Department for
Business, Energy
& Industrial Strategy

UK INNOVATION SURVEY 2017

Main Report

October 2018

Contents

Executive Summary 3
Introduction 3
Innovation trends 3
Type of investment 3
Collaboration and sources of information 4
Spatial distribution of innovation 4
Factors driving innovation 4
Barriers to innovation for innovators and non-innovators 5
1 Introduction 7
1.2 About the UK Innovation Survey 7
1.2 Policy context for innovation 8
1.4 Definition of innovation 9
1.5 About this report 9
1.6 Contacts for further information 10
2 Levels and types of innovation 11
2.1 Introduction 11
2.2. Changes in innovation over time 11
2.3 Change in innovation expenditure over time 12
3 Innovation support and collaboration 14
3.1 Introduction 14
3.2 Trends in collaboration 14
3.3 Trends in information sources used 15
3.4 Links between public support and firm outcomes 16
4 Innovation characteristics and outcomes 17
4.1 Introduction 17
4.3 Innovation and organisational performance outcomes 18

5 Geography of innovation 20
5.1 Introduction 20
5.2 Spatial distribution of innovative firms 20
6 Factors driving innovation 22
6.1 Introduction 22
6.2 Trends in factors driving innovation 22
6.3 Factors driving innovation and firm outcomes 23
7 Barriers to innovation 24
7.1 Introduction 24
7.2 Trends in barriers to innovation 24
7.3 Barriers to innovation and firm outcomes 25
8 Skills for innovation 27
8.1 Introduction 27
8.2 Trends in skills and innovation over time 28
8.3 Skill levels and organisational performance outcomes 29
Appendix 1 Regression analysis results 30
Appendix 2 – Additional Evidence Sources 34

Executive Summary

Introduction

This report presents the findings from the tenth wave of the UK Innovation survey cross-sectional survey of 13,194 firms and the longitudinal panel data survey of 2,808 firms. It provides a snapshot of incidence and types of innovation by firm size and sector, barriers and drivers of innovation, and relationships between features of innovation practice and organisational performance outcomes.

Innovation trends

Innovation trends showed differences by type of firm, primarily driven by firm size and sector. Average levels of innovation activity fell to 49% in the 2017 survey from 53% in the 2015 survey, accounted for by a rise in the number of innovation-active large firms and a fall in innovation activity in small and medium-sized enterprises (SMEs). The shares of firms which introduced product or process innovations rose, while the shares introducing broader or wider innovations in business practices fell.

Highest and increasing levels of innovation activity in over two thirds of firms in the manufacture of electrical and optical equipment and manufacture of transport equipment were reported in the cross-sectional survey. In other sectors innovation activity fell between the 2015 and 2017 surveys. After a period of increasing shares in innovation-active firms, several sectors showed a decline in innovation in the longitudinal panel sub-sample between the 2015 and 2017 surveys including electricity, gas and water; transport equipment manufacture; food, clothing, paper, wood, publishing and printing and real estate. Retail sector firms reported a consistent trend in decreasing innovation activity since the 2013 survey with lower levels of innovative firms than in most other sectors, at around 45% in the 2017 cross-sectional survey. The hotel and restaurant sector reported the lowest share of innovative firms with less than two fifths reporting innovation activity in the 2017 survey.

Type of investment

Shares of firm investment in internal R&D increased on average from 35% in 2014 to 46% in 2016, while shares of investment in capital equipment, design training for innovation and marketing have dropped. Analysis of the longitudinal sub-sample of firms showed that shares of investment in design, acquiring external knowledge and training all increased.

This may reflect differences in the characteristics of the panel sample and attitudes of firms within it towards innovation.

Collaboration and sources of information

Over half of broader innovators, an increase of 18 percentage points, reported collaboration in the 2017 survey with partners to support innovation, particularly with other firms in the same group, suppliers, public and private sector clients. Similarly, while firms are more likely to look within their own organisation for sources of information or advice on innovation, there has been an increase since the 2015 survey in the proportions consulting public or private sector clients, competitors or firms in the same sector or equipment suppliers.

Spatial distribution of innovation

Between 39% and 52% of firms in each UK country and English region reported being innovation-active in the 2017 survey. Incidence of reported innovation activity in the cross-sectional survey has decreased in all UK countries between the 2015 and 2017 surveys with the largest percentage point fall of 6% among firms in Northern Ireland and the smallest fall of 3% among firms in England. Similar trends were found in the panel survey, except for an increasing proportion of firms in Wales who engaged in innovation. Within English regions, there was an increase in firms reporting innovation activity in the South West and declines in all other regions.

Factors driving innovation

Improving product/service quality, replacing outdated products/services and increasing value added were the most common drivers of innovation reported by around one third of firms in the cross-sectional survey. Motivating factors reported by increasing shares of at least 8% of firms were meeting regulatory standards, improving product/service quality and increasing value added. This is indicative of more firms adopting business strategies which are focussed on product/service quality.

Some of these drivers may explain the decrease in investment in marketing innovations reported earlier. Increasing shares of at least 16% of firms reported replacement of existing good/services and improving quality as innovation drivers. Firms may not choose to invest as much in marketing products/services which are being refreshed compared to those which are wholly new or being targeted at new potential customers.

Educational skill level of the workforce is known to be associated with innovation activity and performance[1]. The average proportion of workers holding degree level qualifications or higher in STEM and non-STEM subjects in non- and broader innovators increased by between 1 and 4% since the 2015 survey, with the highest increases in broader innovators. This may reflect a rising share of the population holding graduate qualifications.

Barriers to innovation for innovators and non-innovators

Common barriers to innovation, including availability and costs of finance together with innovation cost and perceived economic risk, were experienced by decreasing proportions of organisations. The share of innovation-active firms experiencing barriers fell from 20% in 2011 to under 15% in the 2017 survey. Government and EU regulations, lack of qualified personnel and lack of market information showed small increases of 1-3% as reported barriers to innovation in no more than 10% of firms since the 2015 survey. Nine per cent of firms reported the EU referendum as a barrier to innovation. The 2017 survey fieldwork period covered a pre- and post-referendum time frame, so firm conclusions about the impact of the referendum on innovation should not be made.

Common barriers to innovation did not appear to be deterrents to most non-innovating firms with stable numbers of only 3% reporting constraining factors as reasons for not innovating. Absence of market pressures was the most common factor, reported by 29% of firms in the cross-sectional 2017 survey.

Innovation behaviours and firm performance outcomes

Understanding whether and how innovation behaviours affect firm performance outcomes could provide a means for helping to prioritise and target areas of innovation policy and government investment.

Simple regression analyses showed that firms with the following characteristics were more likely to experience increases in turnover and employment levels:

- implementing broader innovation activities
- receiving public financial support – note that only 7% of firms sampled had received public financial support to support innovation, so this result must be interpreted with caution

[1] Coad, Alex., Cowling, M., Nightingale, P., Pellegrino, G., Savona, M. and Siepel, J. (2014) *Innovative Firms and Growth*. BIS Research Report, Department for Business, Innovation and Skills, London.

- rating one or more factors driving innovation as of ‘high’ or ‘medium’ importance
- rating one or more barriers to innovation as of ‘high’ or ‘medium’ importance – this is consistent with the survey evidence showing that wider factors such as market conditions are more commonly cited as deterrents to innovation than specific barriers
- employing an increasing proportion of STEM and non-STEM graduates in the workforce – this may reflect rising levels of education across the UK population which have increased the broad supply of graduate labour.

These factors each explained a very small proportion of variation in firm performance of up to 3.8%.

1 Introduction

1.2 About the UK Innovation Survey

This report presents key findings from the UK Innovation Survey 2017 (UKIS 2017). The survey provides the main data source for business innovation in the UK and is used widely across government and by the research community to help improve policy, supplemented by experimental statistics which examine the associations between different facets of innovation practice and organisational performance. The report complies with the Code of Practice for Statistics 2.0[2] and its principles of trustworthiness, quality and value.

The survey is the UK contribution to the tenth Europe-wide Community Innovation Survey (CIS). Because the questions in the CIS are harmonised across Europe, UK Innovation survey data are directly comparable with responses from other countries. This provides useful international benchmarking for UK performance.

