Analysis of Ireland's Innovation Performance

March 2011

Forfás

Executive Summary

This analysis is the first to take a closer look at trends and developments in Ireland's comparative innovation performance, using the results of the Community Innovation Survey 2006-2008 as a central plank. The aim of the paper is to establish Ireland's innovation performance at international level, identifying macro-level strengths and weaknesses, and to examine in greater detail where in particular these strengths and weaknesses lie.

It is intended that the findings arising from the analysis will provide an important input to the overall assessment of the returns to the State from the funding for science, technology and innovation and the foundation for an evidence base for policy, and provide initial signposts to focal points of innovation policy into the future.

Key Messages and Policy Implications

- Ireland's performance is encouraging at an international level, with a high proportion of firms engaged in innovation activity, and high level of innovation expenditure. However, when one looks more closely at the results at a domestic level, there are notable weaknesses in innovative activity, particularly on the part of small indigenous firms.
- In the context of the downturn, international evidence suggests that innovative firms are more likely to persist with innovation investment to sustain productivity growth and/or product development than firms with little or no experience of/expertise in innovation. Early indications from the Forfás ABSEI Survey 2009 are that both indigenous and foreign firms sustained investment in Research and Development during the recent downturn, an important component of overall innovation expenditure.
- Looking ahead, there are still challenges faced by firms in Ireland, notably access to finance and high costs of innovation, as well as the availability of world-class ICT infrastructure, which may hamper future innovation. Improvements in other forms of physical infrastructure impact positively on returns (and therefore incentives) notably to process innovation, and are also important in the context of overall innovation performance.

Table E.1 provides an overview SWOT analysis of Ireland's key high level challenges with respect to innovation policy, viewed from an international perspective.

Table E.1 SWOT Matrix of Ireland's Current International Innovation Performance

Strengths	**Weaknesses**
▪ High proportion of firms engaged in technological innovation, particularly among SMEs ▪ Relatively high levels of expenditure on innovation by EU standards – maintained in 2008	▪ High costs of innovation, particularly for small firms ▪ Contribution to turnover of new-to-firm and new-to-market innovations is below EU average ▪ Innovation intensity has fallen between CIS 2006 and CIS 2008
Opportunities	**Threats**
▪ International evidence suggests that Ireland's high innovation intensity will ensure a greater number of firms remain innovative during recession ▪ Potential value in non-technological innovation, particularly marketing innovation in service industries	▪ Innovation expenditure may be poorly targeted and inflexible, with a current over-emphasis on technological innovation and R&D; machinery and equipment ▪ Improving but relatively poor external physical infrastructure, particularly telecoms, may hold back technological product innovation, particularly in knowledge-intensive service industries

The following summarises the key findings in the survey analysis and identifies emerging issues for policy consideration, with the starting premise that there is an ongoing commitment to stimulating export-led growth in the small firms sector, as well as a commitment to the knowledge, or "smart" economy, as core elements to future enterprise development and economic growth, in a straitened fiscal climate.

- **The larger the firm, the more likely it is to innovate.** About 40% of small firms undertake some form of innovation, compared to 61% of medium-sized firms and some 76% of large firms. The proportion of small firms that innovate tend to focus more on process innovation (generally less resource intensive) and are overall less likely to engage in more than one innovation mode.
    - As the largest cohort within the survey population (approximately four-fifths of companies, and two-thirds of employment), targeting and encouraging innovation activity in small firms is an important issue.
    - In the context of encouraging small indigenous firms to grow and to successfully exploit overseas markets, innovation policies targeting small firms are all the more important, particularly when one considers the positive relationship between innovation activity and propensity to export.

- **Returns to product innovations are lower than the EU average.** The rate of return to new-to-firm product innovations (as measured by proportion of turnover) is weaker than many other EU states. This could reflect poorer targeting of R&D resources by enterprises in Ireland, or could be due to internal or external capacity issues.
    - It is, however, important to note that this could also be interpreted as a positive reflection of Ireland's performance, in that it has attained a "steady state" level of return to product innovation. There are a number of countries, including EU accession states, who record high returns to new-to-firm and new-to-market innovations, but which by other metrics would be considered to still be converging towards a more developed national innovation system.

- **Indigenous firms are less innovative than foreign-owned firms in Ireland.** While there are distinct differences in the structure of indigenous and foreign-owned firms in Ireland, it is notable that the indigenous sector is significantly less innovative, and is less likely to effectively collaborate across the range of potential partners, notably Universities and publicly-funded bodies, than foreign-owned firms based here. However, the proportion of all indigenous Irish firms engaged in some mode of innovation activity is still higher than the EU-27 average.
    - Across almost all cohorts, foreign-owned firms are more likely to be innovation-active than Irish firms. It is also the case that a typical foreign-owned firm is likely to be engaged in a greater number of innovation modes.
    - It should be noted that all foreign-owned firms have specific ownership characteristics not shared by all Irish firms, in particular being part of an enterprise group. It is therefore to be expected that foreign-owned firms will be somewhat more likely to innovate, and more capable of finding working capital and innovation partners than a typical Irish firm of a similar size. However, the area of concern is the often large differential between Irish and foreign-owned firms, particularly amongst small firms, in key areas such as product innovation and cooperation arrangements – with respect to collaboration, indigenous firms may not be benefiting fully from positive externalities arising from proximity to innovative foreign-owned firms.

- **Particular modes of innovation are more suited to certain industries and sectors than others.** *It is neither accurate nor helpful to view innovation merely in terms of, say, R&D or acquired patents.* Innovation policy should not be seen as limited to funding internally or externally-sourced R&D. The variation in modes of innovation by sector is, in many cases, a reflection of the goods and services that firms in these sectors provide. Innovative firms are more likely to export and operate in internationally traded sectors, where there are open, competitive markets. Policies to encourage technological or non-technological innovation need therefore to take into account the sectors targeted, e.g. as between manufacturing and retail businesses.

  The motivations for firms to engage in different modes of technological innovation can also vary by sector. In high value-added sectors such as chemicals and ICT, long-term product goods innovation (normally via R&D) is crucial from the point of view of product development and long-term revenue growth; on the other hand, other sectors of manufacturing may place more emphasis on pursuing process innovations as a means of

reducing their cost base. Innovation approaches can therefore sometimes vary between the more offensive and strategic, and the more defensive and tactical.

- **Innovation potential and growth opportunities lie in non-technological innovation.** With the ongoing structural shift towards service industries, there is potential for a greater impact from marketing and organisational innovations at firm level. Given the likely short and medium-term fiscal climate, the emphasis should be placed on value and achieving more for less. *Policies to encourage non-technological modes of innovation represent such an opportunity.*
  - Non-technological innovations can in some cases supersede product/service innovations in terms of their value to companies. For small firms, initiatives such as these are often more affordable and, in some cases, more effective than, say, long-term R&D arrangements, which may not even be applicable in some sectors. Policy must take this into account, if the objective is to achieve greater output per euro spent on innovation.
  - Increasing prevalence of organisational innovations can be linked to improvements and increases in strategic decision making, which can be encouraged through management development provision. There are frameworks already being put in place to incentivise management development, and the link to the wider innovation agenda should also be taken into account.
  - With respect to marketing innovation, it is important to point out that the most recent survey data already appears to reflect medium and large indigenous firms' awareness of the value of such innovations. More medium and large Irish firms engaged in marketing innovation than foreign-owned firms, in part reflecting the specific functions of large foreign firms in Ireland and going against the general trend that foreign firms are more likely to engage in a given mode of innovation than Irish firms. This also reflects the relatively high concentration of medium-sized Irish companies in service industries.

- **At survey level, there is currently a lack of feedback data.** While the CIS captures in detail firms' approaches and inputs to innovation, there is very little data available to measure and monitor the effects of prior or current innovation activities. As a result, in the absence of a broader evidence base on the outcomes of innovation, it becomes more difficult to incentivise non-innovation-active firms, particularly those who face high barriers to innovation such as small firms, to make investments in upgrading their products or processes.

  Added to this is the difficulty in determining the 'optimal' number of firms that should be engaged in innovation for a given expenditure, or the 'optimal' level of engagement, particularly for small firms, given the financial and resource constraints often faced by this cohort. Setting tangible innovation performance targets in the context of the existing CIS may also be difficult, given the subjective response nature of the aggregate evidence base. Efforts to improve data that measures and monitors the effects of prior or current innovation activities would be useful. This will be raised at the OECD National Experts on Science, Technology and Innovation (NESTI) group, of which Forfás is a member.

- **Sound Framework Conditions for Innovation must remain or otherwise be put in place.** In the context of developing a knowledge economy, forms of hard and soft infrastructure at a national level become increasingly important. For example, the availability of a high speed, low cost, reliable broadband service can enhance or improve particular forms of service innovation, and also forms of process innovation. Solid skills in areas such as ICT can enable companies to (cost-) effectively implement more ambitious process innovations across a range of sectors. Improved marketing innovations can also be linked to a wide range of softer skills.

- **The innovation agenda can and should easily link into other initiatives and fora with respect to implementation.** In terms of advancing and encouraging the innovation agenda, the following bodies are useful levers, and can, where appropriate, feed innovation into their work programmes. These include the Expert Group on Future Skills Needs, which can focus on opportunities to capitalise on innovation opportunities at firm level depend on the right skillsets in the workforce can be advanced. Similarly, it is helpful that the National Competitiveness Council continue to highlight the role of innovation performance in galvanising productivity growth. The Advisory Science Council will have important monitoring and advisory roles in this regard, especially on medium- to long-term innovation issues and in providing the primary interface between stakeholders and policymakers in the innovation arena. Finally, Forfás will continue to collect data on innovation (jointly with the CSO) in the Community Innovation Survey and analyse these data to produce research findings on innovation that continue to highlight strengths and areas that require attention by Government.

1. Background to Community Innovation Survey 2006-2008 Analysis

This analysis is the first to take a deeper look at trends and developments in innovation, using the results of the Community Innovation Survey as a central plank. The aim of the paper is first of all to establish Ireland's innovation performance at international level, identifying macro-level strengths and weaknesses, before examining in greater detail where in particular these strengths and weaknesses lie. It is intended that the findings arising from the analysis provide the foundation for an evidence base for policy, and provide initial signposts to focal points of innovation policy into the future.

The Community Innovation Survey 2006-2008 is the sixth in a series of surveys of company attitudes and approaches to innovation activity, and is standardised across the EU. A number of EU candidate states and EEA member states also conduct the survey. The responses to the survey are based on company managers' assessments of their companies' approach to innovation. In this paper, it is the focal point of the analysis of Ireland's innovation performance, both at national and international level. The European comparative analysis in chapter 2 places Ireland's performance into context across a range of metrics, as well as identifying recent research on wider innovation trends and best practice. A more in-depth exploration of Ireland's strengths and weaknesses is covered in chapters 3 and 4, based on closer analysis of the CIS survey results, with the policy implications and recommendations outlined in chapter 5.

This analysis will be an important input to the overall assessment of the returns to the State from the funding for science, technology and innovation and as to whether the investments are being made in the right ways. Relevant analyses are continuing within Forfás, including examining the linkages between the public research system, enterprise performance and economic impacts in terms of productivity, sales/exports and employment growth and the assessment of strengths and future needs as part of the STI Investment Prioritisation process.

2. International Overview of Innovation Performance

This section looks primarily at Ireland's relative Community Innovation Survey performance at the European level in 2008, and also looks at its most recent performance in the Innovation Union Scoreboard 2010. In addition, there is a brief review of the effects of innovation on firm performance across countries, based on recent international survey data, identifying trends where present

The aim is to establish at a general level where Ireland's relative strengths and weaknesses lie, and to identify where opportunities for improvements may be present and exploitable, both for firms based in Ireland and for policymakers to develop or strengthen the underlying framework conditions.

Key Points

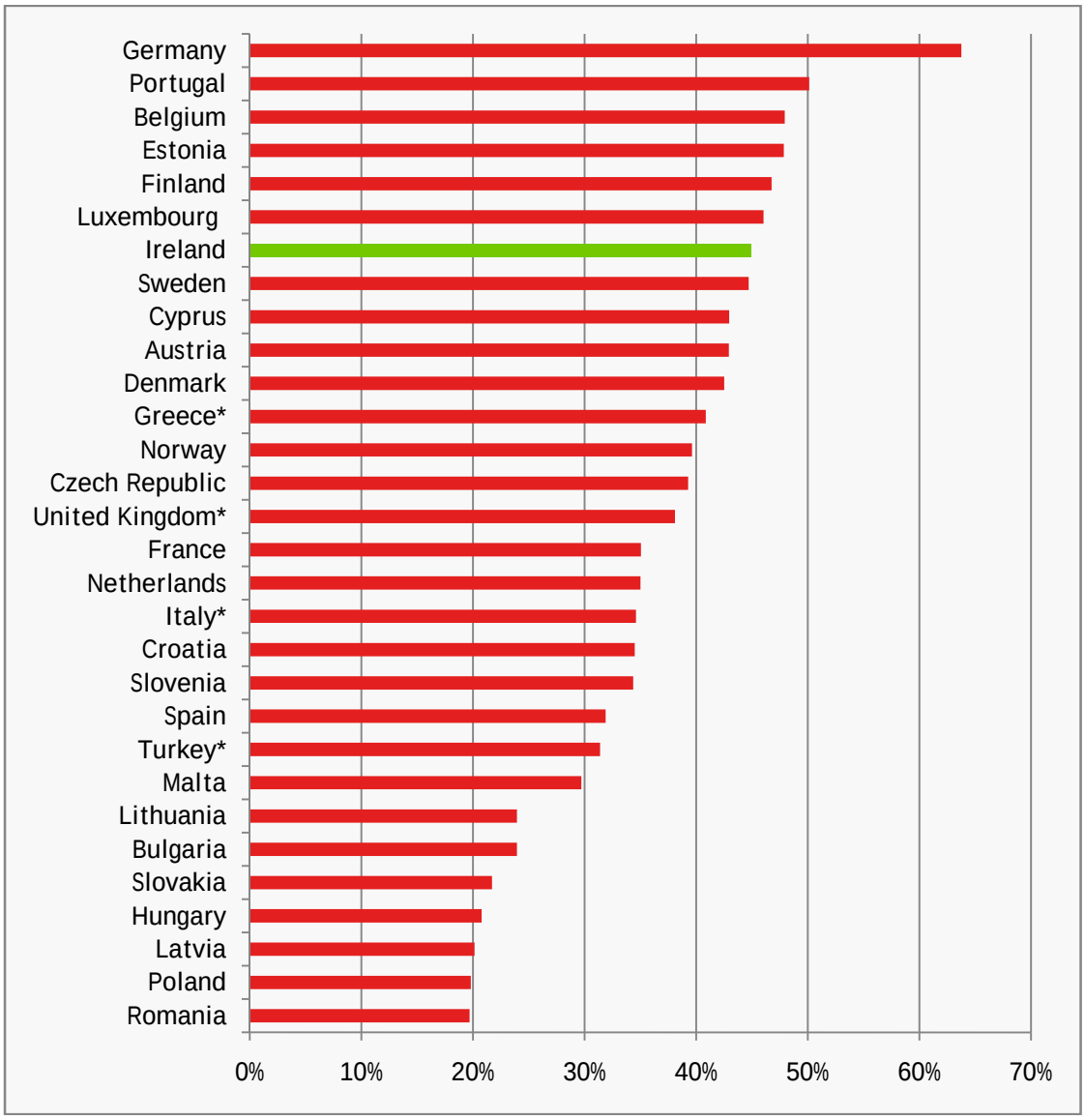
- At an international level, Ireland has a high proportion of firms engaged in innovation activity, and high level of expenditure.
- There are still, however, challenges faced by firms in Ireland, notably with access to finance and high costs of innovation, as well as the availability of world-class infrastructure, which may hamper future innovation.

2.1 CIS – European Benchmarking Analysis

Taking enterprises of all sizes into account, Ireland's relative innovation performance at European[1] level is encouraging. In 2008, 44.9 percent of firms were engaged in some form technological (i.e. product or process) innovation (Figure 1). This was the seventh-highest level of all reporting EU-27/EEA/EU Accession states. With 63.8 percent, Germany had the highest proportion of innovation active firms, considerably higher than the next most innovation-active firm populations: Portugal (50.1 percent); and Belgium (47.9 percent).

[1] In this section, 'European' comparators are all reporting EU-27/EEA Countries, plus Accession/candidate states.

