest proportion of innovation active firms than other UK regions while wholesale and retail had the lowest. Given that Scotland has a smaller manufacturing sector and larger wholesale & retail sector than the UK, this helps explain an overall low proportion of innovation active firms compared to the UK.

2.2 Investment by Sector

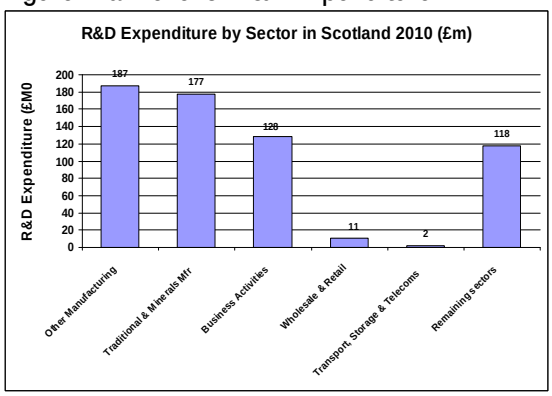
Successful sectors frequently adopt and adapt, rather than invent, important technologies, and exploitation of existing technology can be more important than new inventions. Banking and construction are examples of such sectors. Banks invest in technology that enables them to

[37] Innovation in Services, DTI, 2007
[38] OECD Scoreboard of Indicators

offer more services to their customers while the materials and processes used in modern methods of construction offer the ability to build more quickly and cheaply.[39]

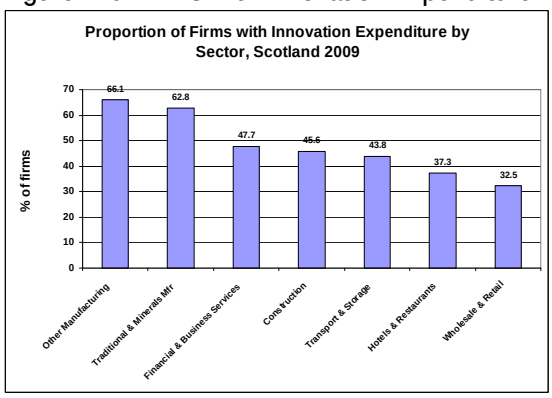
Comparing the pattern of R&D expenditure by sector with the pattern of innovation expenditure by sector, figures 22a and 22b illustrate that the sectors with high levels of R&D are also those with the highest proportion of innovation expenditure. However, it also highlights that innovation investment is more widespread across sectors than R&D activity alone. As is the case with R&D expenditure, the manufacturing and business services sectors have the highest proportion of innovation expenditure. However, a significant proportion of firms in the other sectors had innovation expenditure, including those traditionally not associated with R&D such as wholesale & retail and hotels & restaurants.

Figure 22a: Level of R&D Expenditure



Source: BERD

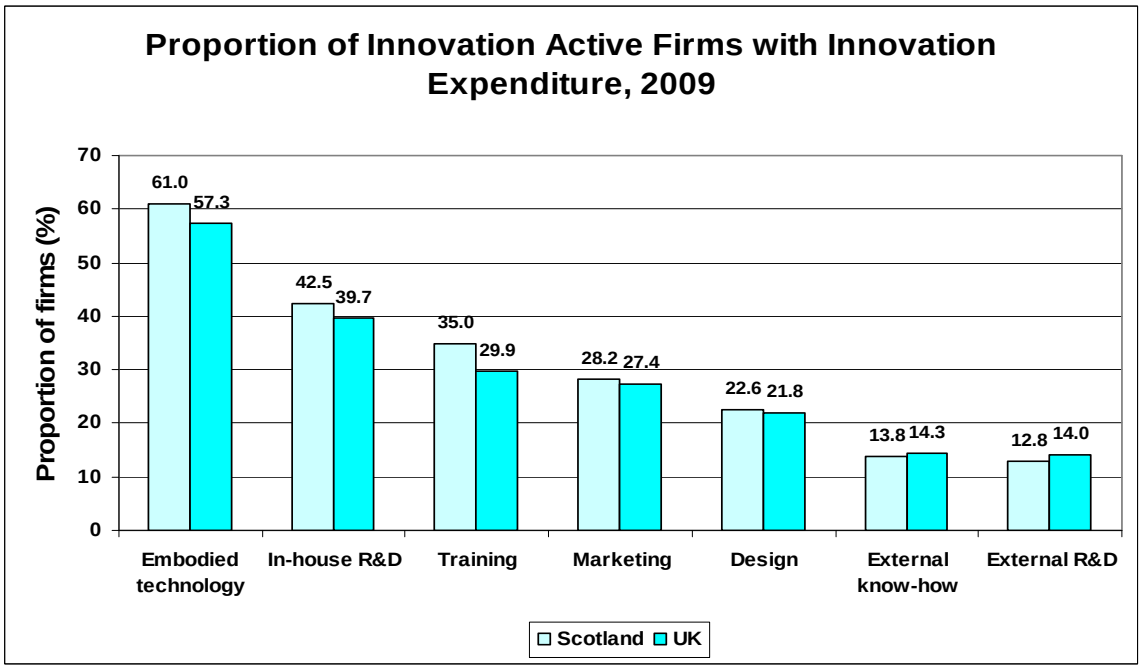
Figure 22b: Firms with Innovation Expenditure