The survey focusses on firm adoption of innovation through new and improved products and services, investments in different types of innovation and changes in business structures, management, design and marketing innovations. The survey also asks businesses about the drivers which motivate and barriers to innovation. Although innovation is a strong predictor of higher productivity, wider research shows that it can be difficult to measure accurately, partly due to the changing nature of economic activity. Innovation value is fluid and travels easily across organisational boundaries so may be hard to recoup at the point of origin. Some firms, especially SMEs, may find it challenging to report on innovation activity accurately[3], so it is important to be cautious in interpreting these results.

The sample selection was conducted by the Office for National Statistics (ONS) and followed very similar sampling methodology to the previous surveys. The questionnaire used for the survey remained mostly the same as in the 2015 survey. The 2017 achieved sample composition was similar to the last survey, with 21 per cent made up of large firms, 49 per cent made up of businesses with 10 to 49 employees and 30 per cent from businesses with 50 to 249 employees.

Fieldwork was undertaken between 20 February and 31 October 2017. As the EU referendum took place in June 2016, users should not draw firm conclusions about the impact of the referendum on innovation. Comparisons are made with the UK Innovation

[2] https://www.statisticsauthority.gov.uk/code-of-practice/the-code/

[3] Saunila, M. (2017) 'Understanding innovation performance measurement in SMEs', *measuring Business Excellence*, 21, 1, 1-16.

Survey 2015 (UK IS 2015) and 2013 (UK IS 2013) and with panel data from a longitudinal sub-sample of 2808 firms surveyed in 2013, 2015 and 2017. Any changes reported are indicative of trends rather than being statistically significant.

UKIS 2017 sampled 30,479 UK enterprises with ten or more employees. The survey was voluntary and was conducted primarily through an electronic questionnaire. The change in mode may have affected some responses over the past three survey waves so care should be taken when drawing comparisons since 2013. Businesses that did not complete an electronic response were offered a telephone interview. Responses were received from 13,194 businesses, giving a response rate of 43%.

This report uses weighted data in order to be representative of the business population. The responses were weighted to the total business population using the Inter-Departmental Business Register (IDBR). They were not weighted by factors which would give more weight to larger firms, such as employment or turnover. It is important to note that the previously published headline figures were based on weights using the 14 broad industrial sectors whilst the figures in this report are based on weights using the detailed 25 sectors required by Eurostat to enable international comparisons. The figures in this report may vary slightly from those in the headline report and this is due to the application of the more detailed weights.

1.2 Policy context for innovation

The 2017 Industrial Strategy[4] sets the target of raising public and private sector investment in R&D from 1.7% to 2.4% by 2027[5]. This is intended to support firms to reap the benefits of commercial opportunities available through science and technological development.

Measuring R&D takes a tightly focussed perspective on the kinds of activities that may help firms improve their competitive performance. Innovation is a wider concept and recognises a bigger set of activities, including R&D, which contribute to improved organisational performance in firms across the economy. Evidence shows a positive and statistically significant link between innovation and organisational growth[6]. A series of investment programmes contained within the Industrial Strategy are providing resources to help businesses across a variety of sectors scale up innovations in their products and services.

[4] https://www.gov.uk/government/publications/industrial-strategy-building-a-britain-fit-for-the-future
[5] Ibidem.
[6] https://www.gov.uk/government/statistics/small-business-survey-2017-panel-report

1.4 Definition of innovation

The survey uses the following definitions of innovation drawing on those agreed with Eurostat:

'Broad' innovators develop:

- new or significantly improved product (good or service) or process
- new or significantly improved forms of organisation, business structures, practices or marketing concepts/strategies
- engage in innovation which is incomplete, reduced or abandoned
- investment in internal research and development, training, external knowledge, machinery and equipment for innovation

'Wider' innovators develop:

- new or significantly improved forms of organisation, business structures, practices or marketing concepts/strategies

These organisations are focussed on internal improvement rather than new products and processes.

'Active' innovators develop:

- new or significantly improved product (good or service) or process
- new or significantly improved forms of organisation, business structures, practices or marketing concepts/strategies
- innovation which is incomplete, reduced or abandoned

1.5 About this report

This report provides a snapshot of trends in innovation activity by firm size, sector and UK country/English region, innovation investment and factors that drive and hinder innovation. It compares cross-sectional data from the 2013, 2015 and 2017 surveys[7] with longitudinal panel data from the same period, where available. Experimental statistics seek to assess the presence and strength of influence of innovation support, activities and motivators/barriers with organisational performance outcomes.

Chapter Two illustrates how levels and types of innovation have changed over time since the 2013 survey, together with changes in investment.

Chapter Three examines trends in collaboration for innovation between firms and different kinds of partners including other businesses, higher education institutions and government

[7] The 2013 survey covers data from the period 2010-2012, the 2015 survey covers data from the period 2012 – 2014 and the 2017 survey covers data from the period 2014-2016.

agencies since the 2013 survey. It then examines connections between receipt of public financial support and firm outcomes.

Chapter Four illustrates variations in types of innovation implemented by firms in different sectors and investigates connections with performance.

Chapter Five explores regional variations in innovation activity since the 2013 survey.

Chapter Six analyses trends in factors that motivate firms to engage in innovation which may relate to internal business ambitions, external triggers in the market or from public policy, and links to firm performance.

Chapter Seven analyses trends in barriers to firms seeking to innovate which may relate to internal resources or external constraints and links to firm performance.

Chapter Eight examines links between skills and innovation and connections with firm performance.

1.6 Contacts for further information

For further information about the content of this report, or the UK Innovation Survey, please contact:

Annette Cox	annette.cox@beis.gov.uk	0207 215 3667
James Achur	james.achur@beis.gov.uk	020 7215 1331

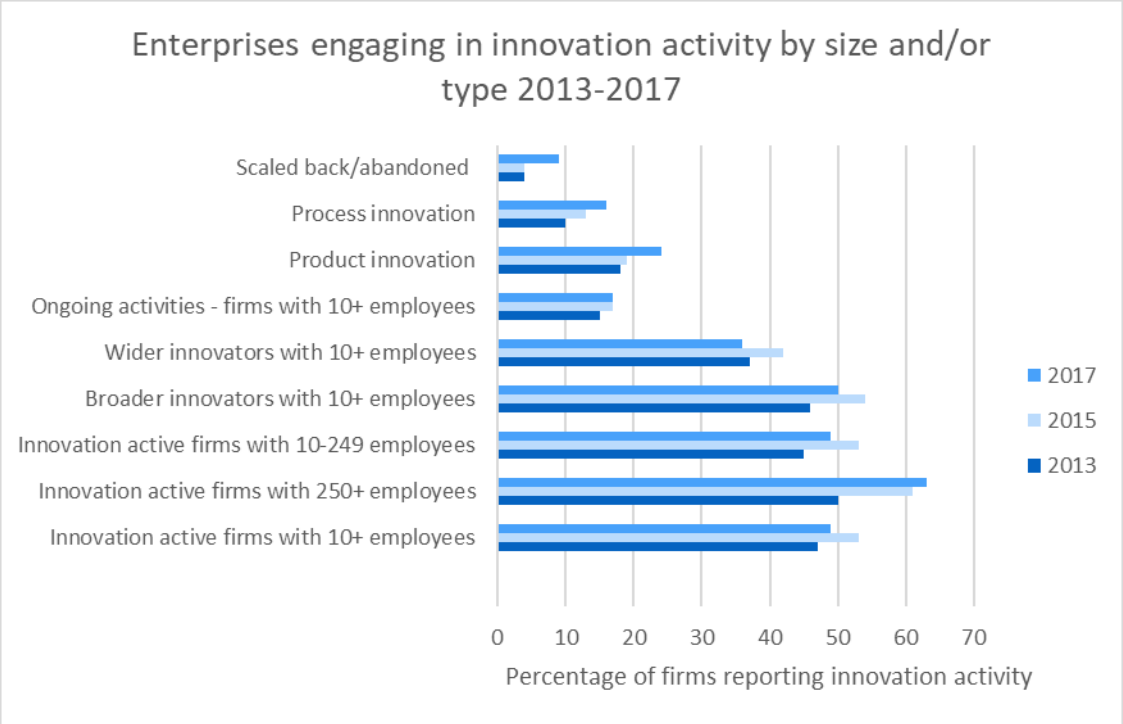
2 Levels and types of innovation

2.1 Introduction

Innovation types and levels vary widely by organisation size and location, while firm investment and its purpose can vary according to individual firm choices in the context of sector and type of innovation.