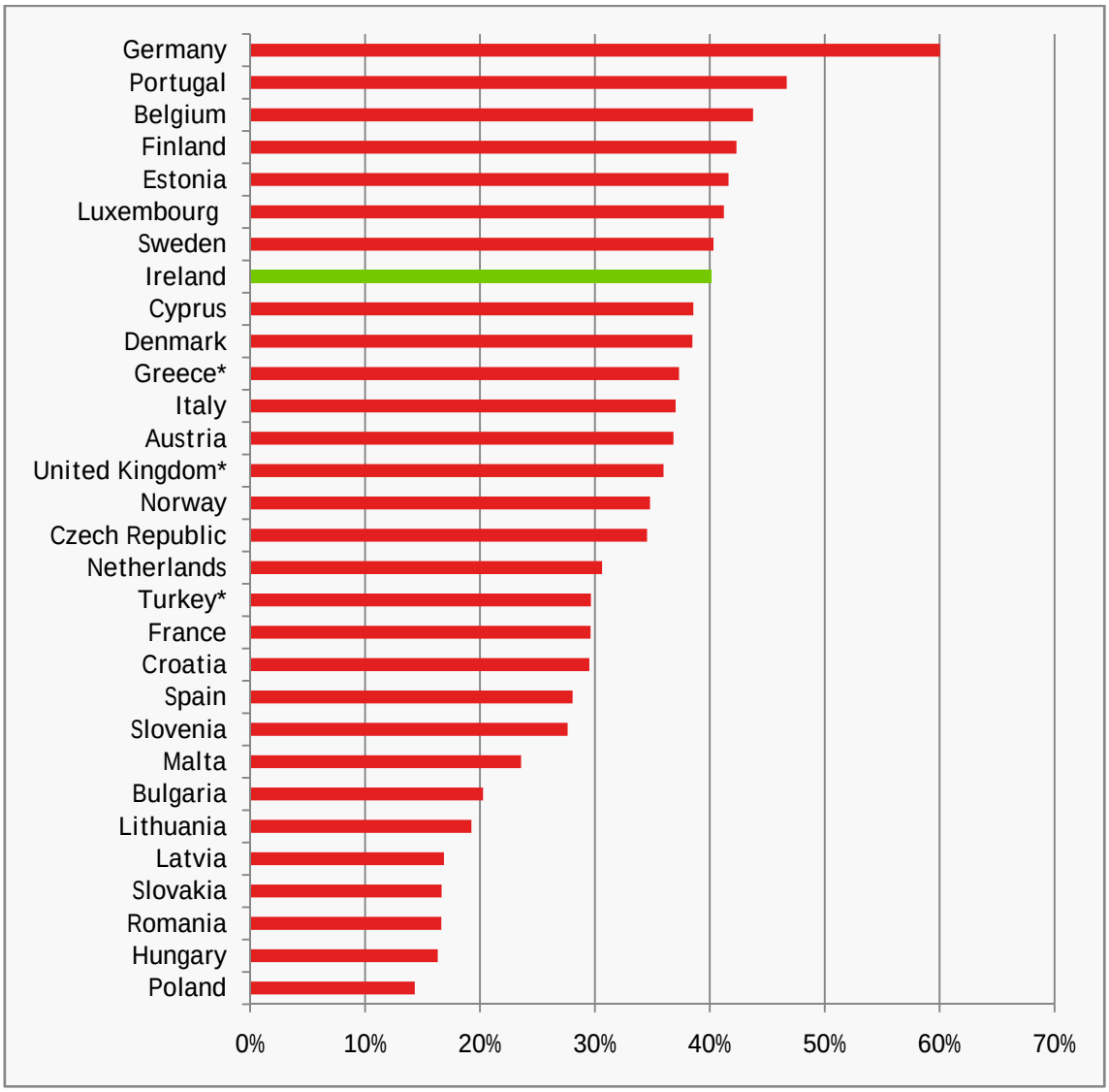
Figure 1: Proportion of enterprises engaged in technological innovation, all sizes: 2008



Source: Eurostat/CSO (*asterisk denotes 2006 data)

Small firms, with 10-49 employees, constitute the largest proportion of the total survey populations in each country. For this reason, the overall innovation trend is largely reflected by that for smaller firms. In general, however, a smaller proportion of small firms innovate when compared to its larger counterparts. In 2008, Ireland ranked eighth of all reporting European states, with 40.1 percent of small firms engaged in innovation activities (Figure 2). Germany (60 percent), Portugal (46.7 percent) and Belgium (43.8 percent) are the states with the highest proportions of innovating small enterprises.

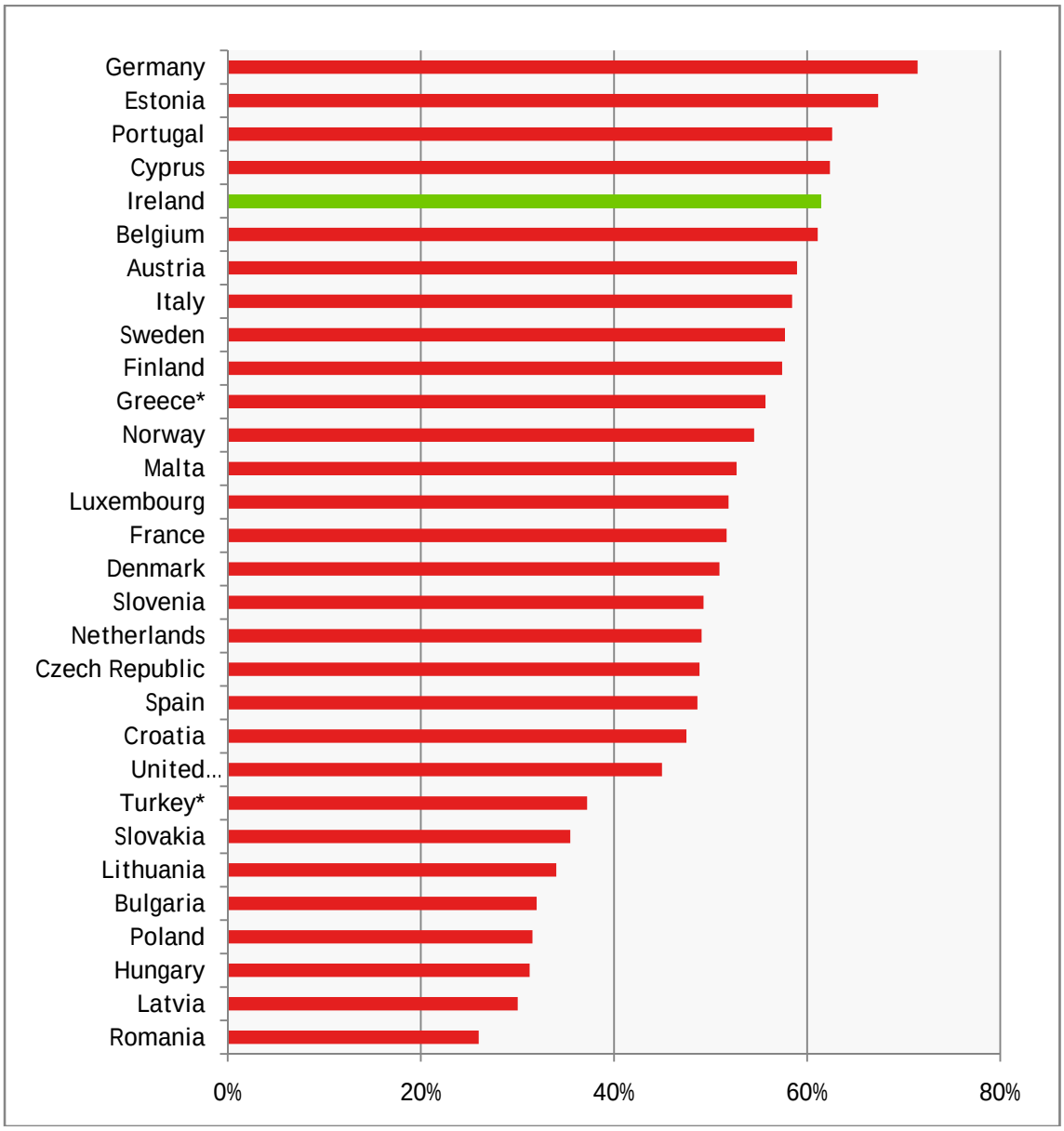
Figure 2: Proportion of enterprises engaged in technological innovation, small enterprises: 2008



Source: Eurostat/CSO (*asterisk denotes 2006 data)

In 2008, Ireland had the fourth-highest proportion of medium-sized firms engaged in innovation, with almost five in every eight firms innovating – 61.8 percent (Figure 3). Germany (71.4 percent), Estonia (67.4 percent) and Portugal (62.6 percent) were the most innovation-active economies for medium-sized enterprises.

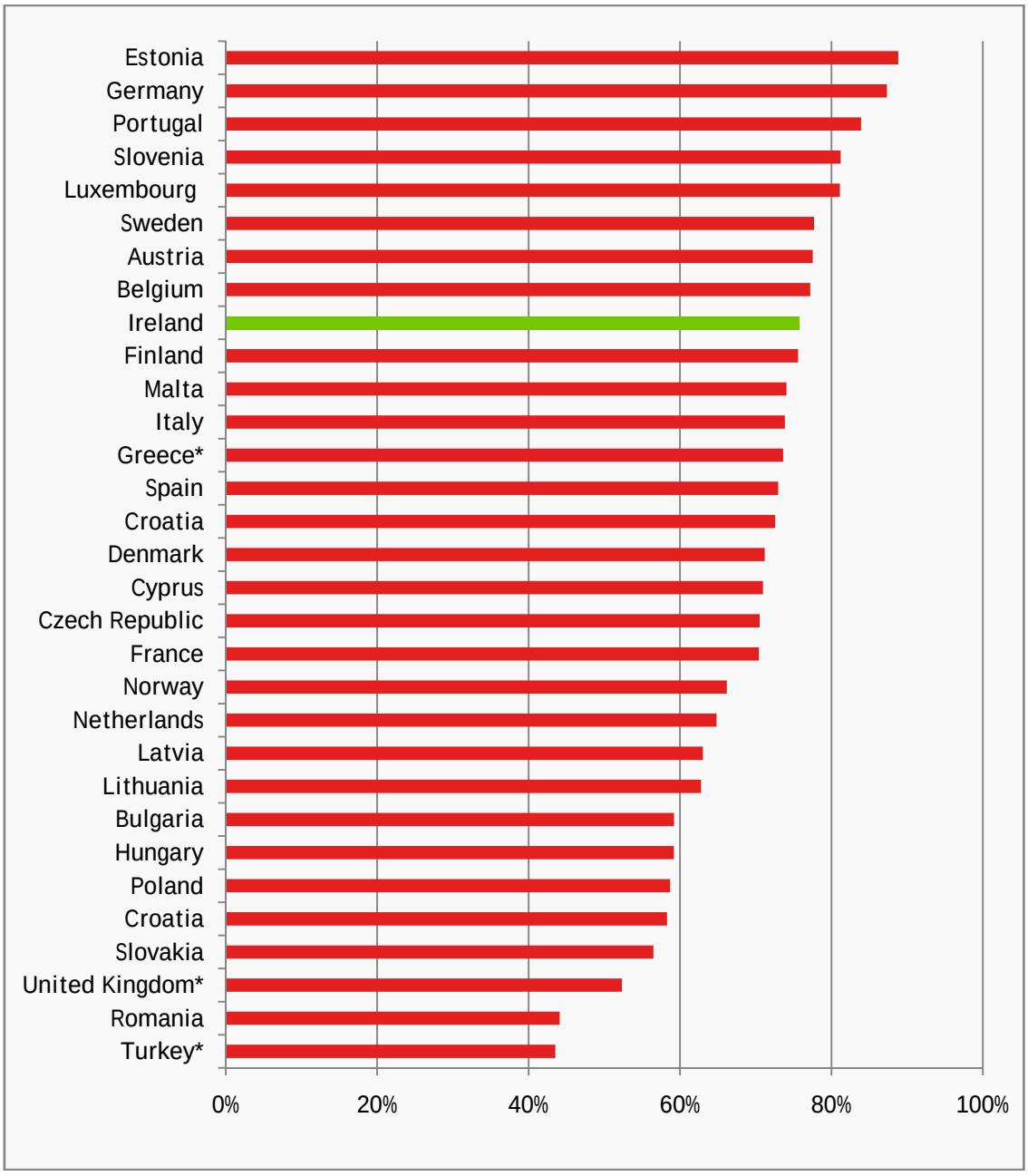
Figure 3: Proportion of enterprises engaged in technological innovation, medium-sized enterprises: 2008



Source: Eurostat/CSO (*asterisk denotes 2006 data)

Large enterprises, comprising 250 employees or more, tend to have the highest prevalence of innovation activity. With respect to this cohort, innovation activity is not as prevalent in comparison with other European states as is the case with small and medium-sized firms. In 2008, the innovation rate in Ireland stood at 75.7 percent, ninth highest of all reporting EU-27/EEA/EU Accession states (Figure 4). The highest proportions of innovating large firms were in Estonia (88.8 percent), followed by Germany (87.3 percent) and Portugal (83.9 percent).

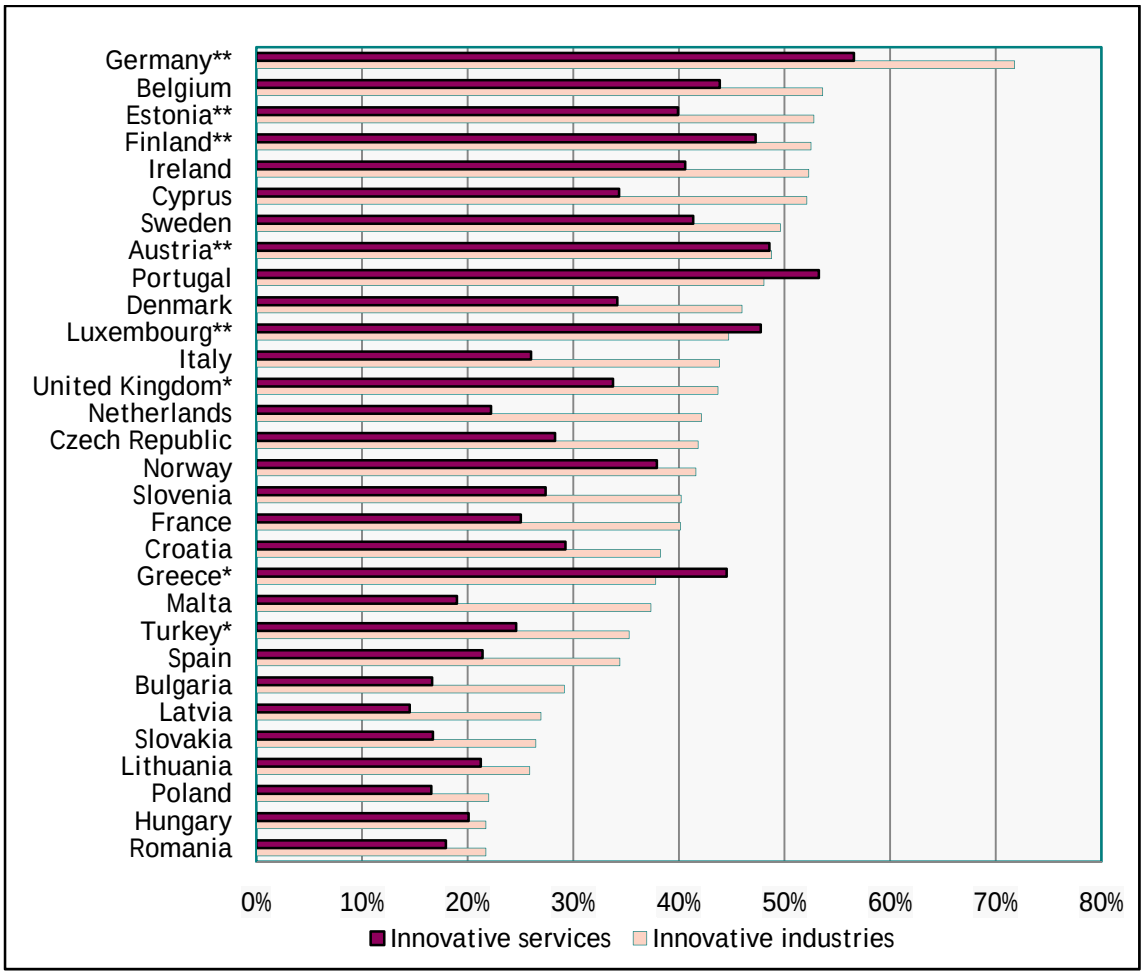
Figure 4: Proportion of enterprises engaged in technological innovation, large enterprises: 2008



Source: Eurostat/CSO (*asterisk denotes 2006 data)

By broad sector, a greater number of firms in goods industries (known collectively here as "industries") innovate than do firms in service industries (known collectively here as "services") (Figure 5). With the exception of Portugal, Luxembourg and Greece, this was the case across Europe in 2008. With 52.3 percent, Ireland had the fifth most active cohort of industrial firms in Europe in 2008; 40.6 percent of firms in service industries were innovation active. Germany had the highest level of industrial and services firms engaged in innovation in 2008 (71.8 percent and 56.6 percent respectively).