Source: ONS

The results also showed a slightly higher proportion of Scottish firms with innovation expenditure than the UK against most types of expenditure (figure 23).

Figure 23: Proportion of Firms with Innovation Expenditure, Scotland & UK, 2009



Source: ONS

[39] Hidden Innovation How innovation happens in six 'low innovation' sectors, NESTA 2007

Research has shown that the UK invests more heavily in innovation than R&D measures would suggest. Private sector businesses invested £133 billion in innovation in 2007 (the most recent year covered by the Index), representing 14 per cent of private sector output, which compares favourably with the data available for countries like France and Germany, and is similar to the US.[40] NESTA has suggested that this may be one reason why the UK has enjoyed higher productivity growth in recent years than France or Germany despite concerns over its investment in R&D.

In Scotland, overall productivity growth was higher than Germany over the period 2002 to 2009 and there was a narrowing of the gap between productivity levels in Scotland and the top quartile of OECD countries.[41] Although still in the third quartile, ranked 17th out of 30 OECD countries in 2009, innovation investment may be one of the reasons why Scotland relative performance has improved in recent years since below average productivity performance was attributed to low rates of R&D, low business innovation activity and low entrepreneurship.

Section 2 Summary and Implications

Analysis of Scotland's survey results by sector help to explain why Scotland tends to have a lower proportion of innovation active firms relative to the UK. Although, in most sectors covered by the survey, the proportion of innovation active firms in Scotland is around the UK average, there are two sectors with large gaps in performance compared to the UK. Traditional manufacturing performs above the UK average while wholesale & retail perform below the UK average.

Traditional manufacturing firms had the most intense levels of activity against most of the main indicators; however, Scotland has a smaller proportion of traditional manufacturing firms in the business base than the UK. On the other hand, the wholesale & retail sector had the lowest proportions of innovation active firms of all sectors covered by the survey in Scotland, and the lowest ranking of the 12 UK regions. Wholesale tends to be more innovation active than retail; however, Scotland has a bigger retail sector and a smaller wholesale sector than the UK and innovation in retail is not easily captured by conventional measures. Therefore, the relative size and performance of these sectors will negatively affect Scotland's overall result.

Analysis of the remaining sectors showed that construction performed relatively well compared to other UK regions. The sector is heavily regulated and characterised by small firms, which suffer from a short term perspective that possibly leads them to suboptimal behaviours. In hotels & catering, medium or large firms seemed to be driving performance, which was just above the UK average. Next to manufacturing, financial & business services was Scotland's highest performing sector. This is probably because firms in these sectors are intensive users of high technology and/or have the relatively highly skilled workforce that is required to benefit fully from technological innovations. Although Scotland ranked in 10th place out of 12 UK regions in this sector, the performance gap between Scotland and the UK narrowed over the survey period.