2.2. Changes in innovation over time

Figure 2.1 Innovation activity in firms over time



Unweighted base = 13,194 for 2017, 15,091 for 2015, 14,487 for 2013
Note: a response option on 'scaled back' in addition to 'abandoned' activities was only included in the 2017 survey

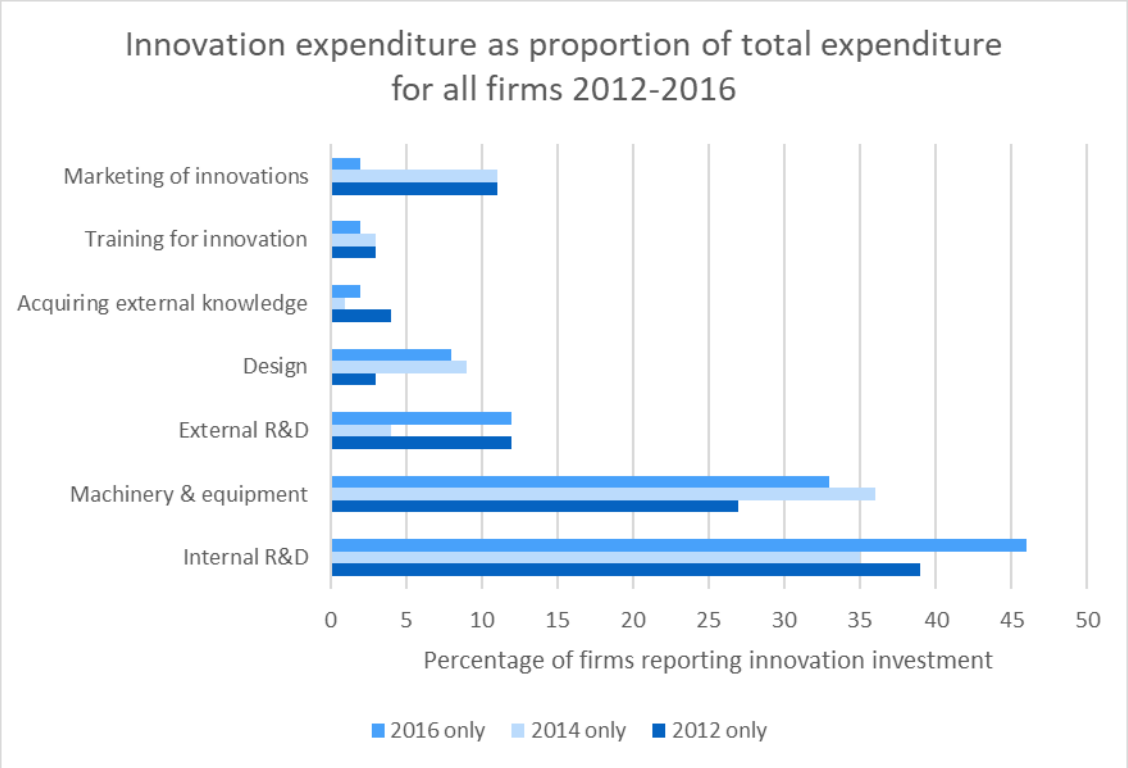
Figure 2.1 illustrates reported levels of innovation activity and types over time across the last three innovation surveys (2017, 2015 and 2013). The results show that reported innovation activity has decreased overall since 2015. This is accounted for by reduced activity in small and medium-sized firms with fewer than 250 staff including both 'broad' and 'wider' innovation types, in contrast with increased innovation activity in large firms with at least 250 staff. Incidence of engagement in both product and process innovation has increased among firms reporting innovation activities.

Internal research and development innovation activity was less common in Scotland and North East England and more common among firms in the East Midlands and South East (see Statistical Annex – Table 2).

This pattern of declining innovation activity in SMEs and increased activity in larger firms was mostly replicated within the panel data covering a longitudinal sub-sample of 2,808 firms from the 2013, 2015 and 2017 surveys. The main exception was innovation activity in firms with at least 250 staff which reduced from 64% in the 2015 survey to 60% in the 2017 survey (see Statistical Annex – Table 14, Table P1).

2.3 Change in innovation expenditure over time

Figure 2.2 Innovation expenditure in firms



Unweighted base = 13,194 for 2017, 15,091 for 2015, 14,487 for 2013

Figure 2.2 shows changes in focus of innovation expenditure over time. The share of spending on internal R&D has increased noticeably since 2014, while investment in capital equipment and marketing of innovations, design, external knowledge and training has decreased. The drop in spending on marketing of innovations was particularly marked. Possible explanations for these trends are discussed in Section 6.1.

Share of investment in machinery were lower in London and Northern Ireland (see Statistical Annex – Table 2), which is likely to reflect the fact that a greater proportion of

the economy is in the service sector and, in Northern Ireland, in the public sector[8]. Investment in computer software was lower in the North East of England. Investment in training was lower in the North West of England and investment in both training and design was lower in Northern Ireland (see Statistical Annex – Table 2).

Within the longitudinal panel data sub-sample of 2,808 firms, similar patterns of increased shares of investment in internal R&D, and decreased shares of capital equipment and marketing were evident (see Statistical Annex – Table 14, Table P2). In contrast with the cross-sectional sample, shares of investment in design, acquiring external knowledge and training have all increased. This may reflect differences in the characteristics of the panel sample and attitudes of firms within it towards innovation.

8 https://www.ons.gov.uk/file?uri=/businessindustryandtrade/business/activitysizeandlocation/datasets/ukbusinessactivitysizeandlocation/2017/ukbusinessworkbook2017.xls

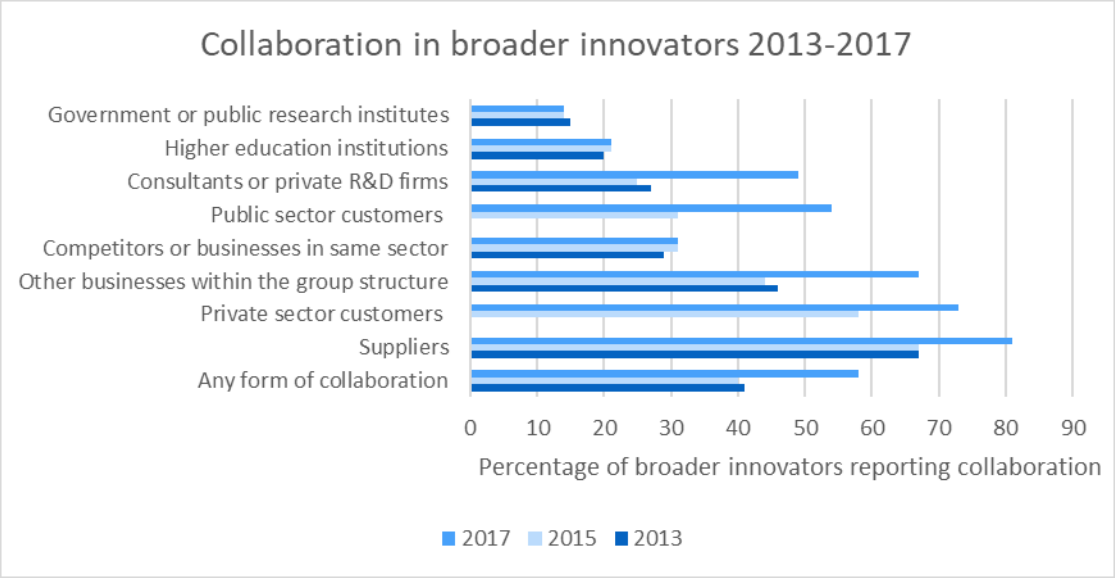
3 Innovation support and collaboration

3.1 Introduction

Developing innovations of any kind can be a complex process and firms may decide to work jointly with other businesses and seeks access to sources of advice and information to help the creative process. This section explores the types of collaborators that firms work with and where they turn to for support.

3.2 Trends in collaboration

Figure 3.1 Types of collaborator for broader innovators



Unweighted base = 13,194 for 2017, 15,091 for 2015, 14,487 for 2013

Note: no distinction was made in the questionnaire between public and private sector customers in 2013, so no data is given for that year

Figure 3.1 shows increased collaboration reported by broader innovators over time, with greater activity taking place especially with other firms in the same group, suppliers, public and private sector customers. Collaboration was least common between firms and higher education institutions and government or public research institutes.