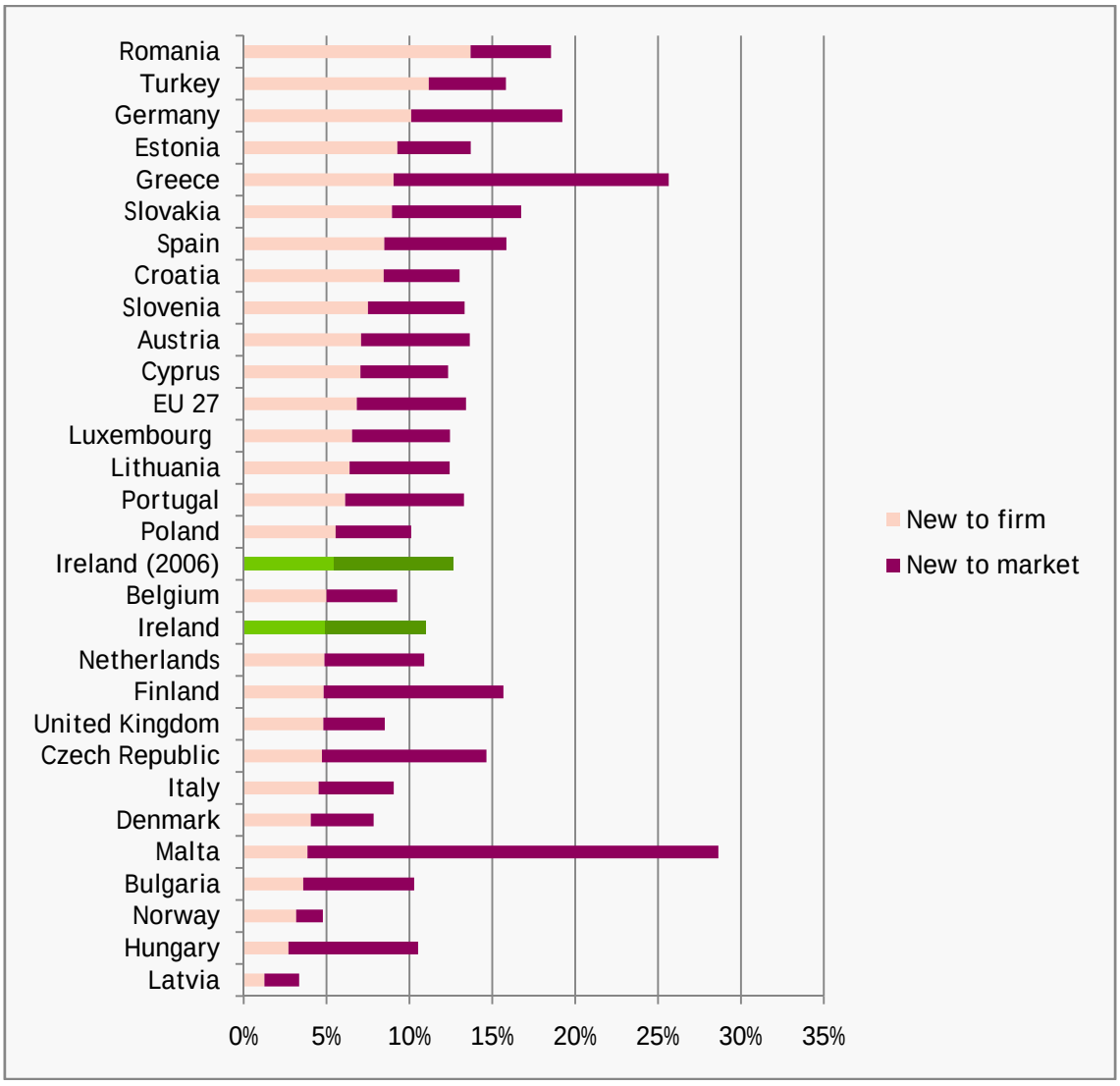
Figure 5: Proportion of enterprises engaged in technological innovation by broad sector: 2008



Source: Eurostat/CSO (*asterisk denotes 2006 data for industry and services; **double asterisk denotes 2006 data for services only)

In terms of the return to innovative activities pursued by firms in Ireland, the level of turnover that is attributable to innovation is relatively low. In 2006, 5.4 percent of firms' turnover was attributable to new-to-firm innovations, while 6.2 percent of firms' turnover was directly linked to new-to-market innovations (Figure 6). In 2008, this fell slightly to 4.9 percent new-to-firm, and 6.1 percent new-to-market. Of the EU-27/EEA and EU accession/candidate states for which data is available, Romania (13.7 percent new-to-firm; 4.9 percent new-to-market), Turkey (11.2 percent new-to-firm; 4.7 percent new-to-market) and Germany (10.1 percent new-to-firm; 9.1 percent new-to-market) had the highest numbers of firms whose innovations feed directly into turnover.

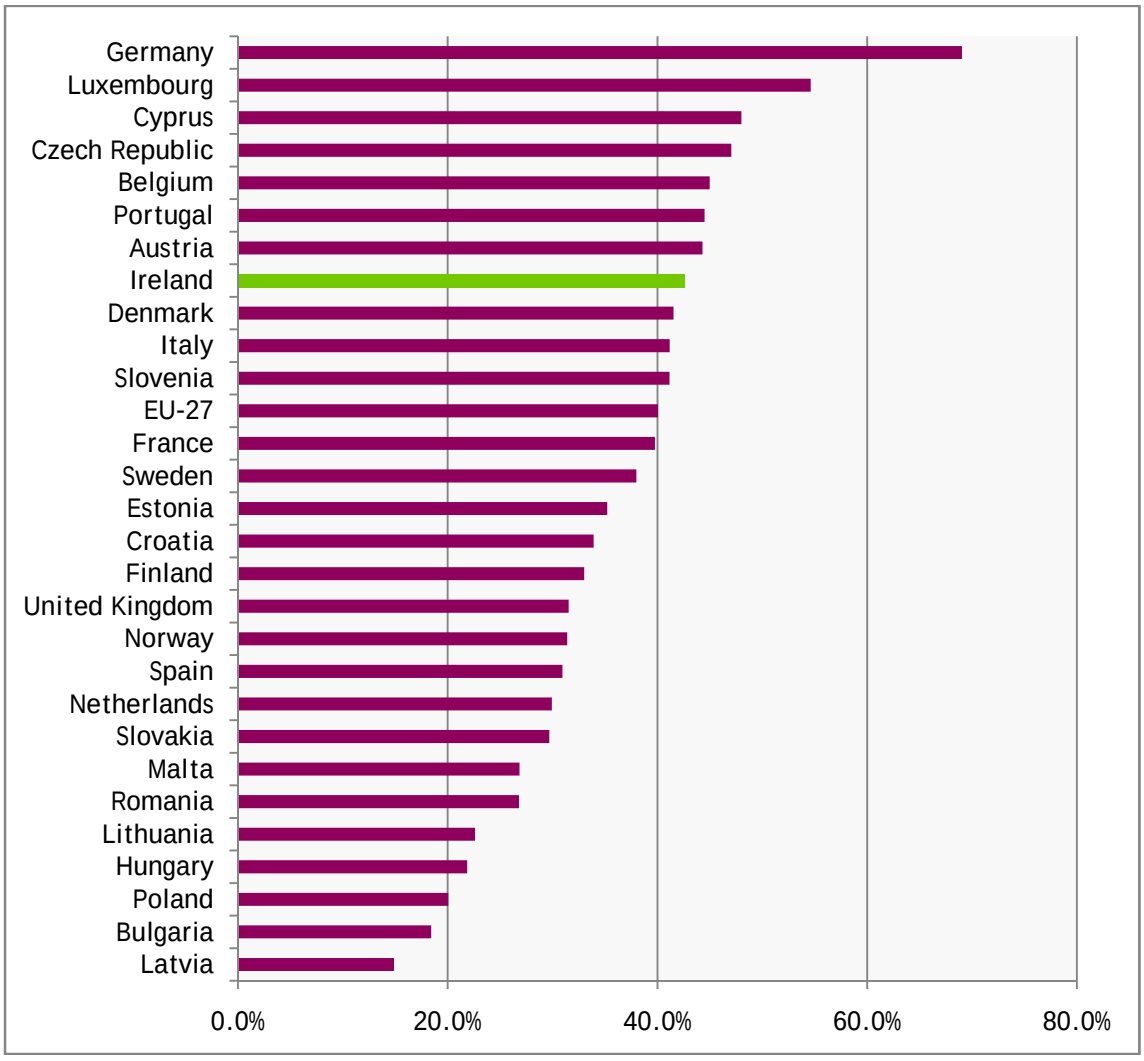
Figure 6: Percentage of turnover attributed to product innovation – all enterprises, 2006 & 2008



Source: Eurostat/CSO (2006 data for other states)

With respect to non-technological modes of innovation, namely marketing and organisational innovations, the picture is also encouraging. Of the reporting countries, Ireland ranks eighth-highest, with approximately 42.6 percent of all firms engaging in marketing and/or organisational innovation (Figure 7), in excess of the EU-27 average of 40.1 percent. Germany, Luxembourg and Cyprus were the three leading countries in this area, with proportions of 69.0 percent, 54.6 percent and 48.0 percent respectively.

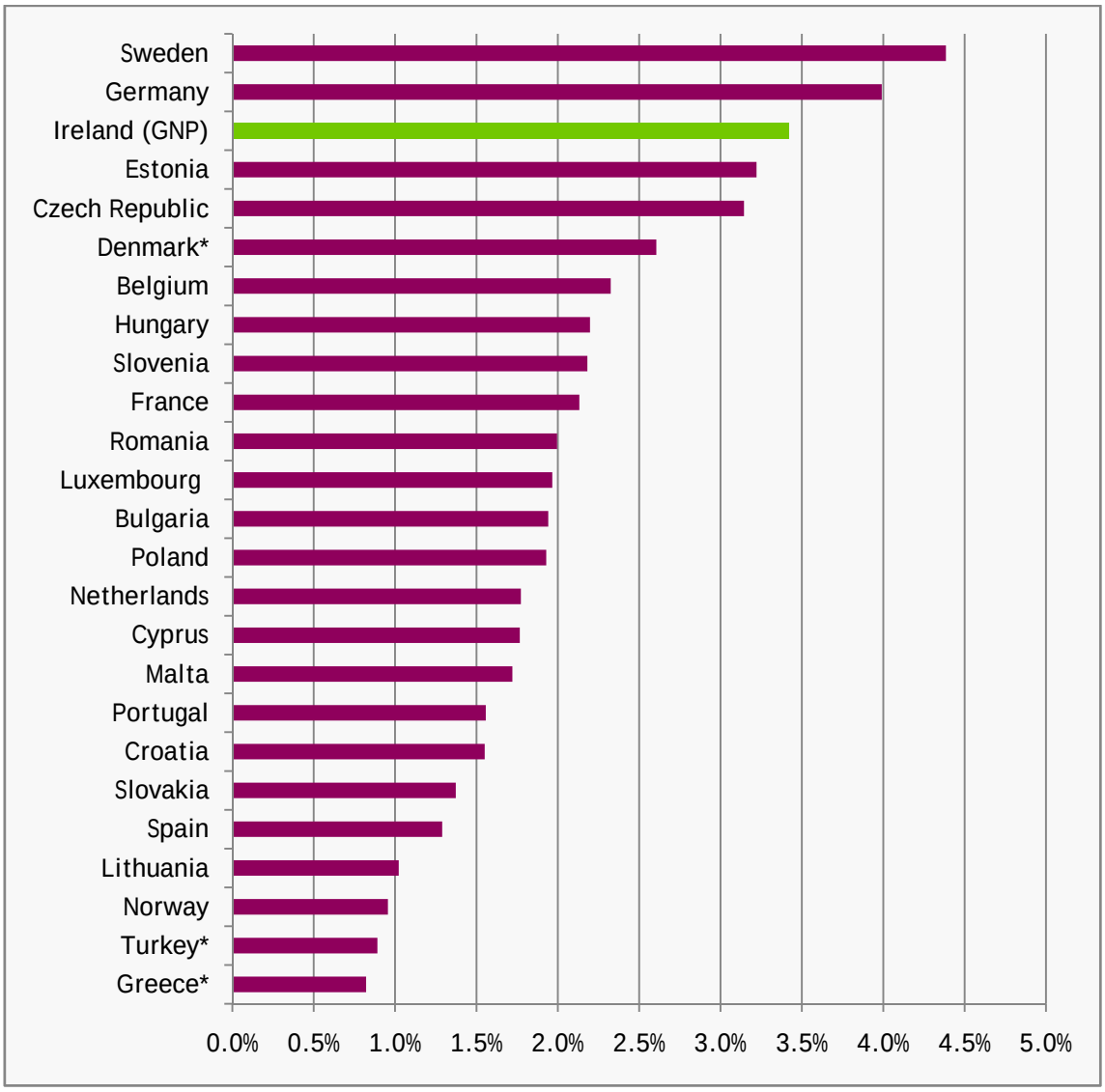
Figure 7: Rates of Non-Technological Innovation – all firms, 2008



Source: Eurostat/CSO (*asterisk denotes 2006 data)

As a proportion of national output, firms in Ireland spent just under 3 percent of GDP on innovation activities in 2008. Uniquely in the case of Ireland, however, GNP is a more accurate indicator of national income, given the extensive presence of multinational enterprises in Ireland, and the associated repatriation of income. Using this metric, firms in Ireland spent 3.4 percent of national output on innovation, the third-highest level of all comparator countries (Figure 8). However, it should be noted that although the level of innovation expenditure in Ireland increased by €721 million between 2006 and 2008, GNP was relatively flat between over the same period, owing to the onset of recession in mid-2008. This inflates the innovation expenditure to GNP ratio for Ireland in 2008 somewhat in Figure 8 relative to previous years. With 4.4 percent of GDP, Sweden had the highest innovation expenditure to GDP ratio in 2008, followed by Germany (4.0 percent).

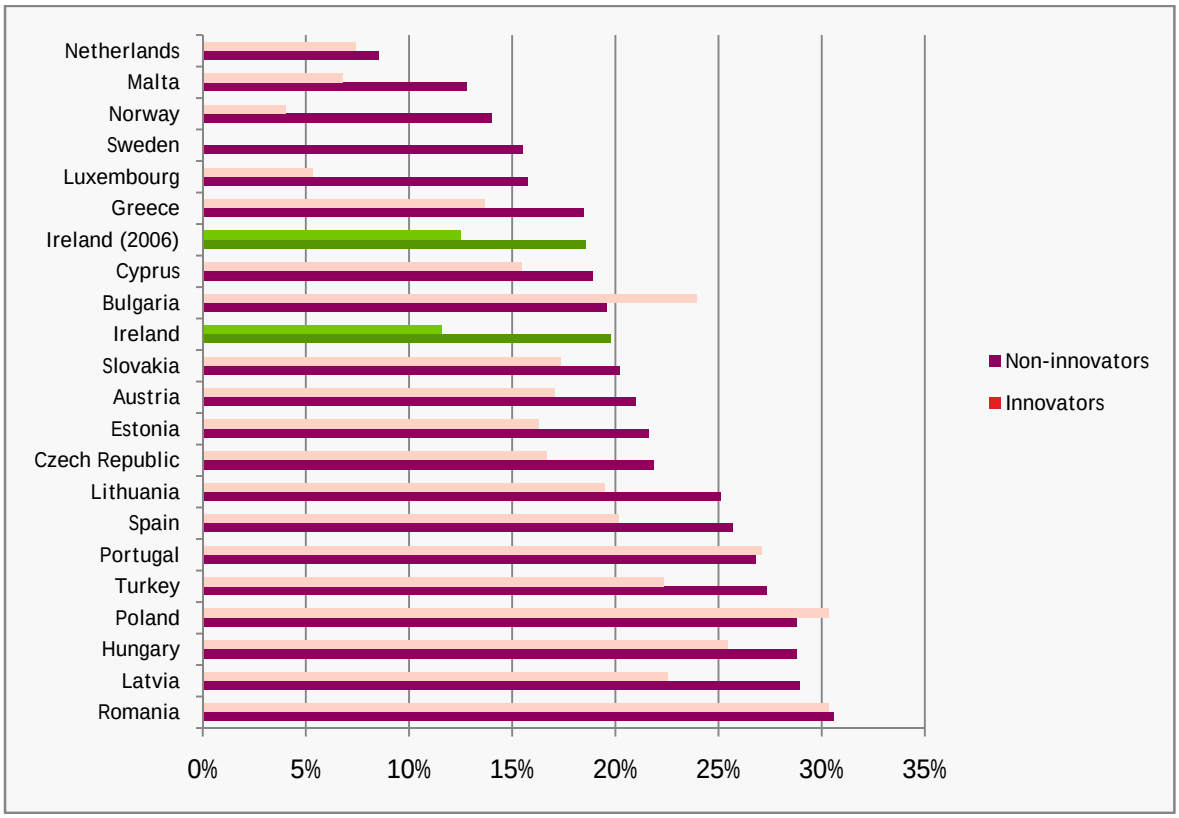
Figure 8: Proportion of GDP spent on innovation activities, 2008



Source: Eurostat/CSO (*asterisk denotes 2006 data)

Community Innovation Surveys also record the barriers to innovative activity, which innovating and non-innovating firms face. Two key barriers identified are access to internal and external finance (Figure 9). Among innovating firms, 18.6 percent of Irish firms considered a lack of access to internal finance as a highly important barrier to innovation in 2006; for non-innovating firms, the figure was 12.5 percent. In 2008, the figures climbed to 19.8 percent and 11.6 percent for innovating and non-innovating firms respectively. This is relatively low in comparison to other EU-27/EEA and Accession states; the Netherlands, Malta and Norway had the lowest proportions of innovative firms citing inadequate internal funds as a highly important barrier to innovation.