Banking and construction are examples of sectors that frequently adopt and adapt, rather than invent, important technologies, and exploitation of existing technology can be more important

[40] The Innovation Index Measuring the UK's investment in innovation and its effects, NESTA, 2009
[41] High Level Summary of Statistics Trend, Productivity, Scottish Government, 2011

than new inventions. Comparing the pattern of traditional R&D expenditure by sector with innovation expenditure highlights that innovation investment is more widespread across sectors than R&D activity alone and includes sectors not traditionally associated with R&D such as wholesale & retail and hotels & restaurants. Against most types of innovation expenditure, Scotland had a slightly higher proportion of firms than the UK. Innovation investment may be one of the reasons why the productivity gap between Scotland and the top quartile of OECD countries has improved in recent years.

The OECD has noted that the service sector is growing in importance in OECD economies and that productivity and employment growth are highly dependent on the success of this sector[42]. Although less likely to innovate than manufacturing, service sector firms are becoming increasingly innovative and knowledge-intensive and policies. They note that only a few countries have integrated services-related issues into innovation and suggest policies for enhancing service sector innovation need to reflect differences in the innovation processes in services and manufacturing, with support programmes adapted to be more relevant and useful to the service sector.

[42] Working Party on Innovation and Technology Policy, Promoting Innovation in Services, OECD 2005

3. Conclusions

The analysis of the 2009 Innovation Survey results highlights a number of interesting findings:

- Innovation activity among businesses in Scotland (and the UK) by 2009 was lower than in 2007, probably due to the onset of the economic downturn
- Scotland's business innovation performance lags the UK as a whole for most innovation indicators
- Innovation activity rises as firm size increases – and large firms in Scotland outperform those in the UK as a whole across most innovation indicators
- Scottish businesses invest more of their innovation expenditure in 'non-technological' innovation than UK firms
- Scottish firms are more likely 'buy in' technology, and less likely to invest in their own R&D, compared to UK firms
- Scottish firms that do invest in innovation spend more per employee than the UK average
- 'Return on innovation investment' in Scotland is higher than for the UK as a whole
- Turnover growth rates were significantly higher for innovation active firms and their average headcount increase was almost double that of inactive firms
- Innovation active businesses became more competitive than their non innovation active counterparts as the proportionate increase in turnover was greater than the proportionate increase in the number of employees
- A higher proportion of innovation active firms were exporters than inactive firms
- Generally, Scotland's innovation performance was around the UK average for most of the sectors covered by the survey
- Scotland's smaller manufacturing base and larger retail base contributed to relatively lower levels of innovation activity in Scotland compared to the UK
- Innovation investment is more widespread across sectors than R&D activity alone, including those traditionally not associated with R&D such as wholesale & retail and hotels & restaurants.

There has been a tendency for Scotland to lag the UK average over time, although differences in the results for Scotland and the UK are relatively small. However, there are fairly substantial differences between small and large firms' innovation activity levels in Scotland and the UK as a whole. The tendency for smaller firms to be less innovation active in Scotland than the rest of the UK will have some impact on Scotland's overall results, particularly when weightings are applied to the sample, since small firms have the largest share of the business base. Large firms in Scotland are more innovation active, have more innovation related expenditure, are more likely to be process innovators and more likely to be strategic innovators than for UK as a whole. However, while the proportion of innovation active large firms has grown in Scotland relative to the UK, the proportion of small firms has fallen, reducing Scotland's overall performance.

Possibly the most important influence on Scotland's overall levels of innovation performance is the business base's industrial structure. Relatively high levels of performance in manufacturing are offset by relatively poor levels of performance in wholesale & retail. In other sectors, Scotland performs at around the UK average. As the service sector is growing in importance across OECD economies, support programmes may to be adapted to be more relevant for the service sector.

APPENDIX 1:

Main indicators by enterprise size

Main indicators by enterprise size, percentage of all enterprises (UK average in parenthesis) 2009 – weighted data