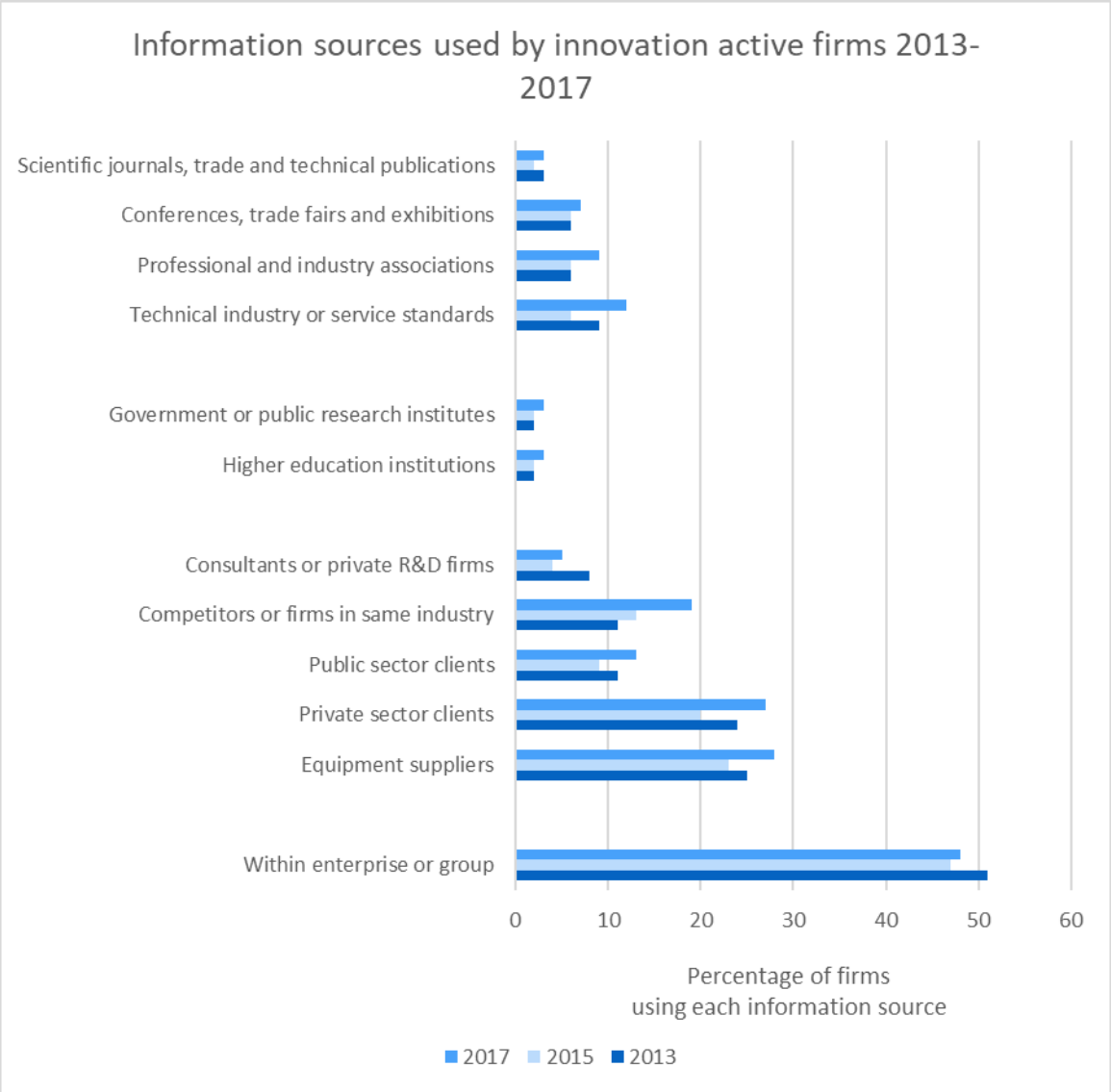
Further analysis at regional level within the UK is available in the Statistical Annex -Table 8. Collaboration with suppliers was less common in the West Midlands and more common in North East and North West England and Wales. Collaboration with private sector customers was more common in London, potentially reflecting ease of collaboration in a

concentrated geographical area. Collaboration with public sector customers was more common in South West England and less common in North East England, the West Midlands and the South East. Collaboration with both public and private sector customers was less common in Northern Ireland (see Statistical Annex – Table 8c).

A pattern of increased collaboration since 2015 was also reported in the panel survey sub-sample of 2,808 firms from the 2013, 2015 and 2017 surveys (see Statistical Annex – Table P4 in Table 14). In contrast to the cross-sectional data, collaboration with higher education institutions and government or public research institutes also increased within the panel sample.

3.3 Trends in information sources used

Figure 3.2 Use of information sources by innovation-active firms



Unweighted base = 13,194 for 2017, 15,091 for 2015, 14,487 for 2013

Figure 3.2 shows a consistent indicative trend in firms reporting that they most commonly seek information from within their own firm or group structure, which was also found in the longitudinal panel data sub-sample. In the 2017 cross-sectional survey, there were notable increases in firms reporting seeking information from public or private sector clients, competitors or other firms in the same sector or equipment suppliers. This is consistent with the trend in Figure 3.1 for greater collaboration between organisations in developing innovations.

At regional levels within the UK, firms in Northern Ireland were less likely to seek information from public or private sector clients and more likely to seek information from within their own enterprise group (see Statistical Annex – Table 9). Firms in North East England were less likely to seek information from suppliers or private sector customers. Firms in the South East and London were more likely to seek information from consultants.

In the longitudinal panel sub-sample increasing shares of firms reported seeking information from each of the possible sources between the 2015 and 2017 surveys (see Statistical Annex – Table P5 in Table 14).

3.4 Links between public support and firm outcomes

Around 5 per cent of firms in the 2017 cross-sectional survey reported receiving financial support from central government, compared to 7 per cent receiving support in the 2015 survey.

It is possible that those firms making use of public support in the form of financial support via tax credits or deductions, grants, subsidised loans and loan guarantees may benefit from greater capacity to innovate. In turn this could lead to superior performance outcomes including increased turnover and increased numbers of employees.

A simple regression analysis was performed using the panel data sub-sample from the 2013 and 2017 surveys to assess whether receipt of public support in the 2013 survey predicted increases in an index of outcome measures (turnover and employment), that is whether increases in turnover and employment were statistically more likely to occur than by chance in firms receiving public financial support.

Firms that received financial support were more likely to experience increases in turnover and employment (see Appendix 1).

4 Innovation characteristics and outcomes

4.1 Introduction

Innovation engagement varies across different types of sectors and the type of innovation can vary according to sector, in particular whether firms are supplying products or services[9].