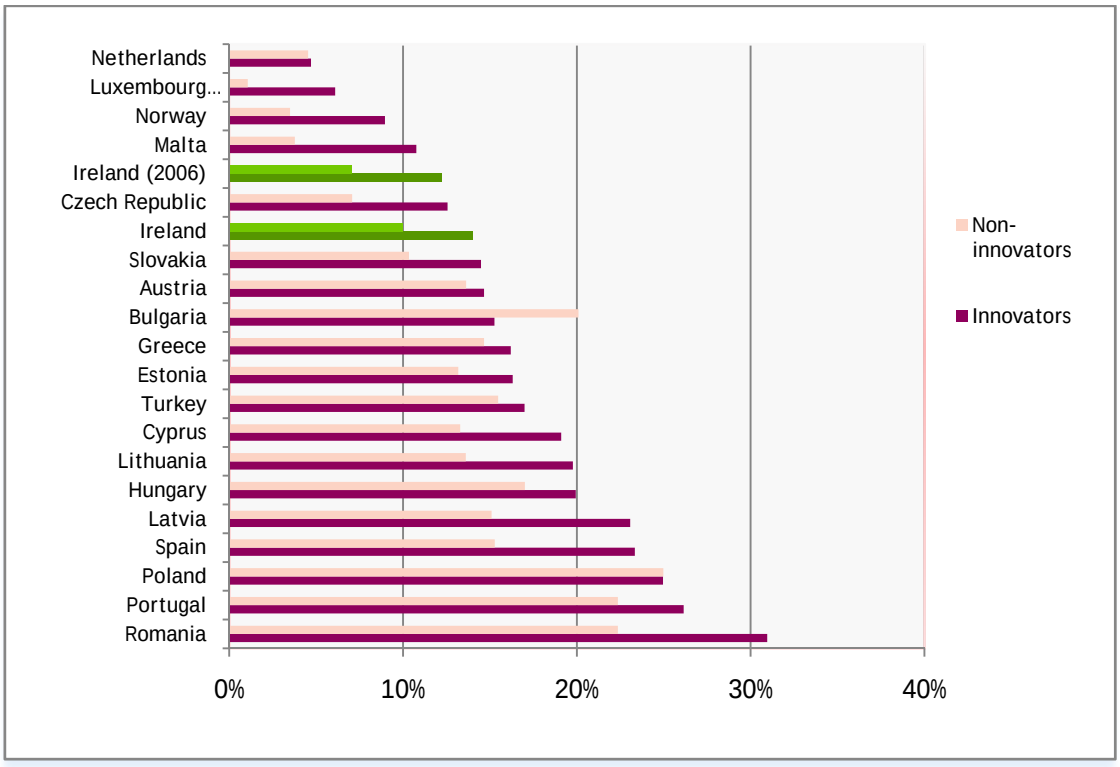
Figure 9: Proportion of Firms citing inadequate funds within Enterprise/Enterprise Group as an important Barrier to Innovation, 2008



Source: Eurostat/CSO (2006 data for other states)

With respect to access to external funding, Ireland ranked fifth-lowest in terms of the number of innovative enterprises citing this as a highly important barrier to innovation. In 2006, 12.2 percent of innovative firms, and 7 percent of non-innovative firms cited this as a highly important factor (Figure 10). In 2008, the number climbed to 14 percent and 10 percent respectively. Across the EU-27/EEA, the Netherlands, Luxembourg and Norway had the lowest proportions of firms citing this lack of access as a highly important barrier.

Figure 10: Proportion of Firms citing lack of access to external finance as an important Barrier to Innovation, 2008



Source: Eurostat/CSO

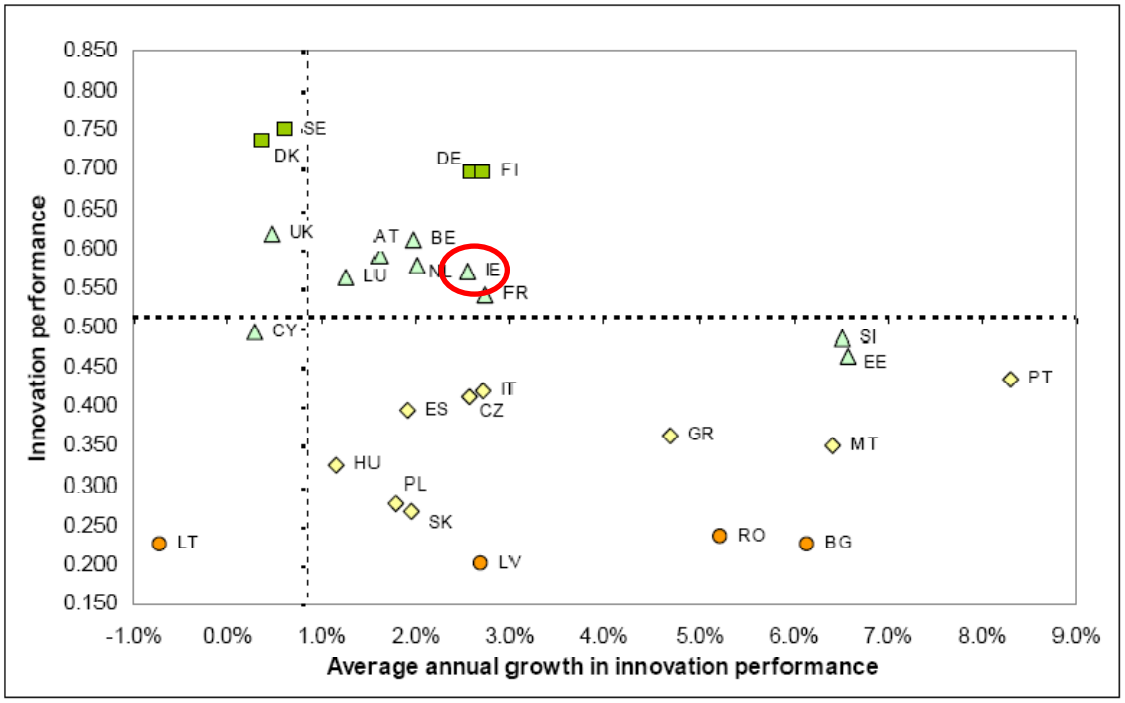
2.2 Other Performance Indicators: Innovation Union Scoreboard 2010

Released in February 2011, the annually-published 2010 Innovation Union Scoreboard (IUS; formerly known as the European Innovation Scoreboard) is also a useful barometer for Ireland's innovation performance[2]. The IUS focuses on a range of technical performance indicators relating to enablers (e.g. human resources, finance and support); firm activities (e.g. investments, linkages and entrepreneurship) and outputs (e.g. innovators, effects on employment and sales) across each of the EU-27 states.

- In 2010, Ireland continued to rank highly; it has a higher than average innovation performance score, and an average annual performance growth rate that is above the EU-27 average. Using a combination of these metrics, the IUS groups countries into four categories: innovation leaders (top performing countries); innovation followers (above EU-27 average); moderate innovators (somewhat below the EU-27 average) and catching-up countries (well below the EU-27 average). Ireland is grouped among the innovation followers, with an innovation score above the EU average, with an average annual growth rate at approximately that of the EU-27 (Figure 11; Ireland circled in red).

[2] PRO INNO Europe, February 2011: Innovation Union Scoreboard 2010

Figure 11: Convergence in Innovation Performance: IUS 2010



Source: Innovation Union Scoreboard 2010

- Looking at a number of innovation-related indicators, Ireland performed above the EU average in the majority of cases. In 2010, Ireland performs relatively well in areas such as educational attainment, in-house SME innovation, non-R&D innovation expenditures by businesses, and the outcomes related to knowledge-intensive services exports. Notable areas where Ireland is relatively weak in the overall innovation framework include access to venture capital, SME innovation collaboration and sales of new-to-firm and new-to-market innovations. While SME product and process innovation activities were an area where Ireland performed well in 2009, that position had reversed in 2010, and was now regarded as a weakness of the innovation system with respect to SMEs, when compared with the EU average.
- More generally, the previous 2009 European Innovation Scoreboard reported that in the context of the economic downturn, firms in the EU with a strong background in product and service innovation are less likely to cut innovation expenditures. This is particularly the case if these innovations contribute a high proportion of turnover. Interestingly, the report also concluded that firms whose principal markets are overseas are more likely to reduce their innovation expenditure and activities as a result of domestic and international recession.

2.3 Wider Innovation Trends in OECD Economies: Overview

In a November 2009 study[3], the OECD used microdata from a combination of recent innovation surveys conducted across 18 states to populate a number of models. These aimed to establish the relationships between particular modes of innovation and its associated outcomes; metrics used include labour productivity and a firm's propensity to innovate. Although data for Ireland were not used, there are a number of trends that are interesting and relevant to Ireland in light of the recent downturn in the world economy.

The extensive analysis looked at innovation performance from a range of perspectives. Overall, with respect to international innovation performance, the study reveals that Canada and Germany consistently rank among the highest in terms of innovation intensity. Notably in manufacturing, Canada records the highest levels of "formal" i.e. internally sourced, innovation activity, with the highest proportion of new-to-international market innovation. Among the international trends identified in the surveys, the most significant include:

- Firms that are large and predominantly target foreign markets are more likely to be innovative - this holds across all countries surveyed;
- Across almost all countries, firms that are part of an enterprise group are more likely to be innovative;
- Generally, firms in receipt of public financial support spend more on innovative activities - this is particularly the case in European economies;
- With the exception of Switzerland, all countries register a positive and significant relationship between engaging in product innovation and sales per employee;

However, one of the most interesting findings is that process innovation is generally not closely linked with sales per employee. In one of the cross-country models where a significant relationship was established, it was actually negative. This is not necessarily a surprising outcome. If implementing process innovations does not require a substitution of capital for labour, as can often be the case, one would not expect to see a resultant difference in productivity - as measured by sales per employee - for a given, finite level of market demand; rather, one would expect that an implemented process innovation would result in lower costs per employee.

That a significant relationship between process innovation and productivity is not established in the study could be due in part to the narrow timeframe. It could also be linked to the short-term adjustment costs of the process introduction/revision, or reverse causality, whereby the process innovation undertaken is in response to a drop in sales and any positive effects of the innovation on productivity are yet to feed through at firm level. Nevertheless, from a policy perspective, this finding is particularly significant, as it helps to illustrate the divergence between the effects of product and process innovations, and the motivations and purposes to which they are used.

[3] "Innovation in Firms: A Microeconomic Perspective" - OECD, November 2009.

2.4 Appraising Ireland's High Level Innovation Strengths and Challenges

Based on the leading indicators from the Community Innovation Survey 2008 data, and latterly, the Innovation Union Scoreboard 2010 data, Ireland continues to outperform most of its European counterparts in terms of engagement in innovation. Encouraging from an Irish perspective are the relatively high proportions of small and medium-sized firms engaged in innovation; high innovation intensity in these cohorts points to embedded systems of product and process innovation that are more likely to prevail during a prolonged recession. Furthermore, should such firms continue to innovate, they are more likely to increase sales in their target markets. Given the size of the Irish economy, the ability of firms to market goods and services abroad will continue to be important, and in the context of seeking to achieve (indigenous) export-led growth, an existing high level of innovation among small firms is an advantage.

Irish firms have continued to invest a high proportion of national output on innovation; this helps to embed Ireland's reputation as an innovative economy. IUS evidence from 2010 suggests that Ireland attains a steady state of growth in innovation performance, and continues to be among the top performing countries overall. In relation to barriers to innovation, the challenges faced by Irish firms are also encountered in other countries, often to a greater extent. While survey results at national level in Ireland will show, for example, the challenge in accessing external finance for both innovating and non-innovating firms, the proportion of firms encountering the same difficulties is often much higher in other countries.

Given Irish firms' high level of engagement in innovation, the proportion of turnover attributed to new-to-firm and new-to-market innovation is rather modest. Although there appears in any case to be a generally weak relationship between innovation intensity and innovation-driven proportion of turnover ("moderate innovators" and "catching-up" countries such as Romania, Spain and Malta are showing among the highest in this area), it may be of concern that innovation activities do not drive relatively higher levels of sales. Against this backdrop, firms may question their justification for innovating, and/or the appropriateness of the type of innovations they implement. It is necessary therefore to look in more detail at the types of innovation firms pursue, controlling for factors such as sector, size of firm, market orientation and firm origin – this is explored in the next section.

Whilst not within the domain of the Community Innovation Survey, the Innovation Union Scoreboard 2010 also points to weaknesses in respect of innovation performance that could pose a strategic threat and disincentive to innovate; one in particular is access to venture capital. This could also inhibit innovative activity and entrepreneurial risk in small firms, particularly those which already have difficulty accessing liquidity in the current economic climate. In 2009, the European Innovation Scoreboard had also highlighted Irish firms' ICT infrastructure as a relative weakness. A weak internal ICT infrastructure will limit the impact of technological innovations, such as logistical process innovation at firm level. This is equally the case with external ICT infrastructure - access to, and quality of, broadband connections – this can also negatively impact on service product innovations in industries heavily reliant on

a modern telecoms infrastructure. The availability and sophistication of Next Generation broadband infrastructure is already highlighted as an important innovation facilitator in the 2010 Innovation Task Force Report. Taking all of this into account, the matrix in Table 1 broadly outlines Ireland's innovation performance in a forward-looking context.

Table 1: SWOT Matrix of Ireland's Current International Innovation Performance

Strengths	**Weaknesses**
▪ High proportion of firms engaged in technological innovation in 2008, particularly among SMEs ▪ Relatively high levels of expenditure on innovation by EU standards – maintained in 2008	▪ High costs of innovation, particularly for small firms ▪ Contribution to turnover of new-to-firm and new-to-market innovations is below EU average ▪ Innovation intensity has fallen between CIS 2006 and CIS 2008
Opportunities	**Threats**
▪ International evidence suggests that Ireland's high innovation intensity will ensure a greater number of firms remain innovative during recession ▪ Potential value in non-technological innovation, particularly marketing innovation in service industries	▪ Innovation expenditure may be poorly targeted and inflexible, with a current over-emphasis on technological innovation and R&D; machinery and equipment ▪ Poor external physical infrastructure, particularly telecoms, may hold back technological product innovation, particularly in knowledge-intensive service industries

3. Community Innovation Survey 2008 – Modes of Innovation

This section explores in more detail the results of the CIS 2008 for Ireland, disaggregated by size of firm, sector, and origin of firm; concentrating on approaches to the various modes of innovation.

Key Points

- The general trend is that the larger the firm, the more likely it is that it will be engaged in at least one mode of technological innovation; this holds across all sub-modes of innovation.
- The highest proportion of innovators is found in the Manufacturing and Information & Communication sectors. The proportion of innovating firms in both sectors is higher than the average for the economy as a whole.
- Irish firms are generally less innovative than their foreign-owned counterparts; this holds across the majority of size/origin/sectoral cohorts.

3.1 Innovation Activity - Overview

When viewed by size of firm and sector, the highest proportion of innovators is found in the Manufacturing and Information and Communication sectors. The proportion of innovating firms in both sectors is higher than the average for the economy as a whole; this also holds by size of firm, as shown in Table 2. A small population and low response rate accounts for the outlying values of 100 percent returned by large firms in the Utilities (Electricity, Gas, Steam & Air Conditioning Supply and Water Supply; Sewerage and Waste Management) sectors. Throughout this sectoral analysis, the large firms account for the smallest proportion of the innovative enterprise base and, by extension, the survey population by firm size; Utilities firms also account for a small proportion of the total survey population by sector.

Table 2: Proportion of innovating firms by NACE Sector and Firm Size

	Size of Firms		
Sector	**10-49**	**50-249**	**250+**
Mining & Quarrying	14.3%	26.7%	50.0%
Manufacturing	45.3%	69.0%	87.3%
Wholesale Trade	35.1%	45.9%	30.8%
Transportation & Storage	29.0%	43.8%	48.0%
Information & Communication	58.0%	70.3%	86.2%
Financial & Insurance Activities	34.2%	55.7%	78.2%
Architectural and Engineering	31.8%	37.7%	28.6%
Economy-Wide	**38.9%**	**59.1%**	**75.5%**

Source: Community Innovation Survey 2008

In the Community Innovation Survey population, Irish-owned firms outnumber their foreign-owned counterparts by more than 4 to 1; therefore it would be expected that a greater number of Irish firms are engaged in some form of technological innovation. Table 3 a) shows that while Irish firms account for almost three-quarters of all innovative firms, they also account for a much larger proportion – nearly seven-eighths - of non-innovative firms. Despite a lower foreign-owned firm population, this suggests that foreign firms are more innovative than Irish-owned firms.

Table 3 a): Innovation Activity by Origin (% of Innovation Status)

	Irish	Foreign
Total (% of Total Respondents)	**81.3%**	**18.7%**
Innovative	74.5%	86.5%
Non-Innovative	25.5%	13.5%

The point is illustrated further when this data is transposed to show the proportions by origin, in Table 3 b). Whereas exactly two-fifths of Irish-owned firms are innovative, almost three-fifths of foreign-owned firms are innovative.

Table 3 b): Innovation Activity by Origin (% of Origin)

	Innovative	Non-Innovative	Total (% of Total Respondents)
Irish	40.0%	60.0%	81.3%
Foreign	59.2%	40.8%	18.7%

Source: Community Innovation Survey 2008

3.2 Technological Innovation

The two broad types of innovation specified in the Community Innovation Survey are product and process innovation, together classed as technological innovation:

- Product innovation comprises goods and services innovation;
- Process innovation includes upgrading Manufacturing processes, Logistics, Delivery and Distribution processes, and other Supporting Activities.

Whether or not firms engage in process and/or product innovation can vary quite dramatically by firm size.

3.2.1 Size of Firm

Table 4 gives an overview of the modes of innovation by firm size. The general trend is that the larger the firm, the more likely it is that it will be engaged in at least one mode of technological innovation; this holds across all sub-modes of innovation. Particularly noticeable, however, is the jump between medium (50-249) and large (250+) firms in the proportion engaging in logistical process innovation. This could be a reflection of the higher importance of logistical improvements for larger firms, which are more likely to be targeting, often predominantly, overseas export markets than smaller firms.