	10-49		**50-249**		**250+**		**All 10+**	
Innovation active	53.8	(57.3)	58.2	(62.5)	67.1	(61.2)	54.8	(58.2)
of which								
Product innovator	20.4	(23.0)	25.2	(28.5)	28.7	(31.5)	21.3	(23.9)
Goods	11.6	(13.5)	17.1	(18.4)	19.2	(20.5)	12.7	(14.4)
Services	15.9	(17.4)	16.7	(18.6)	16.7	(20.5)	16.0	(17.6)
Process innovator	11.8	(12.0)	14.2	(15.4)	22.9	(18.9)	12.5	(12.6)
Abandoned activities	2.1	(3.3)	4.0	(4.5)	8.2	(6.6)	2.5	(3.5)
Incomplete activities	4.9	(5.1)	5.9	(8.1)	12.0	(9.2)	5.3	(5.6)
Innovation-related expenditure	17.9	(18.0)	23.9	(27.1)	34.7	(27.0)	19.3	(19.5)
Wider innovation	23.5	(24.5)	34.8	(36.5)	45.6	(39.0)	25.9	(26.5)
Broader innovation	54.9	(59.3)	66.9	(66.7)	71.8	(65.2)	57.3	(60.4)
Product and process innovation	8.6	(8.9)	10.8	(11.5)	16.2	(14.5)	9.1	(9.4)
Product or process innovation	23.6	(26.0)	28.7	(32.4)	35.4	(35.9)	24.7	(27.1)

Main indicators by enterprise size, percentage of all enterprises (UK average in parenthesis) 2009 – un-weighted data

	10-49		50-249		250+		All 10+	
Innovation active businesses	59.4	(60.2)	59.9	(62.8)	65.4	(59.7)	60.8	(60.7)
of which								
Product innovator	26.4	(25.5)	25.3	(28.6)	28.0	(29.5)	26.4	(27.3)
Goods	15.1	(15.9)	16.0	(18.5)	17.3	(18.5)	15.8	(17.2)
Services	20.4	(18.5)	17.8	(18.9)	17.3	(20.0)	19.0	(18.9)
Process innovator	14.4	(13.4)	15.4	(15.2)	22.0	(18.0)	16.3	(15.0)
Abandoned	4.0	(4.1)	3.9	(4.6)	7.5	(5.8)	4.7	(4.6)
Incomplete	6.5	(6.4)	6.9	(7.6)	11.0	(8.0)	7.6	(7.1)
Innovation-related expenditure	23.1	(22.0)	24.7	(27.2)	33.9	(25.0)	25.8	(24.1)
Wider innovation	27.8	(26.6)	36.1	(36.6)	46.5	(37.9)	34.1	(32.0)
Broader innovation	61.2	(62.2)	67.8	(66.9)	70.1	(63.8)	64.9	(63.8)
Product and process innovation	11.0	(10.2)	11.1	(11.5)	15.7	(13.6)	12.1	(11.4)
Product or process innovation	29.8	(28.7)	29.5	(32.4)	34.3	(33.9)	30.7	(30.9)

APPENDIX 2:

Main Indicators by Sector and Size Band

Main indicators by sector and enterprise size band, percentage of all enterprises, Scotland 2009

Traditional & Minerals Manufacturing (weighted)

Indicator	Small 10-49 employees	Medium - 50-249 employees	Large - 250+ employees	All 10+
Innovation Active	77.8	68.6	94.1	76.4
Product Innovator	36.2	49.3	44.1	40.1
Process Innovator	21.1	22.9	35.3	22.5
New or improved goods	28.5	42.1	41.2	32.9
New or improved services	22.9	*	*	22.2
Abandoned activities	9.5	8.6	17.6	9.7
Incomplete activities	7.4	5.0	20.6	7.6
Wider Innovation	37.9	42.1	52.9	39.9
Broader Innovation	77.8	77.1	94.1	78.6
Co-operator	32.1	42.1	61.8	36.6
Expenditure	56.9	57.9	76.5	58.4

Traditional & Minerals Manufacturing (unweighted)

Indicator	Small 10-49 employees	Medium - 50-249 employees	Large - 250+ employees	All 10+
Innovation Active	77.4	69.2	94.1	80.5
Product Innovator	35.8	50.0	44.1	41.6
Process Innovator	*	*	35.3	25.7
New or improved goods	28.3	42.3	41.2	35.4
New or improved services	22.6	*	*	19.5
Abandoned activities	*	*	*	11.5
Incomplete activities	*	*	*	10.6
Wider Innovation	37.7	42.3	52.9	43.4
Broader Innovation	77.4	76.9	94.1	82.3
Co-operator	32.1	42.3	61.8	43.4
Expenditure	56.6	57.7	76.5	62.8