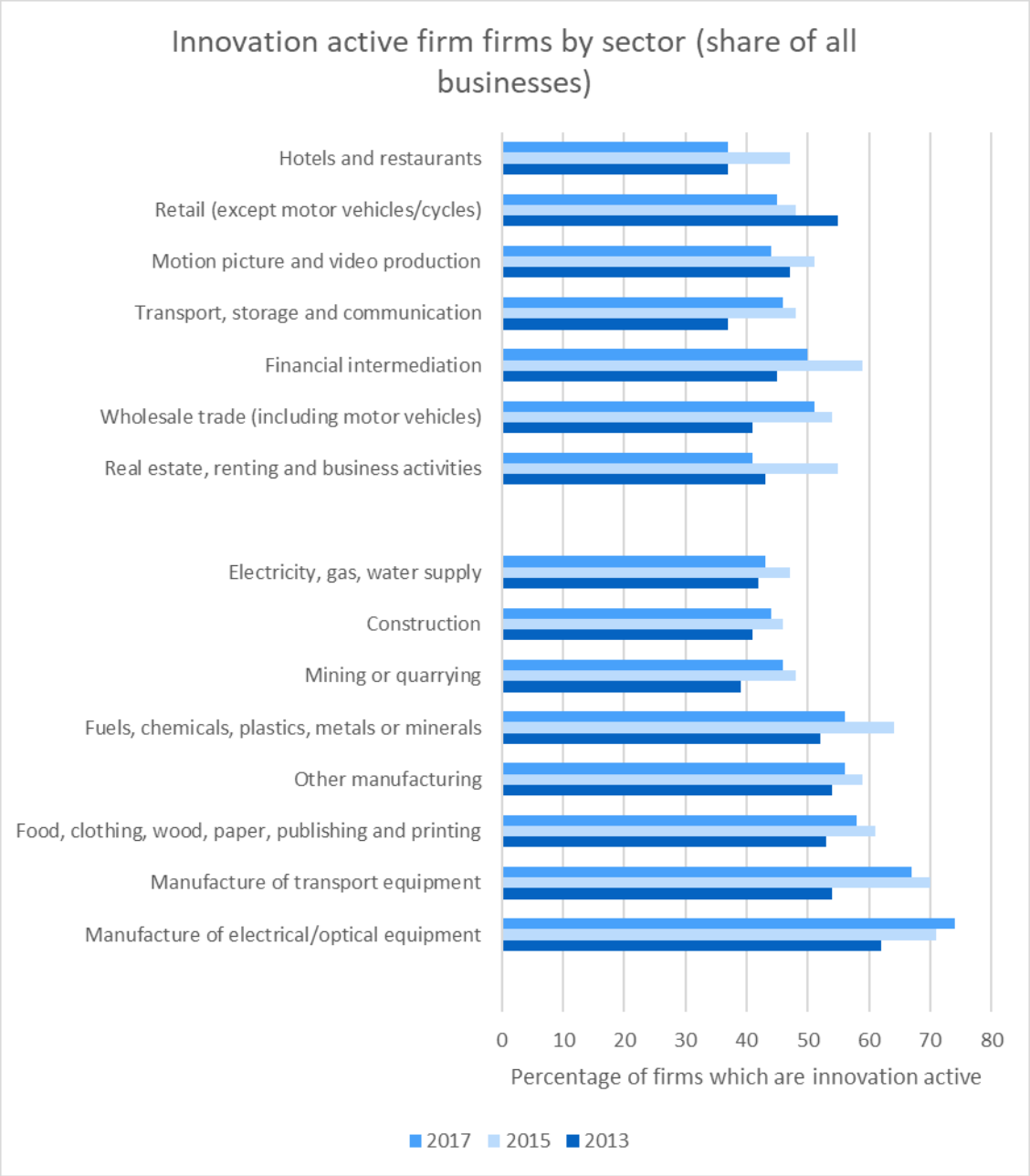
4.2 Patterns of innovation behaviours in sectors

Figure 4.1 overleaf shows how innovation activity varies across sectors. Higher incidence of innovation active firms was found in manufacture of electrical and optical equipment and manufacture of transport equipment. The only sector where a greater proportion of firms reported innovation activity since the 2015 survey is manufacture of electrical and optical equipment. In the panel survey shares of innovative firms in this sector also remained high and stable over time.

In contrast, several other sectors showed a consistent pattern of decreases in businesses reporting that they were active innovators between the 2015 and 2017 surveys, after increasing shares reported innovation activity between the 2013 and 2015 surveys. Firms in the retail sector reported a consistent trend in decreasing innovation since the 2013 survey with lower levels of innovation overall than in other sectors. This pattern is repeated in the panel survey. In addition, within the panel survey, electricity, gas and water; transport equipment manufacture; food, clothing, paper, wood, publishing and printing and real estate all showed declining shares of innovation-active firms within each sector (see Statistical Annex - Table P6 of Table 14).

[9] Ibidem.

Figure 4.1 Variations in innovation activity by sector



Unweighted base = 13,194 for 2017, 15,091 for 2015, 14,487 for 2013

4.3 Innovation and organisational performance outcomes

Wider research has shown associations between firm level innovation and benefits of superior performance outcomes including increased turnover and increased numbers of employees[10].

[10] Ibidem.

A simple regression analysis was performed using the panel data sub-sample from the 2013 and 2017 surveys to assess whether being a broader innovator in 2013 predicted increases in an index of performance measures (turnover and employment) by 2017, that is whether increases in turnover and employment were statistically more likely in innovative firms than by chance.

Firms which were broader innovators were more likely to experience increases in turnover and employment (see Appendix 1).

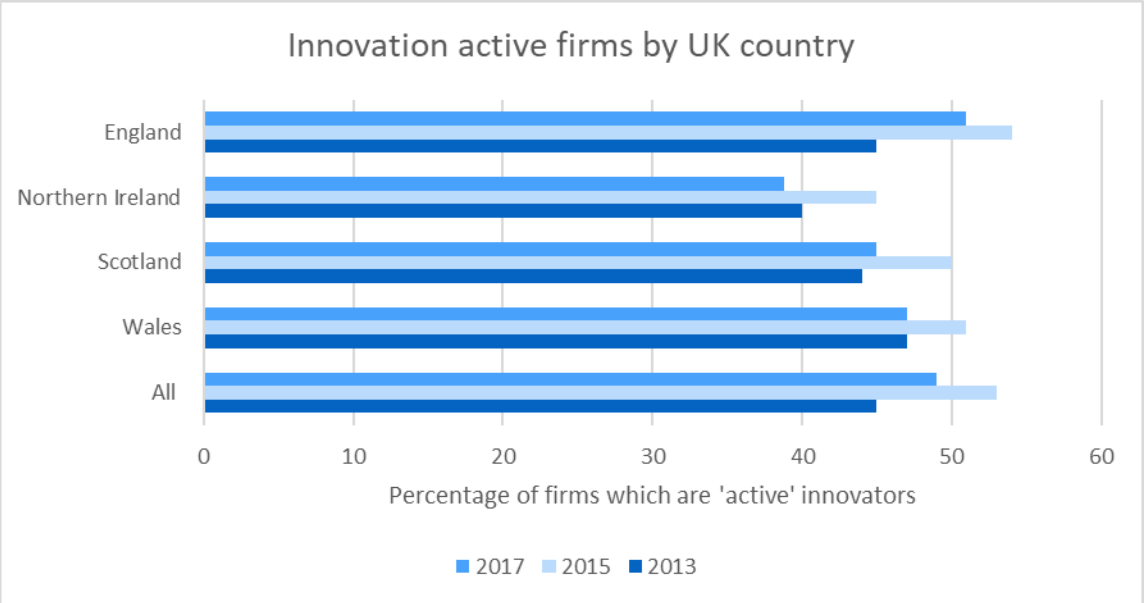
5 Geography of innovation

5.1 Introduction

Panel analysis of UKIS surveys from 2004 to 2010 show that highly innovative firms are distributed relatively evenly across the UK and within England and are not concentrated in particular locations[11]. This section investigates variations in engagement in innovation at a spatial level over the past three waves of the survey.

5.2 Spatial distribution of innovative firms

Figure 5.1 Variations in innovation activity by UK country



Unweighted base = 13,194 for 2017, 15,091 for 2015, 14,487 for 2013

Between 39% and 52% of firms in each UK country and English region report that they are innovation-active. Figure 5.1 shows that the incidence of reported innovation activity in the cross-sectional survey has decreased in all UK countries between the 2015 and 2017 surveys with the largest fall among firms in Northern Ireland and the smallest fall among firms in England. Similar trends were found in the panel survey, except for an increasing

[11] Coad, Alex., Cowling, M., Nightingale, P., Pellegrino, G., Savona, M. and Siepel, J. (2014) *Innovative Firms and Growth*. BIS Research Report, Department for Business, Innovation and Skills, London.

proportion of firms in Wales which engaged in innovation (see Statistical Annex - Table P7 of Table 14).

Among English regions, there has been a reported increase in innovation activity among firms in the South West, and declines in all other regions (see Table 1a in the Statistical Annex). The largest decreases took place in Yorkshire and the Humber and the North East (of 16 and 11 percentage points respectively) and the smallest decrease of one percentage point was found in London. The longitudinal panel survey shows similar trends (see Statistical Annex - Table P7 on Table 14).

Consistent with previous evidence on the distribution of highly innovative firms[12] there is limited variation in engagement in innovation between different English regions.

[12] Ibidem.