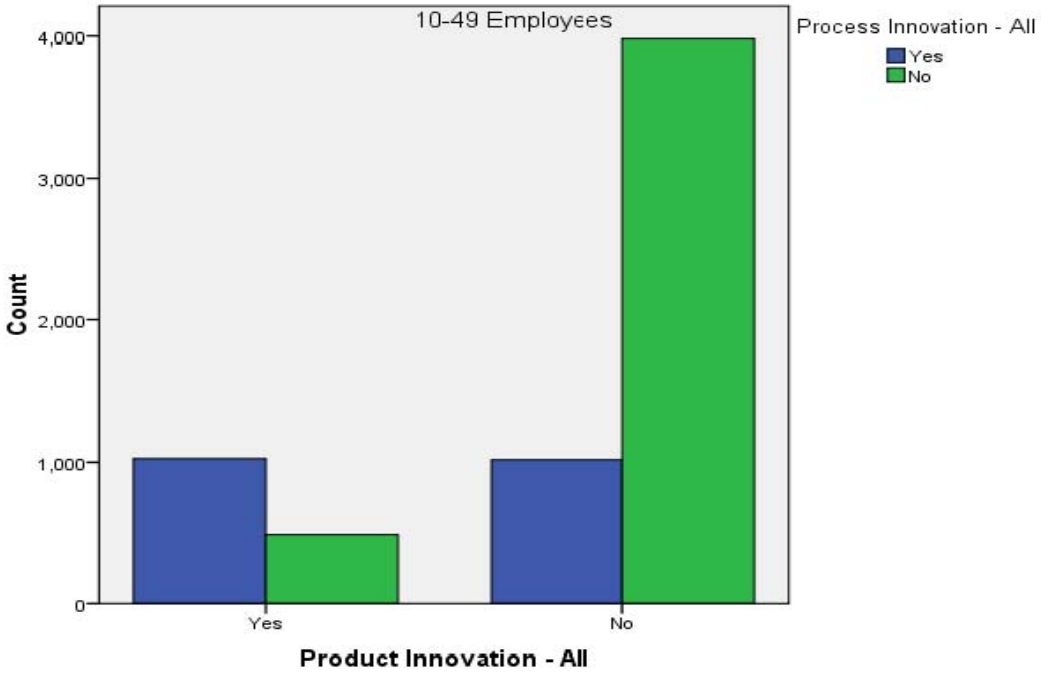
Table 4: Technological Innovation by Firm Size (No. of Employees)

	Product			Process			
	All	**Goods**	**Service**	**All**	**Methods**	**Logistics**	**Supporting Activities**
10-49	**23.2%**	15.7%	14.5%	**31.4%**	14.8%	12.1%	23.5%
50-249	**44.2%**	34.2%	19.9%	**45.9%**	30.8%	18.0%	33.2%
250+	**61.3%**	44.5%	33.4%	**64.6%**	48.0%	36.5%	47.8%

Source: Community Innovation Survey 2008

Figures 12-14 below show the complementarities between the two principal modes of technological innovation. Taking innovation modes by firm size, a significant majority (61.1 percent) of small firms (S1; 10-49 employees) surveyed engaged neither in product nor process innovation. Almost exactly half of those engaged in process innovation also engaged in some form of product innovation.

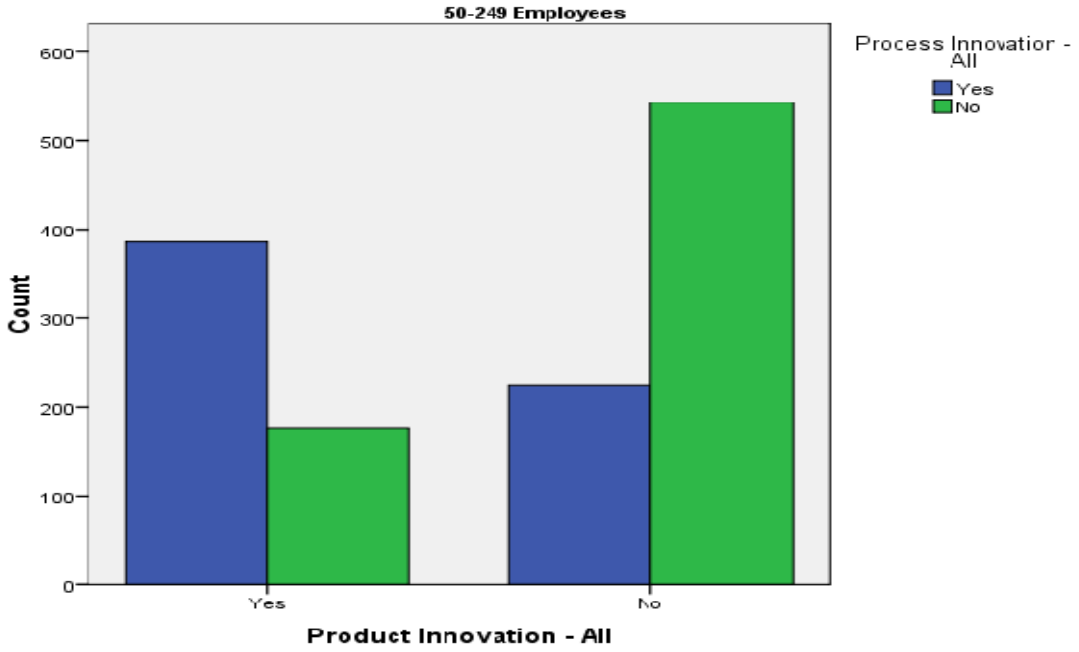
Figure 12: Product and Process Innovation in firms with 10-49 employees



Source: Community Innovation Survey 2008

Medium-sized firms (S2; 50-249 employees) demonstrated a higher propensity to innovate; 59.1 percent of firms surveyed engaged in some form of either product innovation, process innovation, or a combination of product and process innovation.

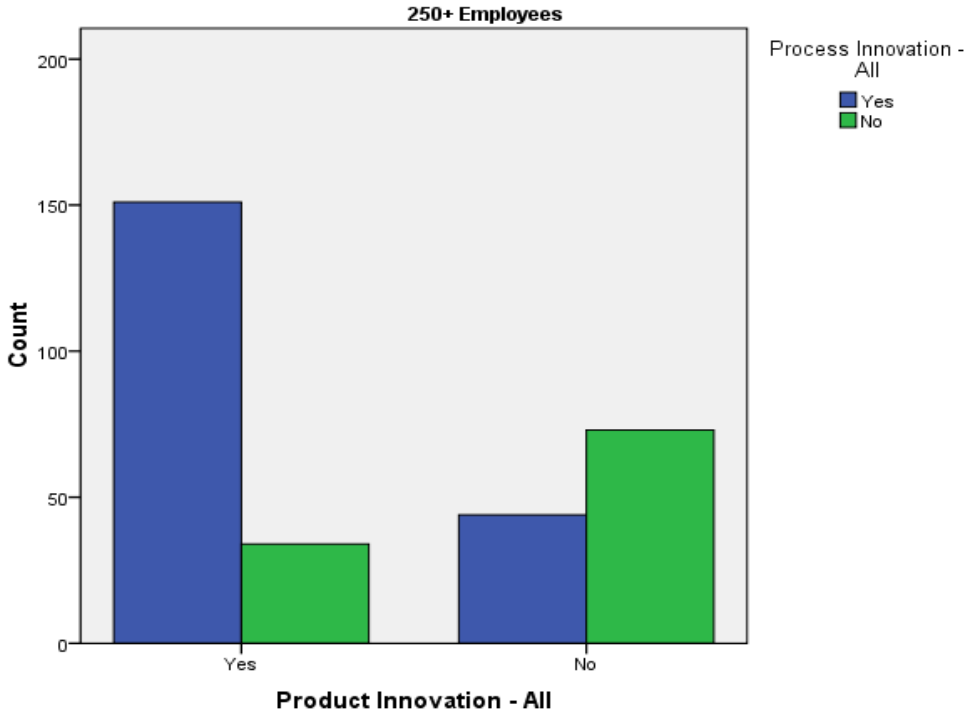
Figure 13: Product and Process Innovation in firms with 50-249 employees



Source: Community Innovation Survey 2008

With respect to the survey group with the largest firms; i.e. S3 - those with over 250 employees, exactly 50 percent of firms engaged in both product and process innovation; while 75.8 percent of firms engaged in at least some form of innovation.

Figure 14: Product and Process Innovation in firms with 250 employees or more



Source: Community Innovation Survey 2008

The distinction between the largest and smallest-sized firms in terms of its innovation activity is marked: larger firms are more likely to have an allocated budget for product and service development, as well as having a greater number of operations and processes into which innovation, particularly process innovation, could be applied. Overall, larger firms engage slightly more in process innovation than product innovation.

On the other hand, the smallest firms are often lacking the resources, financial, physical and human, to engage in innovation. They also engage more in process innovation than product innovation, and to an even greater extent than their counterparts in the largest firms. This could reflect the fact that process innovations such as Logistics or Support activities are often on a smaller timescale, and often less capital and labour intensive, than many forms of goods innovation.

For medium-sized firms, the picture is more ambiguous, as the profile, and thus, the market orientation of firms varies widely. Whereas small firms predominantly target domestic (local and regional) markets, and larger firms favour European and International markets over domestic markets for their goods and/or services, the medium-sized group of firms comprises both domestically-oriented and export-focused companies.

3.2.2 Sectoral Level

The level of product and process innovation varies considerably by broad sector, reflecting variations in size, market orientation and the different combinations of labour and capital

inputs across these sectors. The manufacturing and information and communication sectors include key exporting industries which, due to external competition, are generally faced with greater incentive to upgrade their products and its methods of production (Table 5). Manufacturing has seen a reduction in total numbers employed over the past decade, but maintains high levels of technological innovation. Notable is the high level of firms in this sector (33.9 percent) engaging in improving their methods of production, the highest of all broad sectors and something which has taken place alongside this reduction in employment. It is therefore possible that the consequences of innovation are generating a labour surplus, or indeed that labour has been/is being substituted for capital in this sector on an ongoing basis.

By contrast, although accounting for approximately one quarter of the survey population, the wholesale and retail sector records levels of product and process innovation consistently below the economy-wide average, with product and process innovation levels of 19.6 percent and 28.3 percent respectively. This sector differs crucially from the manufacturing sector in that it is predominantly low-skill labour-intensive, and is above all a domestically-traded sector, generally not exposed to international competition. These characteristics help to explain the relatively low levels of technological innovation in the sector.

In terms of product innovation, the balance between goods and services innovation are generally reflective of the types of outputs produced in each sector; on the one hand, manufacturing focuses the bulk of its product innovations into its goods produced, while the Financial and Insurance Activities sector focuses its product innovations on its services provided. The information and communications sector is somewhat diverse, including publishing, telecommunications and computer programming producing a range of goods and services – this could explain the relatively similar levels of goods and services innovation in these areas.

Table 5: Product and Process Innovation by Broad Sector

	Product Innovation			Process Innovation			
	All	Goods	Services	All	Methods	Logistics	Supporting Activities
Mining and Quarrying	**7.1%**	7.1%	0.0%	**16.3%**	10.2%	4.1%	6.1%
Manufacturing	**34.3%**	32.0%	11.6%	**44.2%**	33.9%	14.3%	28.3%
Wholesale and Retail	**19.6%**	14.6%	10.7%	**28.3%**	6.6%	12.7%	23.7%
Transportation and Storage	**17.9%**	6.7%	14.6%	**26.4%**	9.2%	16.8%	17.7%
Information and Communication	**50.9%**	33.2%	41.2%	**42.2%**	21.6%	18.9%	37.0%
Financial and Insurance Activities	**27.7%**	7.0%	26.7%	**35.6%**	14.0%	11.3%	31.3%
Professional, Scientific and Technical Activities	**19.7%**	6.7%	18.1%	**24.7%**	10.6%	7.0%	20.6%
Economy-Wide	**27.8%**	19.8%	16.1%	**32.4%**	18.7%	14.0%	26.0%

Source: Community Innovation Survey 2008

Looking at a selection of sectors, predominantly Ireland's key exporting sectors (Table 6), there is generally an above average level of technological innovation. What is particularly noticeable is that sectors with an above average proportion of medium and large firms tend to have higher levels of product and process innovation, and tend to engage in a greater number of both. This is underlined by the pharmaceutical sector - a key exporting sector dominated in Ireland by multinationals - where process innovation levels stood at 71.6 percent, yet less than a quarter of firms in this sector are small, with over a third of firms in this sector employing more than 250 people. The selected service sectors tend to have a much higher proportion of small firms, and the levels of technological innovation, although above the economy-wide average, is lower than in most manufacturing sectors. With the exception of computer manufacturing, all manufacturing sectors whose firms engaged in product innovation were active in goods innovation.

Table 6: Product and Process Innovation in Selected Sectors

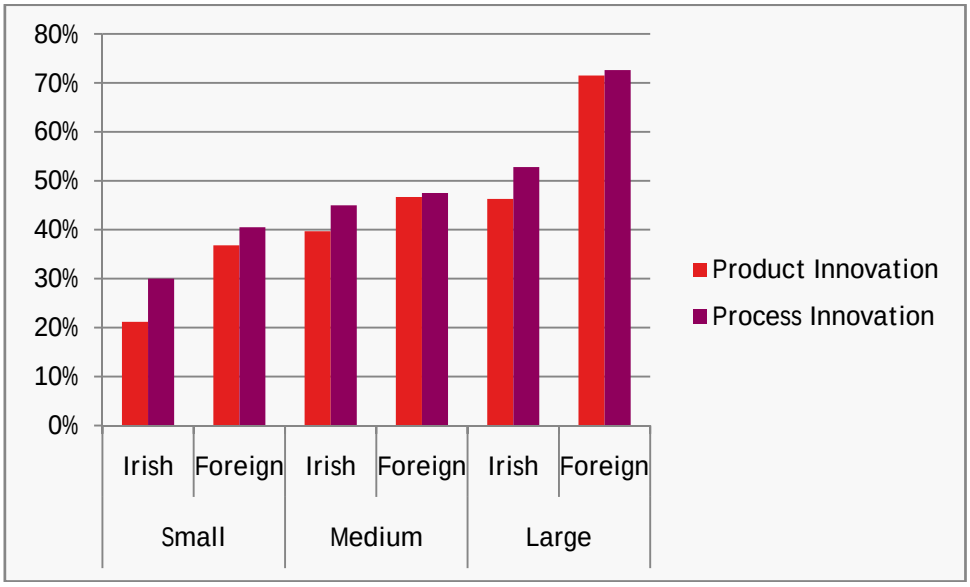
	Product Innovation			Process Innovation				Size of Firm (No. of Employees)		
	All	Goods	Services	All	Methods	Logistics	Supporting Activities	10-49	50 - 249	250+
Medical Equipment (3250)	**44.9%**	44.9%	19.2%	**47.4%**	44.9%	23.4%	26.0%	39.0%	39.0%	22.0%
Food Products (10)	**39.7%**	39.7%	6.0%	**54.6%**	38.9%	13.2%	35.1%	61.5%	29.3%	9.1%
Chemicals (20)	**56.5%**	56.5%	21.7%	**57.6%**	45.7%	20.7%	45.7%	58.7%	33.7%	7.6%
Pharma-ceuticals (21)	**60.4%**	60.4%	9.4%	**71.7%**	60.4%	20.8%	41.5%	24.5%	39.6%	35.8%
Manufacturing of Computers (26)	**51.0%**	46.0%	12.0%	**46.0%**	37.0%	22.0%	32.0%	53.0%	27.0%	20.0%
Telecomms (61)	**48.7%**	27.6%	47.4%	**26.3%**	18.4%	18.4%	26.3%	76.3%	13.2%	10.5%
Computer Programming and Cons. (62)	**56.6%**	37.7%	46.8%	**42.5%**	18.0%	17.5%	39.1%	80.7%	16.6%	2.7%
Information Service Activities (63)	**37.8%**	16.2%	32.4%	**37.8%**	21.6%	21.6%	37.8%	67.6%	27.0%	5.4%
Financial Services (64)	**26.6%**	8.3%	25.5%	**35.9%**	14.8%	11.7%	30.7%	77.9%	12.8%	9.3%
Insurance (65)	**32.0%**	14.7%	29.3%	**42.7%**	17.3%	26.7%	40.0%	57.3%	20.0%	22.7%
Architectural and Engineering (71)	**19.7%**	6.7%	18.1%	**24.7%**	10.6%	7.0%	20.6%	89.2%	9.6%	1.2%
Economy-Wide	**27.8%**	19.8%	16.1%	**32.4%**	18.7%	14.0%	26.0%	80.0%	16.3%	3.7%

Source: Community Innovation Survey 2008

3.2.3 Origin of Firm

The prevalence of product and process innovation and the difference between Irish and foreign firms' approaches to these forms of technological innovation could provide useful information to aid innovation policy approaches. This is the case, for example, with respect to policy that could encourage innovation particularly among small indigenous firms. By national origin of enterprise, foreign firms are consistently more active than Irish firms across all sizes of firm (Figure 15). A relatively small proportion of small Irish firms (21.5 percent) engage in at least one form of product innovation, compared with 30 percent of small foreign-owned firms. This is also the case for medium-sized firms (39.7 percent vs. 46.7 percent) and large firms (46.3 percent vs. 71.5 percent). The same trend is apparent for process innovation, with a wider gap between small Irish and small foreign firms, and large Irish and large foreign firms. Slightly higher proportions of firms engage in process over product innovation, whether viewed by size of firm or nationality.