Other Manufacturing (weighted)

Indicator	Small 10-49 employees	Medium - 50-249 employees	Large - 250+ employees	All 10+
Innovation Active	76.3	72.1	86.2	75.8
Product Innovator	34.0	40.1	46.2	36.3
Process Innovator	17.3	21.3	44.6	20.0
New or improved goods	25.0	38.6	46.2	29.8
New or improved services	22.8	17.6	20.0	21.3
Abandoned activities	3.3	5.1	20.0	4.8
Incomplete activities	6.7	12.1	27.7	9.4
Wider Innovation	26.7	58.5	76.9	37.9
Broader Innovation	80.5	86.8	93.8	82.9
Co-operator	35.8	42.6	61.5	39.1
Expenditure	65.2	57.0	76.9	63.8

Other Manufacturing (unweighted)

Indicator	Small 10-49 employees	Medium - 50-249 employees	Large - 250+ employees	All 10+
Innovation Active	75.0	65.9	87.5	75.7
Product Innovator	35.4	31.7	42.5	36.2
Process Innovator	*	*	45.0	23.7
New or improved goods	27.1	29.3	42.5	31.1
New or improved services	21.9	*	*	19.2
Abandoned activities	*	*	*	7.9
Incomplete activities	10.4	*	*	13.0
Wider Innovation	29.2	46.3	80.0	44.6
Broader Innovation	78.1	75.6	95.0	81.4
Co-operator	36.5	36.6	62.5	42.4
Expenditure	65.6	53.7	80.0	66.1

Construction (weighted)

Indicator	Small 10-49 employees	Medium - 50-249 employees	Large - 250+ employees	All 10+
Innovation Active	48.7	51.4	51.9	49.1
Product Innovator	17.9	*	*	16.6
Process Innovator	7.7	*	*	7.0
New or improved goods	12.8	*	*	12.0
New or improved services	10.3	*	*	10.0
Abandoned activities	*	*	*	*
Incomplete activities	5.1	*	*	5.5
Wider Innovation	20.5	18.9	48.1	20.7
Broader Innovation	48.7	59.5	55.6	50.3
Co-operator	30.8	*	*	27.5
Expenditure	46.2	43.2	48.1	45.8

Construction (unweighted)

Indicator	Small 10-49 employees	Medium - 50-249 employees	Large - 250+ employees	All 10+
Innovation Active	48.7	51.4	51.9	50.5
Product Innovator	*	*	*	14.6
Process Innovator	*	*	*	*
New or improved goods	*	*	*	*
New or improved services	*	*	*	10.7
Abandoned activities	*	*	*	*
Incomplete activities	*	*	*	*
Wider Innovation	*	*	48.1	27.2
Broader Innovation	48.7	59.5	55.6	54.4
Co-operator	30.8	*	*	20.4
Expenditure	46.2	43.2	48.1	45.6

Wholesale & Retail (weighted)

Indicator	Small 10-49 employees	Medium - 50-249 employees	Large - 250+ employees	All 10+
Innovation Active	45.3	55.6	45.8	46.6
Product Innovator	11.8	*	*	12.2
Process Innovator	6.6	*	*	7.4
New or improved goods	7.9	*	*	8.1
New or improved services	9.1	*	*	9.0
Abandoned activities	*	*	*	*
Incomplete activities	*	*	*	0.6
Wider Innovation	12.8	26.5	22.9	14.6
Broader Innovation	47.8	59.9	52.1	49.3
Co-operator	17.9	27.8	20.8	19.2
Expenditure	26.6	45.1	29.2	28.9

Wholesale & Retail (unweighted)

Indicator	Small 10-49 employees	Medium - 50-249 employees	Large - 250+ employees	All 10+
Innovation Active	45.3	55.1	45.5	48.4
Product Innovator	*	*	*	14.0
Process Innovator	*	*	*	8.3
New or improved goods	*	*	*	9.6
New or improved services	*	*	*	8.9
Abandoned activities	*	*	*	*
Incomplete activities	*	*	*	*
Wider Innovation	*	*	*	19.7
Broader Innovation	48.0	59.2	51.5	52.2
Co-operator	18.7	*	*	21.7
Expenditure	26.7	42.9	30.3	32.5