6 Factors driving innovation

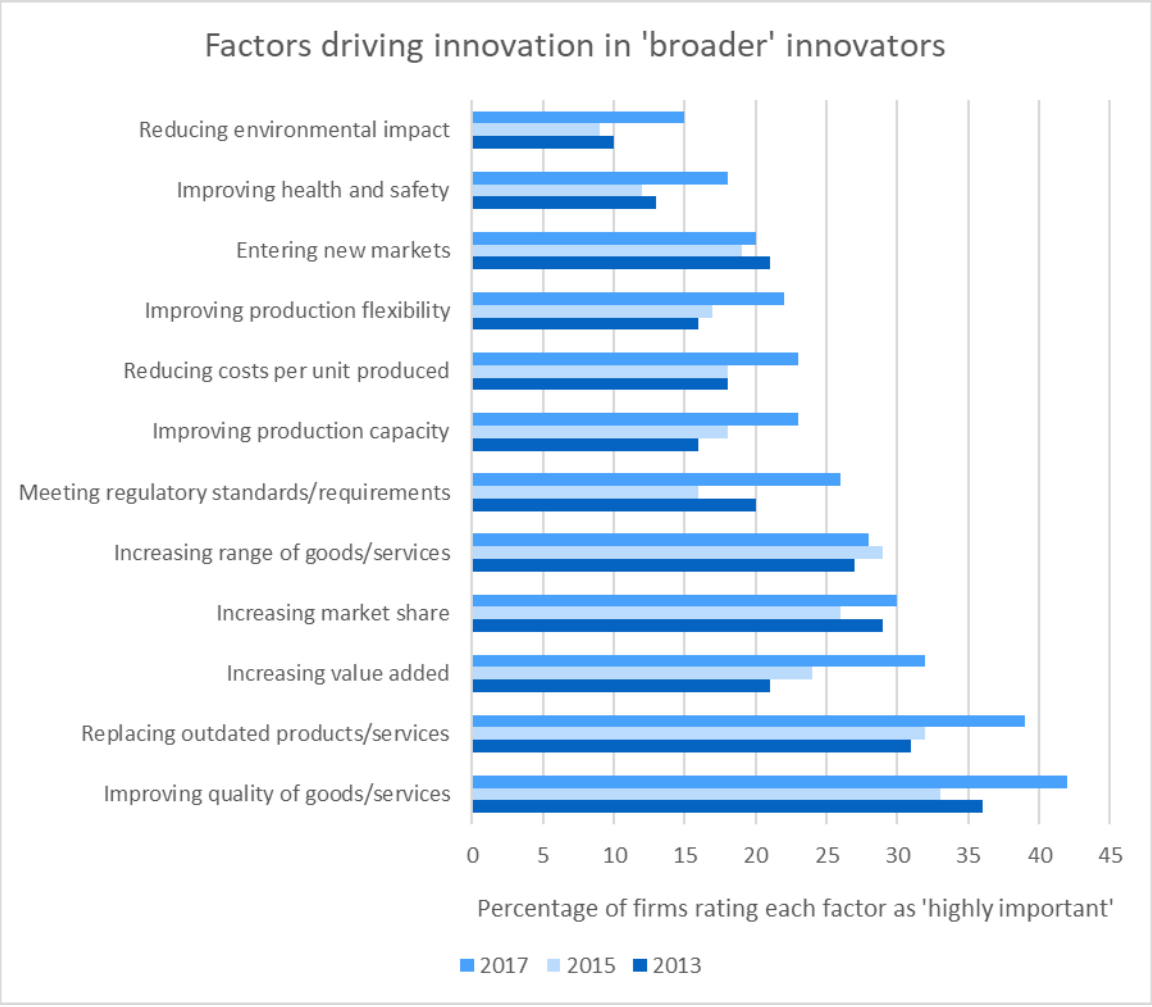
6.1 Introduction

There are varying motivations for firms to engage in broad forms of innovation which may relate to firms' business strategies of improving quality, reducing costs or diversifying their range of products and services. Changes in these motivations can vary over time, reflecting evolution in the external environment and market conditions.

6.2 Trends in factors driving innovation

Figure 6.1 shows trends in motivations for firms to engage in broad forms of innovation.

Figure 6.1 Motivations for innovation activity



Unweighted base = 13,194 for 2017, 15,091 for 2015, 14,487 for 2013

This shows that the most common factors driving innovation reported in the cross-sectional survey are improving product/service quality, replacing outdated products/services (both of which are also most common in the 2017 wave of the panel survey – see Statistical Annex Table P8 on Table 14) and increasing value added. There were some regional variations among the common drivers of innovation (shown in Statistical Annex – Table 10) . Expanding the range of products and services was a more frequent motivator of innovation in North East and Eastern England and lower in North West England. Improving quality of goods and services was less commonly reported as a motivator in Northern Ireland and North East England, but more commonly reported in South East England and Scotland. Replacing outdated products and processes was a less common motivator in North West England, but more common in North East England, West Midlands, Wales, Scotland and Northern Ireland.

Some of these factors, together with other drivers of innovation, were reported by increasing shares of firms. Those factors rising most in influence across enterprises since the 2015 survey were meeting regulatory standards (also evident in the 2017 panel survey data together with replacing outdated goods/services), improving product/service quality and increasing value added. This is indicative of more firms adopting business strategies which are focussed on quality.

Increasing shares of firms reporting replacement of existing good/services and improving quality as innovation drivers may explain the decrease in investment in marketing innovation evident in Figure 2.2. Firms may not choose to invest as much in marketing products/services which are being refreshed compared to those which are wholly new or being targeted at new potential customers.

6.3 Factors driving innovation and firm outcomes

It is possible that firms reporting distinct motivations for innovating may experience superior firm performance outcomes.

A simple regression analysis was performed using the panel data sub-sample from the 2013 and 2017 surveys to assess whether rating drivers of innovation as of high or medium importance in the 2013 survey predicted increases in an index of performance measures (turnover and employment) by the 2017 survey, that is whether increases in turnover and employment in firms reporting high or medium level of innovation motivations were statistically more likely to occur than by chance.

Firms which rated one or more innovation motivations as ‘high’ or ‘medium’ were more likely to experience increases in turnover and employment (see Appendix 1).