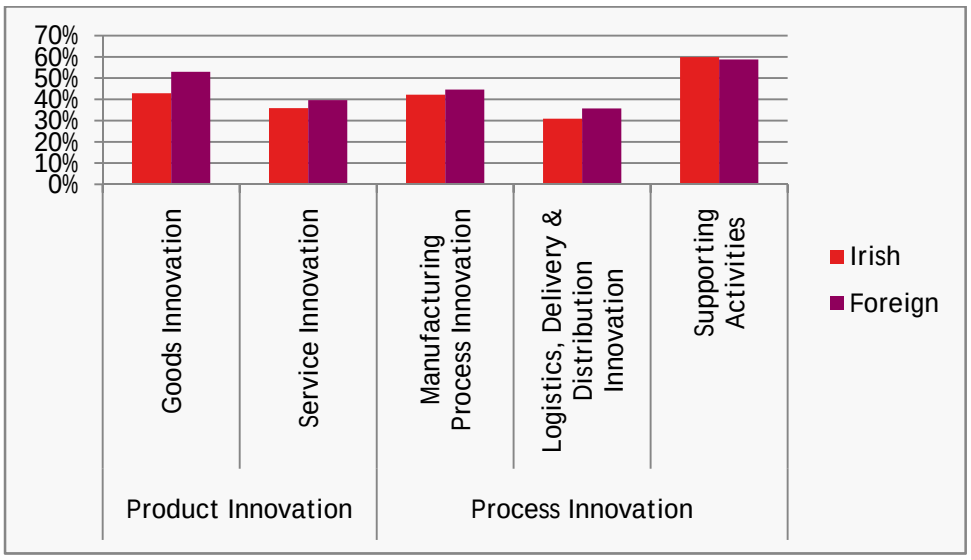
Figure 15: Product and Process Innovation Rates by Origin and Size of Firm



Source: Community Innovation Survey 2008

In terms of the specific types of technological innovation undertaken by Irish and foreign-owned firms, the one noticeable difference is with goods innovation, where innovative foreign-owned firms are significantly more active than their Irish counterparts (53 percent vs. 42.9 percent; Figure 16).

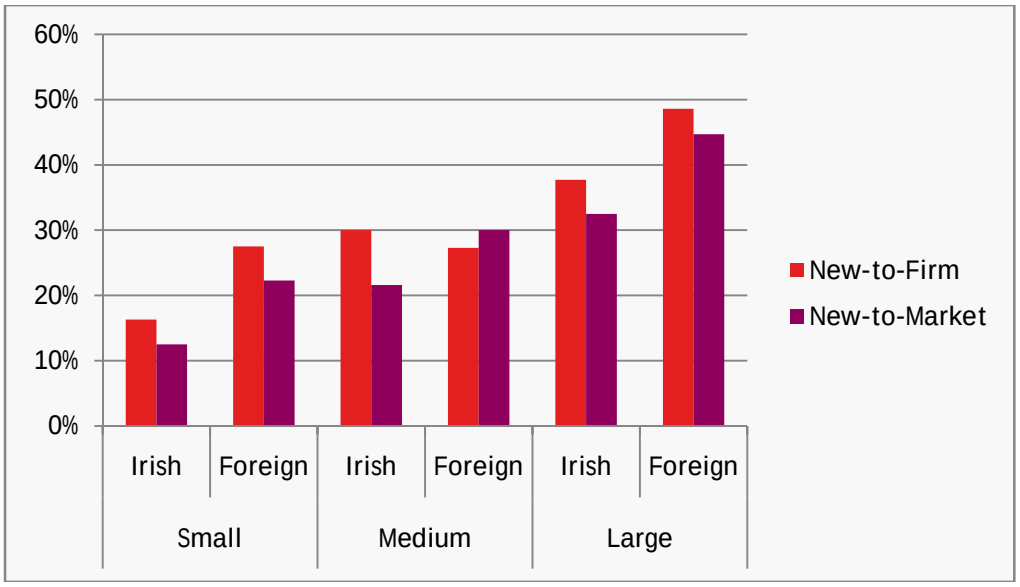
Figure 16: Types of Product and Process Innovation by Origin (% of Innovating Firms)



Source: Community Innovation Survey 2008

In terms of the market impact of product innovations by nationality of firm, a greater proportion of foreign-owned firms introduced new-to-firm and new-to-market product innovations, with the exception of new-to-firm innovations amongst medium-sized companies (Figure 17). Generally, higher proportions of new-to-firm and new-to-market innovations occur are among the larger size of firm.

Figure 17: New-to-Firm and New-to-Market Innovation by Nationality and Size of Firm



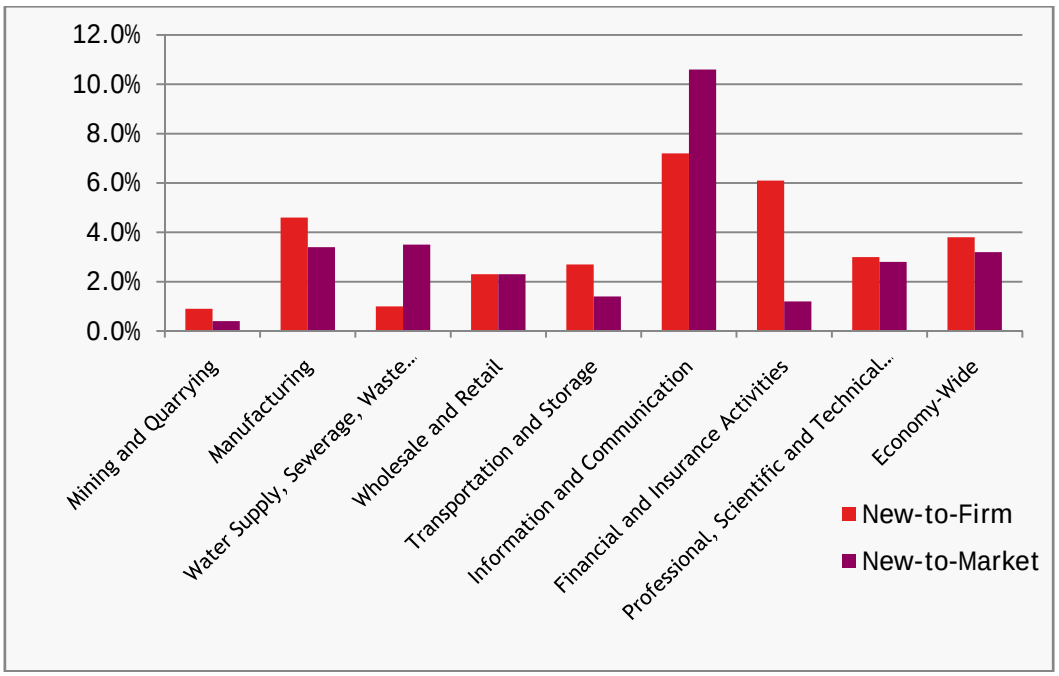
Source: Community Innovation Survey 2008

3.2.4 Outcomes from Product Innovation – Turnover

3.2.4.1 Sectoral Level

By broad sector, the proportion of turnover from innovative activities is highest in the information and communication sector, far in excess of the economy-wide average, and with a notably high proportion of turnover attributable to new-to-market product innovations (Figure 18). In the financial and insurance activities sector, the level of turnover of new-to-firm innovations stood at 6 percent, but with new-to-market turnover substantially lower. In manufacturing, the levels of turnover from new-to-firm and new-to-market innovation are both slightly higher than the economy-wide average.

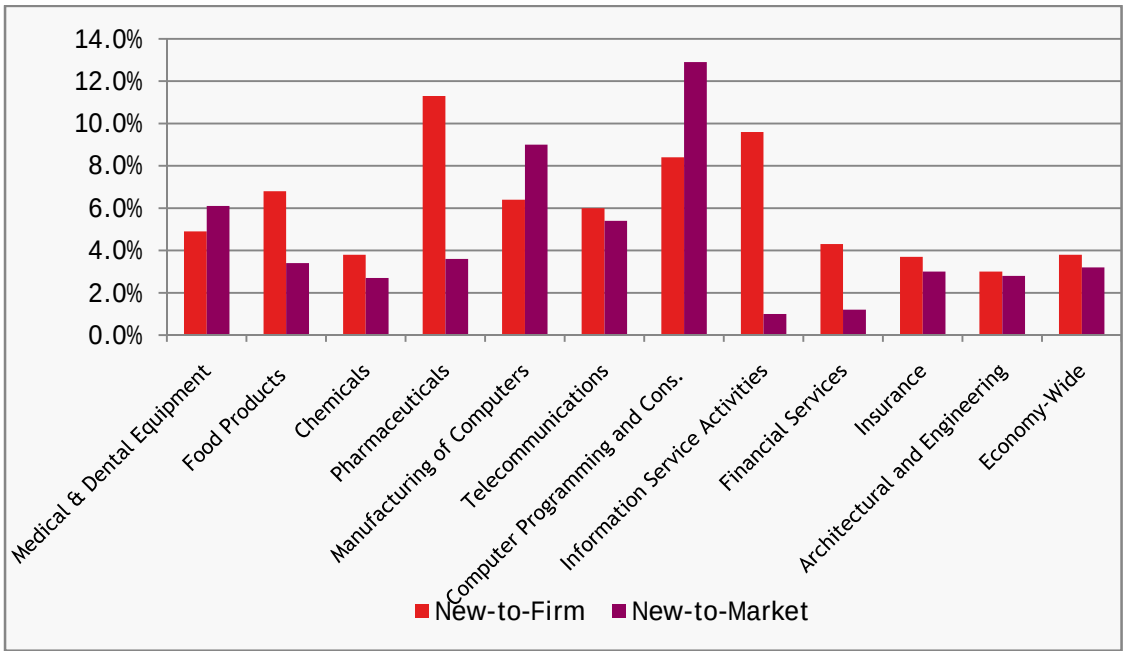
Figure 18: Turnover from Product Innovations by Broad Sector



Source: Community Innovation Survey 2008

In terms of selected sectors, a number of sectors, computer programming and consultancy services have levels of new-to-firm (8.4 percent) and new-to-market (12.9 percent) turnover far in excess of the economy-wide average (Figure 19). Computer manufacturing also has high levels of new-to-firm and new-to-market turnover, while Pharmaceuticals and Information Service activities each have notably high levels of new-to-firm turnover.

Figure 19: Turnover from Product Innovations in Selected Sectors

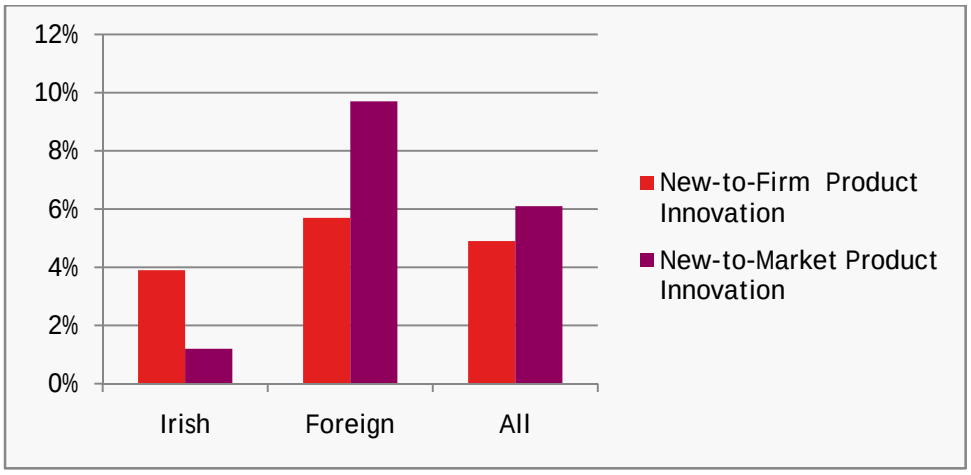


Source: Community Innovation Survey 2008

3.2.4.2 Origin of Firm

A greater proportion of turnover attributable to both new-to-firm and new-to-market product innovations are accrued by foreign firms; in the case of the new-to-market innovations, the difference is quite considerable (9.7 percent vs. 1.2 percent; Figure 20). In addition new-to-market product innovations are contributed considerably more from services sectors than industrial sectors and, generally, also by size of firm.

Figure 20: Turnover from Product Innovations by Origin



Source: Community Innovation Survey 2008

3.3 Non-Technological Innovation

Specifically, non-technological modes of innovation are marketing and organisational innovation.

- Marketing innovation includes aesthetic changes in product design or service delivery; changes in product placement; changes in pricing methods and changes in promotion techniques.
- Organisational innovations are normally the result of strategic management decisions, and include new business practices for organising procedures; new methods of organising work responsibilities or external relations.

3.3.1 Size of Firm

Similar to the modes of technological innovation, the broad trend is: the larger the firm, the greater the likelihood of engagement in marketing or organisational innovation. There is a noticeable difference, however, between the proportion of large firms engaging in marketing and organisational innovation (Table 7).

Table 7: Non-technological Innovation by Size of Firm (No. of Employees)

	Marketing Innovation	Organisational Innovation
10-49	24.8%	28.4%
50-249	35.3%	43.7%
250+	36.9%	65.9%

Source: Community Innovation Survey 2008

3.3.2 Sectoral Level

Engagement in non-technological modes of innovation varies considerably by broad sector. The proportions of manufacturing firms pursuing marketing and organisational innovation are close to the economy-wide average, while across service sectors, the proportions vary greatly (Table 8). In terms of organisational innovation, a considerably higher than average proportion of firms in more highly-skilled service sectors such as information and communication, financial and insurance services, and professional, scientific and technical activities, is active in this innovation mode.

The proportions of firms engaged in marketing innovations are fairly evenly spread across all the major sectors, with the exception of the information and communications sector, where a higher concentration (43.7 percent) of firms are engaged in some form of marketing innovation.

Table 8: Marketing and Organisational Innovation by Broad Sector

	Marketing Innovation	Organisational Innovation
Mining and Quarrying	10.2%	24.5%
Manufacturing	28.2%	32.9%
Wholesale and Retail	26.8%	30.8%
Transportation and Storage	18.4%	20.4%
Information and Communication	43.9%	44.9%
Financial and Insurance Activities	23.5%	38.3%
Professional, Scientific and Technical Activities	22.2%	35.4%
Economy-Wide	27.0%	32.3%

Source: Community Innovation Survey 2008

Looking at selected sectors, with respect to organisational innovation, there is an above average proportion of active firms in each of these sectors (Table 9). In the pharmaceuticals sector, almost 7 in 10 firms were active in this area, with almost 6 in 10 firms in the medical equipment sector also active in this area. Services sectors with particularly high concentrations of active firms were computer programming and consultancy (44.8 percent) and insurance services (50.7 percent).

Notably, firms in the pharmaceuticals and medical equipment sectors, despite their high level of engagement in organisational innovation, are much less active in marketing innovation. Again, this may reflect the predominance in these sectors of large multinationals with a diffuse production structure which, in the context of multinationals' specific Irish operations, negates the need for marketing innovations.

Table 9: Marketing and Organisational Innovation in Selected Sectors

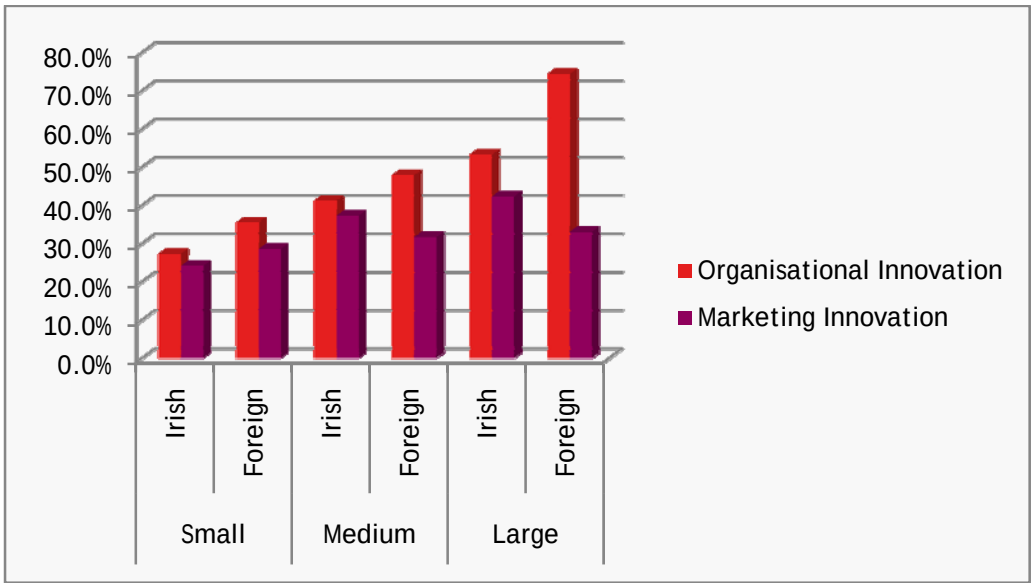
	Marketing Innovation	Organisational Innovation
Medical & Dental Equipment (3250)	29.9%	58.4%
Food Products (10)	41.8%	36.8%
Chemicals (20)	44.6%	35.9%
Pharmaceuticals (21)	28.3%	69.8%
Manufacturing of Computers (26)	51.0%	39.0%
Telecommunications (61)	34.2%	34.2%
Computer Programming and Cons. (62)	43.9%	44.8%
Information Service Activities (63)	21.6%	40.5%
Financial Services (64)	17.9%	34.8%
Insurance (65)	34.7%	50.7%
Architectural and Engineering (71)	22.2%	35.4%
Economy-Wide	27.0%	32.3%

Source: Community Innovation Survey 2008

3.3.3 Origin of Firm

The principal modes of non-technological innovation are also instrumental to a firm's activities and the differences between firm attitudes and approaches in these areas vis-à-vis technological (product and process) innovation are considered increasingly important at a policymaking level. There is also an increasing realisation that the importance of non-technological forms of innovation has been overlooked in the context of firm performance at the micro level, and of the repercussions for specific policy at the macro level. The composition of the firms engaging in non-technological innovation could inform the content and specific targeting of innovation policies to meet the needs of indigenous and/or foreign companies.