Hotels & Restaurants (weighted)

Indicator	Small 10-49 employees	Medium - 50-249 employees	Large - 250+ employees	All 10+
Innovation Active	54.1	*	*	53.4
Product Innovator	21.6	*	*	19.8
Process Innovator	10.8	*	*	10.1
New or improved goods	8.1	*	*	7.6
New or improved services	21.6	*	*	19.8
Abandoned activities	*	*	*	*
Incomplete activities	5.4	*	*	4.8
Wider Innovation	29.7	*	*	28.6
Broader Innovation	54.1	*	*	54.5
Co-operator	18.9	*	*	18.5
Expenditure	35.1	*	*	35.5

Hotels & Restaurants (unweighted)

Indicator	Small 10-49 employees	Medium - 50-249 employees	Large - 250+ employees	All 10+
Innovation Active	54.1	*	*	50.6
Product Innovator	*	*	*	*
Process Innovator	*	*	*	*
New or improved goods	*	*	*	*
New or improved services	*	*	*	15.7
Abandoned activities	*	*	*	*
Incomplete activities	*	*	*	*
Wider Innovation	29.7	*	*	27.7
Broader Innovation	54.1	*	*	54.2
Co-operator	*	*	*	19.3
Expenditure	35.1	*	*	37.3

Transport & Accommodation (weighted)

Indicator	Small 10-49 employees	Medium - 50-249 employees	Large - 250+ employees	All 10+
Innovation Active	54.6	66.9	52.0	56.5
Product Innovator	22.2	*	*	23.6
Process Innovator	7.4	*	*	8.6
New or improved goods	10.5	*	*	10.3
New or improved services	18.5	*	*	19.6
Abandoned activities	*	*	*	*
Incomplete activities	*	*	*	*
Wider Innovation	21.0	36.2	44.0	24.1
Broader Innovation	54.6	72.4	52.0	57.4
Co-operator	24.1	38.6	40.0	26.9
Expenditure	40.4	57.5	44.0	43.3

Transport & Accommodation (unweighted)

Indicator	Small 10-49 employees	Medium - 50-249 employees	Large - 250+ employees	All 10+
Innovation Active	54.3	*	*	58.0
Product Innovator	22.9	*	*	25.9
Process Innovator	*	*	*	13.4
New or improved goods	*	*	*	10.7
New or improved services	20.0	*	*	21.4
Abandoned activities	*	*	*	*
Incomplete activities	*	*	*	*
Wider Innovation	20.0	*	*	28.6
Broader Innovation	54.3	*	*	59.8
Co-operator	24.3	*	*	30.4
Expenditure	38.6	*	*	43.8

Financial & Business Services (weighted)

Indicator	Small 10-49 employees	Medium - 50-249 employees	Large - 250+ employees	All 10+
Innovation Active	50.8	53.4	58.7	51.5
Product Innovator	19.5	30.3	17.5	21.1
Process Innovator	16.6	19.0	15.9	16.9
New or improved goods	9.1	*	*	9.3
New or improved services	15.5	27.4	17.5	17.4
Abandoned activities	5.0	*	*	5.0
Incomplete activities	8.5	7.0	8.7	8.3
Wider Innovation	24.5	40.1	37.3	27.4
Broader Innovation	52.3	62.6	66.7	54.4
Co-operator	25.4	24.5	27.8	25.3
Expenditure	43.4	38.7	44.4	42.7

Financial & Business Services (unweighted)

Indicator	Small 10-49 employees	Medium - 50-249 employees	Large - 250+ employees	All 10+
Innovation Active	57.7	62.3	59.0	59.2
Product Innovator	28.8	32.5	20.5	28.3
Process Innovator	18.1	20.2	17.9	18.7
New or improved goods	13.0	*	*	12.0
New or improved services	24.7	27.2	20.5	24.6
Abandoned activities	6.0	*	*	5.7
Incomplete activities	9.3	*	*	9.6
Wider Innovation	32.6	44.7	38.5	37.1
Broader Innovation	60.0	71.1	66.7	64.4
Co-operator	32.6	34.2	29.5	32.4
Expenditure	48.4	47.4	46.2	47.7

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