7 Barriers to innovation

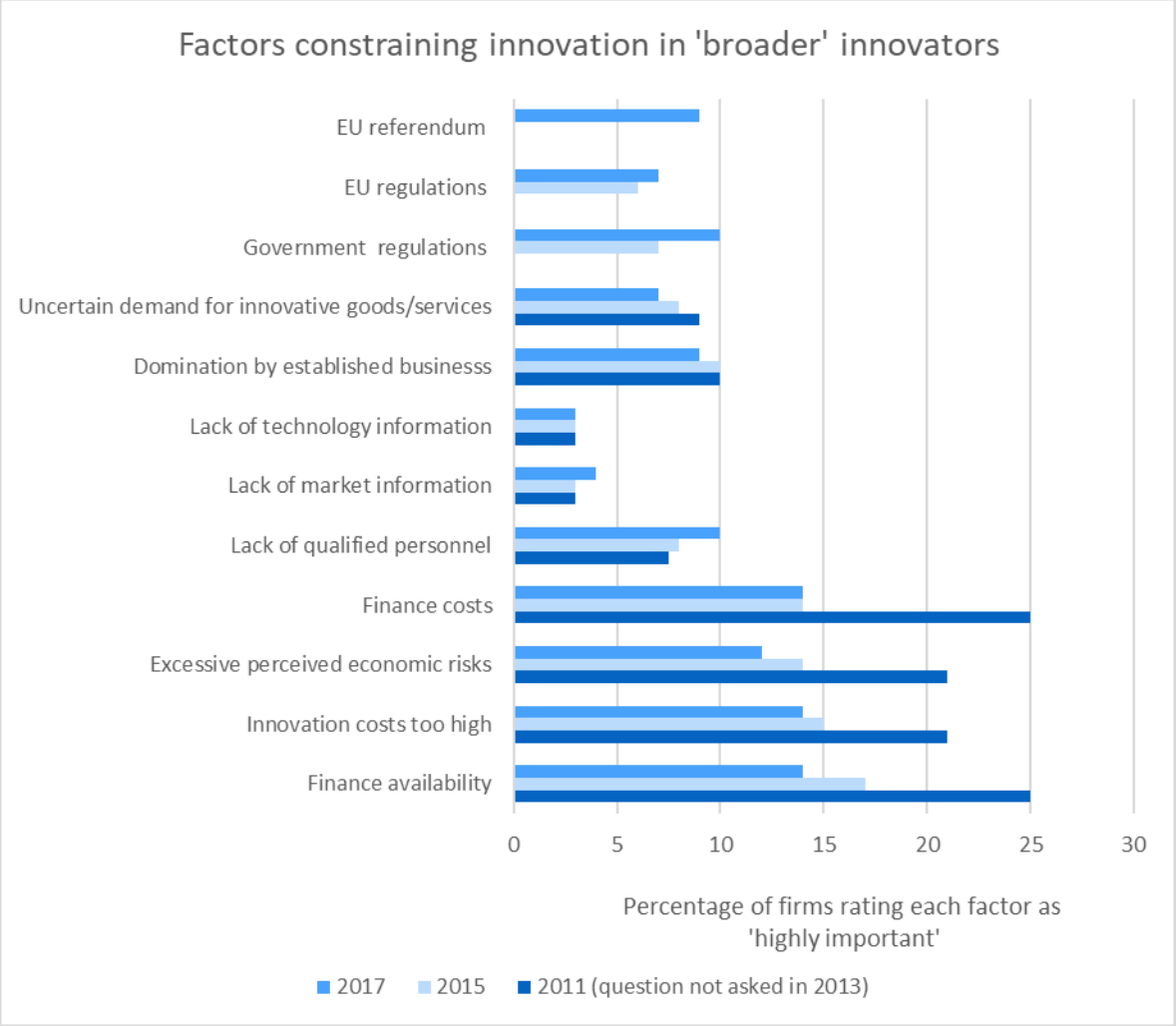
7.1 Introduction

Previous research has shown perceived barriers to innovation appear to have little relation to firm performance when focussing on highly innovative firms[13]. It is important to compare and track perceptions of barriers to innovation among innovative firms and non-innovators over time.

7.2 Trends in barriers to innovation

There are varying barriers to firms engaging in broad forms of innovation shown in Figure 7.1.

Figure 7.1 Factors constraining innovation in broader innovators



Unweighted base = 13,194 for 2017, 15,091 for 2015, 14,487 for 2013
Note that 'government regulation' and 'EU regulation' were combined in one response option in 2011 so figures for this year are not given.

[13] Ibidem.

The chart shows that the share of broader innovators firms reporting several common barriers has reduced over time in the cross-sectional survey, particularly since the 2011 survey. Availability and costs of finance, together with innovation costs and perceived economic risks, are the most common barriers, although the share of firms reporting each of these barriers, except finance costs, has dropped since the 2015 survey. Government and EU regulations, lack of qualified personnel and lack of market information show small increases as reported barriers to innovation since the 2015 survey. This is consistent with the results of the panel survey, in which firms also reported small increases in barriers created by uncertain demand for goods and services, lack of technology information, market domination by established business (see Statistical Annex -Table P9 on Table 14).

Nine per cent of firms in the 2017 cross-sectional survey reported the EU referendum as a barrier to innovation. The survey fieldwork period covers a pre- and post-referendum time frame, so firm conclusions about the impact of the referendum on innovation should not be made.

In the cross-sectional survey, higher shares of firms reported finance costs as a barrier in North East England, Scotland and Wales while higher shares of firms in Scotland and Wales again reported availability of finance as a concern. Innovation costs were raised as a concern by a higher share of firms in North East England and Scotland. Shortages of skilled staff were lower in Yorkshire and the Humber and Northern Ireland than the average. Detailed information is available in the Statistical Annex – Table 10a.

Barriers to innovation do not appear to be major reasons why non-innovators do not innovate. Just three per cent of firms reported constraining factors as reasons for not innovating, compared to 29% stating that they did not need to in existing market conditions (see Statistical Annex - Table 11a). Incidence of reported constraints was consistent with the 2015 survey, while absence of market pressures has grown as a reason for not innovating from 12% in the 2015 survey to 29% in the 2017 survey.

7.3 Barriers to innovation and firm outcomes

It is possible that facing barriers to innovation which are perceived as high or medium may deter firms from innovating and have a negative effect on performance outcomes.

A simple regression analysis was performed using the panel data sub-sample from the 2013 and 2017 surveys to assess whether rating barriers to innovation as of high or medium importance in the 2013 survey predicted reductions in an index of performance measures (turnover and employment) by the 2017 survey, that is whether reductions in turnover and employment in firms reporting high or medium level of innovation motivations were statistically more likely to occur than by chance.

Firms which rated one or more innovation barriers as ‘high’ or ‘medium’ were more likely to experience increases in turnover and employment (see Appendix 1).

8 Skills for innovation

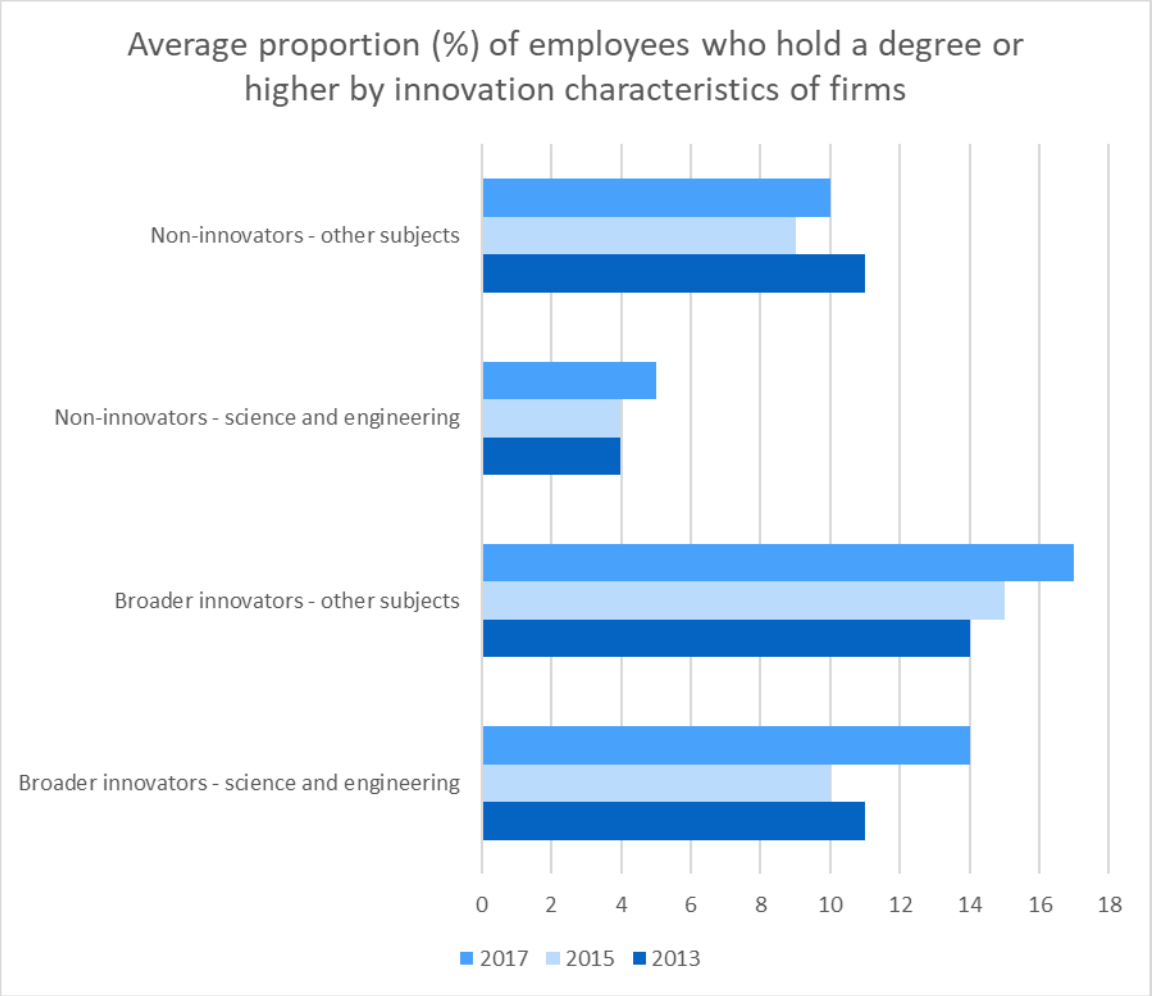
8.1 Introduction

Workforce skills to create and implement new products, services, practice and processes are essential components to introducing innovations. Previous research has shown that science, technology, engineering and Maths (STEM) graduates make up a greater share of the workforce in highly innovative firms than in less innovative organisations[14]. STEM graduate employment is also associated with greater use of external information, co-operation and introduction of new products (ibidem). It is argued that employing STEM graduates increases demand for innovation through greater use of external collaboration and networking, leading in turn to further demand for these graduates.