Figure 21: Non-Technological Innovation Modes by Firm Size and Origin



Source: Community Innovation Survey 2008

With respect to organisational innovation, a higher proportion of foreign firms are engaged in some form of organisational innovation across all firm sizes than Irish-owned firms, with almost three-quarters of large firms engaged (Figure 21). Foreign firms are consistently more active in this area. Interestingly, a greater proportion of medium and large Irish-owned firms are engaged in marketing innovation than their foreign counterparts. This could reflect the structure and dispersion of operations, particularly in larger multinationals, whereby the Irish-based operations of particular firms are focused on one particular area of production, with marketing functions located elsewhere.

However, when one considers that a greater proportion of Irish medium-sized firms also engage in marketing innovation, it could well be argued that there is a more proactive approach to this mode of innovation on the part of these cohorts of firms. One explanation for this is the sectoral composition of the firms surveyed. What is clear is that in the case of both medium and large-sized firms, a greater proportion of the Irish firms are in service industries. 52.5 percent of medium-sized Irish firms are services companies compared with 46.3 percent of those foreign-owned; 50.4 percent of large Irish firms are services companies compared with 44.7 percent foreign-owned. Does this suggest a particular preference on the part of medium and large Irish firms in services industries towards marketing innovation? Independent of firm origin, when the total firm population is differentiated by broad sector only (industry or services), the proportions engaged in marketing innovation are again similar, even when taking firm size into account. This lends support to the idea that the larger Irish services firms show a particular preference towards marketing innovation.

4. Community Innovation Survey 2008 – Characteristics and Approaches

This section looks at Irish firms' characteristics and approaches to innovation, and attempts to identify trends by size of firm, sector and firm origin. Areas explored include market orientation, the role of cooperation, and barrier encountered by firms to innovative activity.

Key Points

Larger firms are more likely to target at least one export market than smaller firms; 77.5 percent of the smallest firms target at least one export market, compared with seven in every eight of the largest firms.

- Innovative firms show a greater propensity to target markets other than their local and domestic markets; this shows up on a fairly consistent basis in the survey data.
- When small firms innovate, they are less likely than larger firms to engage to in a cooperation arrangement in order to pursue innovation activities.
- Between 2006 and 2008, foreign-owned innovative firms were more likely than Irish firms to cooperate with other parties when conducting their activities.
- With respect to the key exporting sectors, there is no sectoral dichotomy (industry vs. services) in the importance of barriers to innovation, although it is noticeable in some cases that sectors dominated by multinationals including chemicals and computer manufacturing, report fewer firms encountering finance as an impediment to innovation.

4.1 Market Orientation

4.1.1 Overview

Table 10 shows how larger firms are more likely to target at least one export market than smaller firms; 77.5 percent of the smallest firms target at least one export market, compared with seven in every eight of the largest firms. More generally, it also shows how firms who are targeting at least one export market for its good or service are more likely to engage in innovation than those who don't.

Table 10: Proportion of respondent exporting firms by size and broad innovation activity

Size of Firm	Innovation-All Types		Total
	Innovating	Non-Innovating	
10-49	79.9%	76.0%	77.5%
50-249	83.8%	79.0%	81.9%
250+	89.6%	80.8%	87.5%

Source: Community Innovation Survey 2008

4.1.2 Sectoral Level

There are no broad sectors in which a greater number of firms target a specific export market (Other EU or Rest of the World) over any of its domestic markets (Table 11). Manufacturing and Information and Communication sectors have a high proportion of firms which target markets beyond the island of Ireland.

Table 11: Market Orientation by Geographic Region, Broad Sector – All Firms

	Local/Regional	National	NI	Other EU	RoW
Mining and Quarrying	79.6%	32.7%	20.4%	25.5%	15.3%
Manufacturing	71.7%	63.5%	43.2%	43.7%	21.0%
Electricity, Gas, Steam and Air Conditioning Supply	75.0%	62.5%	37.5%	0.0%	0.0%
Water Supply, Sewerage, Waste Management	82.9%	38.4%	28.1%	28.8%	9.6%
Wholesale and Retail	70.7%	57.0%	41.5%	21.9%	7.3%
Transportation and Storage	62.9%	48.4%	30.5%	28.3%	11.8%
Information and Communication	68.8%	64.8%	34.8%	50.7%	35.2%
Financial and Insurance Activities	55.8%	49.9%	15.9%	27.7%	21.0%
Professional, Scientific and Technical Activities	76.9%	63.2%	22.7%	21.5%	8.1%

Source: Community Innovation Survey 2008

However, there are a number of specific manufacturing sectors where a greater proportion of respondent firms target foreign markets over domestic, notably the medical equipment, pharmaceutical, and computer manufacturing sectors (Table 12). This is particularly the case in the pharmaceuticals sector, where the proportion of firms targeting the EU market is more than double that which targets the local market. With respect to specific services, computer programming and consultancy, information service activities and insurance services contain relatively high proportions of firms which target foreign markets.

Table 12: Market Orientation by Geographic Region, Selected Sectors – All Firms

	Local	Regional	NI	Other EU	RoW
Medical & Dental Equipment (3250)	51.3%	43.6%	23.1%	66.7%	53.8%
Food Products (10)	68.5%	55.8%	44.2%	49.3%	15.6%
Chemicals (20)	73.9%	83.7%	68.5%	51.1%	20.7%
Pharmaceuticals (21)	43.4%	50.9%	35.8%	98.1%	83.0%
Manufacturing of Computers (26)	65.0%	60.0%	29.0%	73.0%	55.0%
Telecommunications (61)	82.9%	77.6%	39.5%	48.7%	32.9%
Computer Programming and Cons. (62)	64.5%	71.1%	35.7%	55.0%	39.3%
Information Service Activities (63)	86.5%	59.5%	21.6%	45.9%	18.9%
Financial Services (64)	52.8%	36.2%	12.8%	25.2%	17.9%
Insurance (65)	50.7%	56.0%	25.3%	41.3%	21.3%
Architectural and Engineering (71)	76.9%	63.2%	22.7%	21.5%	8.1%

Source: Community Innovation Survey 2008

4.1.3 Origin of Firm

Perhaps unsurprisingly, innovative firms show a greater propensity to target markets other than their local and domestic markets; this shows up on a fairly consistent basis in the survey data. Between Irish and foreign-owned innovative firms, there is a noticeable difference in the proportions targeting more distant i.e. Other EU and Rest of the World markets. In terms of supplying local, regional or Northern Ireland markets, the proportion of innovative Irish-owned firms is higher than that for foreign-owned firms. However, in terms of supplying other EU countries and the Rest of the World, the proportion of Irish-owned firms is considerably less, while the proportion of foreign-owned firms climbs significantly. Table 13 shows the market orientation of innovative firms, broken down by both target market and national origin.

Table 13: Market Orientation of Innovative Firms by Geographical Region and Origin

	Local	National	N.Ireland	Other EU	RoW
Irish	96.7%	90.9%	73.7%	65.8%	41.1%
Foreign	82.8%	84.9%	71.1%	82.4%	66.4%

Source: Community Innovation Survey 2008

From Table 13 above, it is noticeable that even innovative Irish firms are considerably less likely to serve overseas markets; it should also be noted that the number of firms also declines in absolute terms for Irish companies. With respect to foreign-owned firms, those which are innovative are more likely to target overseas markets than Irish firms; approximately two-thirds of foreign-owned firms target at least one of the five standardised geographical markets outlined in the CIS 2008. It should be stressed, however, that the figures given above represent the proportion of total definitive responses; a minority of firms do not respond definitively to whether they sell in some cases, and although it could be assumed that this infers non-participation in certain markets, these responses are nevertheless not taken into account.

4.2 Approaches to Innovation

4.2.1 Overview

When small firms innovate, they are less likely than larger firms to engage to in a cooperation arrangement in order to pursue innovation activities (Table 14). Cooperation could involve collaboration with other enterprises, customers, suppliers, government agencies, universities or some combination of parties. Just over one fifth of innovating small firms cooperated on their innovation activities, compared with just under one third of innovating medium firms, and almost one half of innovating large firms. It is possible that a lack of cooperation opportunities/initiatives also acts as a barrier to innovation for small firms, and could explain why innovation rates are lowest for this cohort of firms.

Table 14: Cooperation among Innovating Firms by Firm Size

Size of Firm	Co-operation for innovation activities	
	Yes	No
10-49	20.5%	79.5%
50-249	31.1%	68.9%
250+	48.7%	51.3%

Source: Community Innovation Survey 2008

4.2.2 Sectoral Level

Despite the above average levels of technological innovation seen in the identified key exporting sectors, there is, in general, a smaller number of respondent firms pursuing innovation activities in conjunction with a third party (Table 15). However, in the case of some manufacturing sub-sectors, for example medical & dental equipment, chemicals and pharmaceuticals, there is a much higher proportion of firms cooperating with Consultants, Labs or R&D Institutes. Cooperation with suppliers is also generally more common in these sectors.

Table 15: Cooperation in Innovation Activities by Selected Sector

	Within Enterprise Group	Suppliers	Clients	Competitors /Sectoral Enterprises	Consultants, Labs or R&D Institutes	Unis/ HEIs	Government or Public Research Bodies
Medical & Dental Equipment (3250)	11.7%	19.2%	16.7%	2.6%	16.7%	6.5%	0.0%
Food Products (10)	1.2%	15.9%	4.3%	1.2%	0.5%	1.9%	0.0%
Chemicals (20)	4.3%	18.5%	4.3%	0.0%	14.1%	2.2%	2.2%
Pharmaceuticals (21)	3.8%	11.3%	0.0%	0.0%	13.2%	5.7%	0.0%
Manufacturing of Computers (26)	8.0%	6.0%	6.0%	0.0%	4.0%	2.0%	0.0%
Telecommunicatio ns (61)	0.0%	15.8%	5.3%	0.0%	0.0%	0.0%	0.0%
Computer Programming and Cons. (62)	6.6%	10.7%	3.2%	3.6%	1.1%	1.1%	0.0%
Information Service Activities (63)	0.0%	5.4%	0.0%	0.0%	0.0%	0.0%	0.0%
Financial Services (64)	3.8%	12.1%	1.0%	0.7%	2.4%	0.7%	1.4%
Insurance (65)	4.0%	9.3%	2.7%	0.0%	0.0%	0.0%	0.0%
Architectural and Engineering (71)	1.3%	4.9%	2.0%	0.9%	0.0%	0.9%	0.0%
Economy-Wide	11.6%	14.6%	13.3%	5.5%	9.4%	9.2%	5.6%

Source: Community Innovation Survey 2008

All selected manufacturing sub-sectors contained higher than average proportions of firms pursuing all types of innovation captured in the CIS survey (Table 16). Almost two-thirds of firms in the pharmaceutical industry pursue in-house R&D, with almost three in five firms adopting technology in innovation.

Table 16: Types of Innovation, Selected Sectors

	Internal R&D	External R&D	Acquired Machinery, Equipment & Software	Acquired External Knowledge
Medical & Dental Equipment (3250)	39.7%	11.5%	33.3%	7.7%
Food Products (10)	36.8%	13.7%	35.6%	4.8%
Chemicals (20)	38.0%	16.3%	40.2%	0.0%
Pharmaceuticals (21)	66.0%	20.8%	56.6%	5.7%
Manufacturing of Computers (26)	38.0%	14.0%	38.0%	12.0%
Telecommunications (61)	35.5%	13.2%	39.5%	13.2%
Computer Programming and Cons. (62)	38.6%	7.7%	25.9%	6.8%
Information Service Activities (63)	21.6%	16.2%	16.2%	5.4%
Financial Services (64)	9.7%	5.2%	17.2%	5.5%
Insurance (65)	24.0%	9.3%	25.3%	9.3%
Architectural and Engineering (71)	13.5%	5.6%	19.3%	7.6%
Economy-Wide	17.5%	7.4%	22.9%	4.9%

Source: Community Innovation Survey 2008

4.2.2.1 Intentions to Innovate at Sectoral Level

Those factors considered by firms to be highly important factors in innovation decisions range somewhat by sector; Medical and Dental Equipment and Pharmaceutical industries place a greater emphasis than other sectors on innovation towards increasing their range of goods, and replacing outdated products or processes (Table 17). Chemicals and Medical and Dental equipment sectors place a greater emphasis than other sectors on increasing market share. These trends could be a reflection of the international market conditions in which these firms operate, and the higher concentration of larger firms in each sector.

With respect to service industries, innovation is seen as instrumental to entering new markets by a higher proportion of firms in the Computer Programming and Consultancy and Information Services sectors. This could be interpreted as a response to increasing importance of, and competition within, services exports markets, particularly with respect to these sectors. The importance of reducing labour costs is, broadly speaking, more important for the listed manufacturing sectors. This may be a reflection of, or a response to, the consistent decline in employment in manufacturing over the last ten years.

Table 17: Highly Important Intentions to Innovate by Selected Sectors

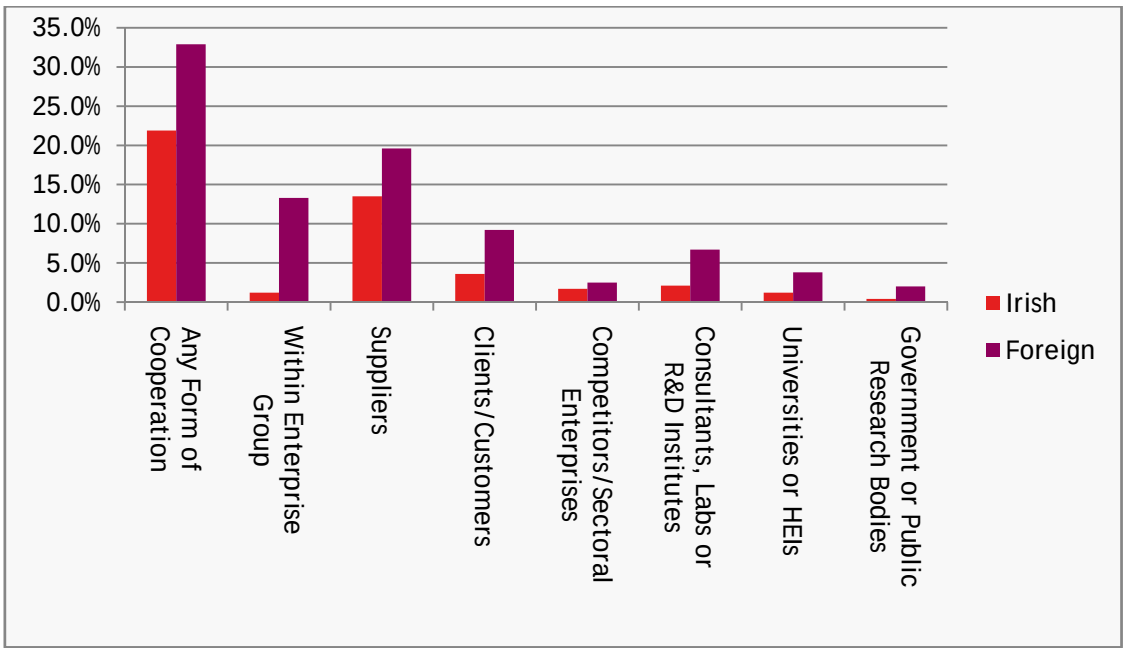
	Increase Range of Goods and Services	Replace Outdated Products or Processes	Enter New Markets	Increase Market Share	Improve Quality of Goods and Services	Improve Flexibility for Producing Goods and Services	Increase Capacity for Producing Goods and Services	Improve Health and Safety	Reduce Labour Costs per Unit Output
Medical & Dental Equipment (3250)	52.6%	33.3%	34.6%	59.0%	33.3%	33.3%	35.9%	16.7%	32.1%
Food Products (10)	35.1%	19.7%	33.9%	36.5%	34.6%	20.9%	26.2%	25.5%	38.0%
Chemicals (20)	23.9%	21.7%	28.3%	47.8%	30.4%	16.3%	14.1%	29.3%	21.7%
Pharmaceuticals (21)	43.4%	49.1%	30.2%	34.0%	37.7%	32.1%	32.1%	30.2%	37.7%
Manufacturing of Computers (26)	16.0%	27.0%	18.0%	31.0%	22.0%	15.0%	12.0%	7.0%	24.0%
Telecomms (61)	26.3%	14.5%	26.3%	31.6%	21.1%	7.9%	5.3%	10.5%	14.5%
Computer Programming & Cons. (62)	37.5%	19.5%	42.3%	36.6%	30.9%	14.3%	10.0%	4.8%	12.3%
Information Service Activities (63)	27.0%	27.0%	43.2%	37.8%	48.6%	37.8%	37.8%	21.6%	32.4%
Financial Services (64)	25.9%	16.2%	12.4%	23.4%	27.9%	18.3%	17.9%	11.4%	11.7%
Insurance (65)	32.0%	24.0%	13.3%	38.7%	36.0%	22.7%	12.0%	4.0%	20.0%
Architectural & Engineering (71)	18.4%	14.1%	20.9%	16.4%	34.7%	22.6%	15.5%	18.2%	24.0%

Source: Community Innovation Survey 2008

4.2.3 Origin of Firm

Between 2006 and 2008, foreign-owned innovative firms were more likely than Irish firms to cooperate with other parties when conducting their activities (Figure 22). 21.9 percent of innovative Irish firms are in at least one form of cooperation arrangement, compared with 32.9 percent of foreign-owned firms. Cooperation with suppliers of equipment, materials, components or software was the most common with both Irish and foreign-owned firms; it was the predominant form of cooperation among Irish firms in particular. Notably, however, foreign-owned firms which innovate are more likely to cooperate with more than one partner. One of the reasons for this is the presence of a wider enterprise group; in almost all cases, foreign firms are part of a group, enabling them to more easily cooperate across its enterprise group, as they are likely to enjoy much reduced transaction and communications costs. However, significantly greater proportions of foreign firms also cooperate with their own clients as well as with consultants, labs and R&D institutes.

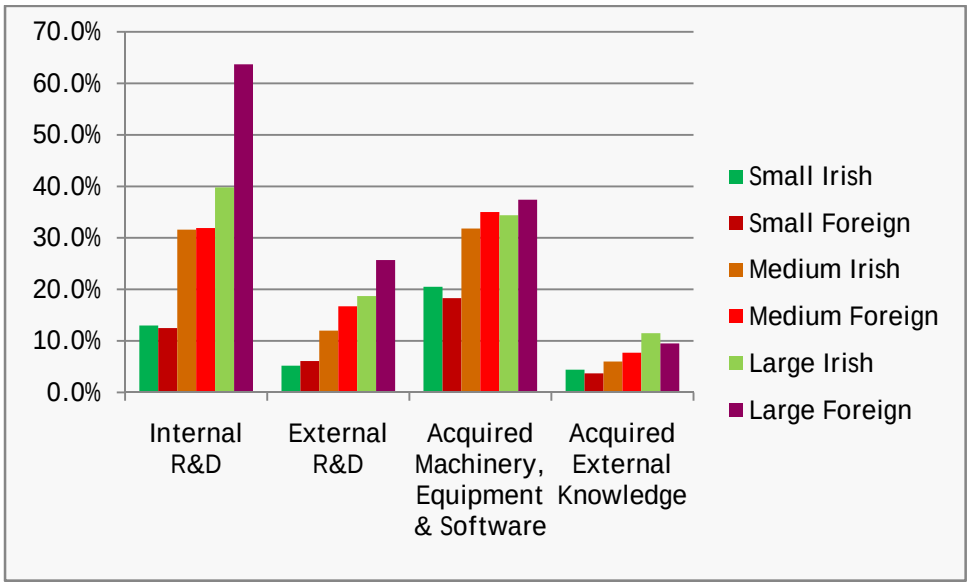
Figure 22: Cooperation in Innovation Activities by Firm Origin



Source: Community Innovation Survey 2008

With respect to each of the principal types of innovation which firms undertake, larger firms are generally more engaged, reflective of the general trend of innovation intensity increasing by size of firm. Encouraging from an indigenous sector perspective is the higher propensity of small Irish firms to engage in internal R&D. However, in many cases, there is no definite pattern to the proportions of active firms by origin, but it is noticeable that large foreign firms engaging in R&D, chiefly in-house, are particularly high, with as much as 63.7 percent of such firms conducting R&D internally (Figure 23). In terms of acquired external knowledge, a greater proportion of small and large Irish firms pursue this than do their foreign counterparts. This innovation type is the area in which firms are generally the least active, however.

Figure 23: Types of Innovation by Firm Size and Origin



Source: Community Innovation Survey 2008

In terms of meaningful comparisons with other types of firms, and resultant policy implications, it is important to consider that the typical firm in the "Large Foreign" cohort is large and interconnected enough to enjoy sufficient scale with which to conduct product tests and trials in its own plants and/or offices. It is difficult to compare directly with firms in other cohorts as a consequence, and highlights that there is no "one size fits all" policy initiative, particularly with respect to R&D.

4.3 Barriers to Innovation

4.3.1 Sectoral Level

In terms of barriers to innovation, a lack of funds (internal and external) is seen as a major barrier for the Food, Pharmaceuticals and Information Service Activities sectors (Table 18). A high proportion of firms in the Information Services sector also encounter high cost as a deterrent to innovation, as well as the dominance of other enterprises in the market. With respect to the key exporting sectors, there is no sectoral dichotomy (industry vs. services) in the importance of barriers to innovation, although it is noticeable in some cases that sectors dominated by multinationals including chemicals and computer manufacturing, report fewer firms encountering finance as an impediment to innovation.

Table 18: Highly Important Barriers to Innovation, Selected Sectors

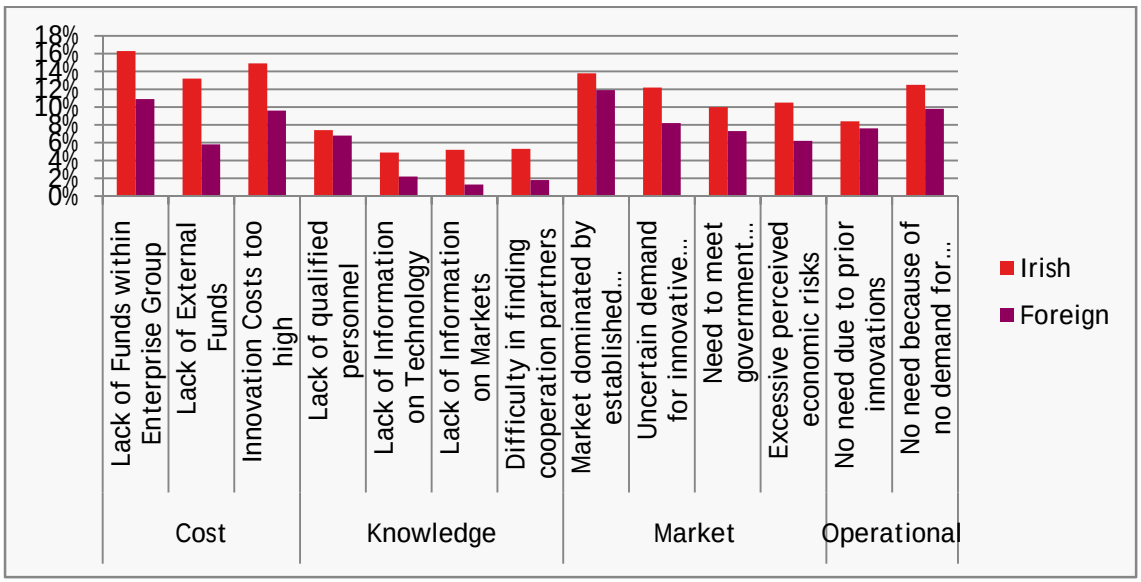
	Cost			Knowledge				Market				Operational	
	Lack of Funds within Enterprise Group	Lack of External Funds	Innovation Costs too high	Lack of qualified personnel	Lack of Information on Technology	Lack of Information on Markets	Difficulty in finding cooperation partners	Market dominated by established enterprises	Uncertain demand for innovative goods/services	Need to meet Government regulations	Excessive perceived economic risks	No need due to prior innovations	No need because of no demand for innovations
Medical & Dental Equipment (3250)	2.6%	0.0%	0.0%	2.6%	0.0%	0.0%	0.0%	20.5%	2.6%	15.4%	2.6%	9.0%	2.6%
Food Products (10)	25.2%	15.1%	28.4%	8.2%	6.3%	4.3%	8.2%	12.3%	20.2%	14.9%	10.6%	2.9%	10.6%
Chemicals (20)	7.6%	5.4%	17.4%	5.4%	0.0%	2.2%	5.4%	5.4%	2.2%	19.6%	5.4%	7.6%	5.4%
Pharmaceuticals (21)	20.8%	15.1%	5.7%	3.8%	0.0%	0.0%	1.9%	11.3%	1.9%	15.1%	1.9%	5.7%	1.9%
Manufacturing of Computers (26)	8.0%	2.0%	12.0%	2.0%	0.0%	4.0%	2.0%	24.0%	0.0%	0.0%	2.0%	5.0%	4.0%
Telecommunications (61)	17.1%	17.1%	11.8%	0.0%	0.0%	0.0%	0.0%	25.0%	11.8%	17.1%	5.3%	15.8%	27.6%
Computer Programming and Cons. (62)	16.6%	9.1%	8.6%	9.8%	1.1%	6.6%	2.5%	7.7%	6.1%	3.0%	4.5%	3.2%	2.5%
Information Service Activities (63)	37.8%	27.0%	43.2%	27.0%	16.2%	16.2%	16.2%	43.2%	21.6%	16.2%	27.0%	13.5%	5.4%
Financial Services (64)	10.0%	11.7%	9.7%	5.5%	2.1%	3.8%	3.1%	10.0%	8.6%	11.0%	4.8%	5.9%	10.3%
Insurance (65)	16.0%	1.3%	1.3%	5.3%	0.0%	0.0%	0.0%	6.7%	0.0%	20.0%	6.7%	5.3%	8.0%
Architectural and Engineering (71)	10.6%	10.6%	12.5%	7.2%	6.1%	5.4%	5.4%	12.5%	13.2%	11.6%	15.0%	10.6%	8.7%

Source: Community Innovation Survey 2008

4.3.2 Origin of Firm

There are a number of key areas where a greater proportion of Irish firms report key impediments to innovation as highly important. Generally, costs and knowledge are the two broad areas where Irish and foreign firms' experiences diverge. With respect to cost-related impediments, notably access to finance, a greater proportion of Irish firms cite access to external funds i.e. from sources outside the enterprise/enterprise group, as highly important, but also access to funds from within the enterprise group. A greater proportion of Irish firms also cite the high cost of innovation as a highly important barrier (Figure 24).

Figure 24: Highly Important Impediments to Innovation



Source: Community Innovation Survey 2008

In terms of knowledge-related factors, there is little difference between Irish and foreign firms in terms of access to personnel, but, notably, a greater proportion of Irish firms report a lack of information on technology as highly important. Connected to the difference in cooperation partnerships between Irish and foreign firms, a greater proportion of Irish firms cited the difficulty in finding cooperation partners as a highly important barrier to innovation.

5. Conclusions

Viewed at a European level, Ireland's headline innovation performance is generally promising, with high proportions of firms engaged in innovation activity, as well as relatively high levels of expenditure and reasonably high levels of turnover attributable to product innovations. The high level strengths, weaknesses, opportunities and threats are discussed in detail in Chapter 2. However, it is when CIS data is disaggregated at national level that a more accurate picture of Ireland's innovation strengths and weaknesses emerges, and further policy implications can be drawn.

5.1 Messages and Policy Implications

The analysis at national level has looked at innovation activity and approaches, based on the results of the Community Innovation Survey 2008. To help provide a framework for policy implications, this analysis was disaggregated by:

- Size of firm;
- Sector; and
- Origin of firm.

The focus of policy recommendations is aligned to the premise that there is an ongoing commitment to stimulating export-led growth in the small firms sector, as well as a commitment to the knowledge, or "smart" economy, as core elements to future enterprise development and economic growth, in a straitened fiscal climate. Overall, in this context, there are a number of important messages, in the survey analysis, and on its periphery, that can help inform innovation policy:

- **Larger firms tend to innovate more.** Across the EU, larger firms tend to undertake more innovative activities, and this also holds for Ireland. The proportion of small firms who do innovate tend to focus more on process innovation (generally less resource intensive) and are less likely to engage in more than one innovation mode.
    - As the largest cohort within the survey population (approximately four-fifths of companies, and two-thirds of employment), policies must target and encourage innovation activity in small firms as a priority.
    - In the context of encouraging small indigenous firms to grow and to successfully exploit overseas markets, innovation policies targeting small firms are all the more important, particularly when one considers the positive relationship between innovation activity and propensity to export.

- **Indigenous firms are less innovative than foreign-owned firms in Ireland.** While there are distinct differences in the structure of indigenous and foreign-owned firms in Ireland, it is notable that the indigenous sector is significantly less innovative, and is less likely to effectively collaborate across the range of potential partners, notably Universities and publicly-funded bodies, than foreign-owned firms based here. However, the proportion of all indigenous Irish firms engaged in some mode of innovation activity is still higher than the EU-27 average.

- Across almost all cohorts, foreign-owned firms are more likely to be innovation-active than Irish firms. It is also the case that a typical foreign-owned firm is likely to be engaged in a greater number of innovation modes.
- It should be noted that all foreign-owned firms have specific ownership characteristics not shared by all Irish firms, in particular being part of an enterprise group. It is therefore to be expected that foreign-owned firms will be somewhat more likely to innovate, and more capable of finding working capital and innovation partners than a typical Irish firm of a similar size. However, the area of concern is the often large differential between Irish and foreign-owned firms, particularly amongst small firms, in key areas such as product innovation and cooperation arrangements – with respect to collaboration, indigenous firms may not be benefiting fully from positive externalities arising from proximity to innovative foreign-owned firms.

- **Particular modes of innovation are more suited to certain industries and sectors than others.** *It is neither accurate nor helpful to view innovation merely in terms of, say, R&D or acquired patents.* Innovation policy should not be seen as limited to funding internally or externally-sourced R&D. The variation in modes of innovation by sector is, in many cases, a reflection of the goods and services that firms in these sectors provide. Policies to encourage technological or non-technological innovation must therefore take into account the sectors targeted.
  - For example, a national initiative in conjunction with a university to encourage new services practices in small businesses is less likely to have an impact in the manufacturing sector than in a fledgling IT consultancy firm. Equally, initiatives such as extending eligibility for R&D tax credits to all small firms in all sectors will, for example, be of less value to a small retail chain than a small nanotechnology firm, potentially distorting firm-level incentives to innovate to the optimal level in the appropriate areas.
  - The motivations for firms to engage in different modes of technological innovation can also vary by sector. In high value sectors such as chemicals and ICT, long-term product goods innovation (normally R&D) is crucial from the point of view of product development and long-term revenue growth; on the other hand, other sectors of manufacturing may place more emphasis on pursuing process innovations as a means of reducing their cost base. Innovation approaches can therefore sometimes vary between the more offensive and strategic, and the more defensive and tactical.

- **Innovation potential and growth opportunities lie in non-technological innovation.** With the ongoing structural shift towards service industries, there is potential for a greater impact from marketing and organisational innovations at firm level. Given the likely short and medium-term fiscal climate, the emphasis should be placed on value and achieving more for less. *Policies to encourage non-technological modes of innovation represent such an opportunity.*
  - Non-technological innovations can in some cases supersede product/service innovations in terms of their value to companies. For small firms, initiatives such as these are often more affordable and, in some cases, more effective than, say, long-term R&D arrangements, which may not even be applicable in some sectors. Policy

must take this into account, if the objective is to achieve greater output per euro spent on innovation.

- Increasing prevalence of organisational innovations can be linked to improvements and increases in strategic decision making, which can be encouraged through management development provision. There are frameworks already being put in place to incentivise management development, and the link to the wider innovation agenda should also be taken into account.
- With respect to marketing innovation, it is important to point out that the most recent survey data already appears to reflect medium and large indigenous firms' awareness of the value of such innovations. More medium and large Irish firms engaged in marketing innovation than foreign-owned firms, in part reflecting the specific functions of large foreign firms in Ireland and going against the general trend that foreign firms are more likely to engage in a given mode of innovation than Irish firms. This also reflects the relatively high concentration of medium-sized Irish companies in service industries.

- **At survey level, there is currently a lack of feedback data.** While the CIS captures in detail firms' approaches and inputs to innovation, there is very little data available to measure and monitor the effects of prior or current innovation activities. As a result, in the absence of a broader evidence base on the outcomes of innovation, it becomes more difficult to incentivise non-active firms, particularly those who face high barriers to innovation such as small firms, to make investments in upgrading their products or processes.
  - Added to this is the difficulty in determining the "optimal" number of firms that should be engaged in innovation for a given expenditure, or the "optimal" level of engagement, particularly for small firms, given the natural financial and resource constraints often faced by this cohort. Whereas with much larger firms, the argument can be advanced that the extent of their innovation activity is in fact optimal as it results from rational, strategic decision making, the same may not be said for smaller firms. Setting tangible innovation performance targets in the context of the existing CIS is also difficult, given the subjective response nature of the aggregate evidence base.

- **Sound Framework Conditions for Innovation must remain or otherwise be put in place.** In the context of developing a knowledge economy, forms of hard and soft infrastructure at a national level become increasingly important. For example, the availability of a high speed, low cost, reliable broadband service can enhance or improve particular forms of service innovation, and also forms of process innovation. Solid skills in areas such as ICT can enable companies to (cost-) effectively implement more ambitious process innovations across a range of sectors. Improved marketing innovations can also be linked to a wide range of softer skills.

- **The innovation agenda can and should easily link into other initiatives and fora with respect to implementation.**

  In terms of advancing and encouraging the innovation agenda, the following bodies are useful levers, and can, where appropriate, feed into their work programmes:

  - **Expert Group on Future Skills Needs:** Much of the work done here promotes the skills agenda, based on identified needs of companies and sectors – this is a forum where the argument that opportunities to capitalise on innovation opportunities at firm level depend on the right skillsets in the workforce can be advanced.
  - **National Competitiveness Council:** Increasingly cognisant of the non-cost elements of competitiveness, the role of innovation performance in galvanising productivity growth can also be highlighted effectively through this forum.

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