[14] Ibidem.

8.2 Trends in skills and innovation over time

Figure 8.2 Shares of staff with higher level qualifications in innovator and non-innovator firms



Unweighted base = 13,194 for 2017, 15,091 for 2015, 14,487 for 2013

Figure 8.2 compares the average proportion of the workforce holding at least a degree level qualification in non-innovators and broader innovator firms in the cross-sectional survey. The proportion of employees holding higher qualifications in both STEM and non-STEM subjects has increased across non- and broad innovators since the 2015 survey, but the increases were more substantial in broad innovators. The panel data trends were similar except for a drop in the share of non-STEM graduates employed in non-innovators since the 2015 survey (see Statistical Annex – Table P10 on Table 14).

Proportions of STEM graduates in the workforce of broader innovators were higher in London, South East England and Scotland and lower in North East England (see Statistical Annex – Table 12). Shares of non-STEM graduates in the workforce of broader

innovators were substantially higher in London and lower in North East England, Yorkshire and Humber and the West Midlands. This reflects the distribution of graduates within the general workforce. These trends may reflect a rising share of the working population holding graduate qualifications[15].

8.3 Skill levels and organisational performance outcomes

It is possible that having a higher share of STEM or non-STEM graduates may support innovation and have a positive effect on firm performance outcomes.

A simple regression analysis was performed using the panel data sub-sample from the 2013 and 2017 surveys to assess whether a positive change in the share of STEM or non-STEM graduates between the 2013 and 2017 surveys predicted increases in an index of performance measures (turnover and employment) by the 2017 survey, that is whether increases in turnover and employment in firms reporting increases in shares of STEM or non-STEM graduates were statistically more likely to occur than by chance.

Firms which employed an increasing share of either STEM or non-STEM graduates were more likely to experience improvements in turnover and employment (see Appendix 1).

[15] The percentage of the population classed as graduates has been rising steadily from 24% in 2002, to 42% in July to September 2017 (ONS (2017) *Graduates in the UK Labour Market*, Statistical Release, 24th November).

Appendix 1 Regression analysis results

A regression analysis was undertaken to test possible predictors of higher turnover and employment growth based on the panel data for UKIS 2013, 2015 and 2017. These statistics and results are experimental.

Possible explanatory variables were identified as receipt of public financial support, innovation activity, factors driving innovation, barriers to innovation, and skills for innovation. The innovation drivers and barriers were grouped into related categories to create new independent variables as follows:

i) Factors driving innovation:

1) **growth** - entering new markets + increasing market share + improving capacity
2) **upgrading** - improving quality + replacing outdated goods and services
3) **diversification** - improving flexibility for goods and services + increasing range of goods and services
4) **costs** - reducing costs
5) **value** - increasing value added
6) **regulation -** Improving health and safety + reducing environmental impacts +meeting regulatory standards

ii) Barriers to innovation:

1) **finance** - cost of finance + availability of finance + direct innovation costs too high
2) **risk and uncertainty** – excessive perceived economic risk + uncertain demand for goods and services
3) **regulation** – EU or UK
4) **market** – dominated by established firms
5) **staff** – lack of qualified personnel
6) **lack of information** - on technology or markets

Dependent variables were change in outcomes (turnover and employment) and calculated as the percentage change of outcomes reported for 2016 compared to those for 2010.

To create an index the turnover percentage changes were recoded into six bands (<0% = 1, 0 to 24% = 2, 25-49% = band 3, 50-74% = band 4, 75-100% = band 5 and >100% = band 6). Similarly, employment growth levels were recoded into six bands. An outcome

index was derived by adding up the turnover and employment bands and ranged from 1 to 12.

Due to small cell sizes for some categories, it was not possible to control for region, firm size and sector within the model.

The regression calculation was based on $Y = b_o + b_1X$ where y = outcome index (discrete variable ranging from 1 to 12), b_o = intercept, b_1 to b_{15} = beta coefficients (marginal effects), and X = explanatory variable. Weighting is used to ensure the data is representative of all 25 sectors from which firms were sampled. Two tables are presented showing unweighted and weighted results. All regression analyses were undertaken using R programming. Results are shown in Table A1 below.

Table A1. Regression results predicting the probability of higher turnover and employment growth

	Unweighted			Weighted		
	Marginal effect/ (Multiple R^2)	Standard error	Significance	Marginal effect/ (Multiple R^2)	Standard error	Significance
Public finance support	0.509 0.003	0.216	*	0.974 0.009	0.228	***
Innovation activity	0.729 0.013	0.141	***	1.246 0.038	0.136	***
Index of all innovation drivers	0.681	0.14	***	1.235 0.038	0.136	***
Growth	0.678 0.011	0.139	***	1.257 0.038	0.138	***
Upgrading	0.662 0.011	0.139	***	1.241 0.038	0.136	***
Diversification	0.63 0.01	0.14	***	1.118 0.03	0.139	***
Costs	0.318 0.002	0.148	*	0.824 0.014	0.152	***
Value	0.737 0.013	0.141	***	1.262 0.037	0.141	***
Regulation and standards	0.567 0.007	0.143	***	0.939 0.02	0.144	***
All barriers	0.42 0.004	0.14	**	0.891 0.01	0.137	***
Finance	0.196 0.001	0.141		0.646 0.02	0.14	***

Risks and uncertainty	0.299	0.14	*	0.708	0.138	***
	0.003			0.012		
Regulation EU/ UK	0.305	0.161		0.687	0.158	***
	0.002			0.009		
Market dominated by established firms	0.026	0.158		0.342	0.157	*
	0			0.002		
Shortage of qualified staff	0.439	0.152	**	0.772	0.149	***
	0.004			0.013		
Lack of information on technology or markets	0.217	0.158		0.446	0.157	**
	0.001			0.004		
Increase in STEM degree holders	0.487	0.14	***	0.745	0.145	***
	0.006			0.012		
Increase in non-STEM degree holders	0.813	0.146	***	0.991	0.138	***
	0.015			0.024		

* = the probability of obtaining this result by chance is less than 10%

** = the probability of obtaining this result by chance is less than 5%

*** = the probability of obtaining this result by chance is less than 1%

Appendix 2 – Additional Evidence Sources

EU-wide statistics are published by Eurostat in the Community Innovation Survey
http://ec.europa.eu/eurostat/statistics-explained/index.php/Innovation_statistics

Further international comparisons are published by the OECD in their Innovation Indicators
http://www.oecd.org/innovation/inno/inno-stats.htm

The Office for National Statistics (ONS) publishes detailed statistics on research and development:

Business enterprise research and development (2016)
https://www.ons.gov.uk/economy/governmentpublicsectorandtaxes/researchanddevelopmentexpenditure/bulletins/businessenterpriseresearchanddevelopment/2016

Gross domestic expenditure on research and development (2016)
https://www.ons.gov.uk/economy/governmentpublicsectorandtaxes/researchanddevelopmentexpenditure/bulletins/ukgrossdomesticexpenditureonresearchanddevelopment/2016

UK government expenditure on science, engineering and technology (2015)
https://www.ons.gov.uk/releases/ukgovernmentexpenditureonscienceengineeringandtechnology2015

For more general business statistics, please see:

Business population estimates for an estimate of the total number of registered and unregistered businesses in the UK

https://www.gov.uk/government/statistics/business-population-estimates-2018

UK business; activity, size and location for UK businesses by legal status, industry, region, employment and turnover size bands

https://www.ons.gov.uk/businessindustryandtrade/business/activitysizeandlocation/bulletins/ukbusinessactivitysizeandlocation/2017

The Longitudinal Small Business Surveys (SBS)[16] are made up of three publications: a panel survey introduced in 2015, a cross sectional survey of small firms with employees and a survey of businesses with no employees. These offer insights into business thinking on a wide range of topics include business aspirations and investment, use of finance support, export and import behaviour, product development, training and engagement with business.

[16] https://www.gov.uk/government/collections/small-business-survey-reports#2017