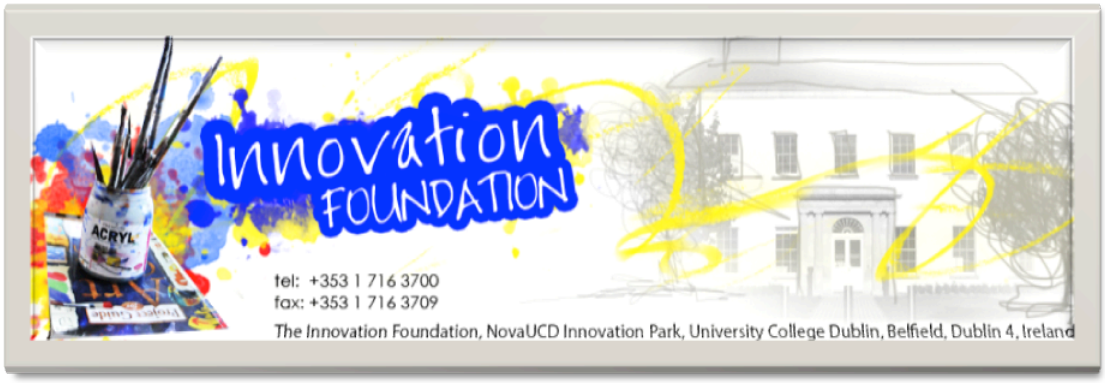
MEASURING FIRM-LEVEL INNOVATION:

REVIEW OF THE LITERATURE & SURVEY-DESIGN



PETER CARNEY ~ MARTIN RYAN

UCD GEARY INSTITUTE

(Guidance provided by Prof. Colm Harmon & Peter Robbins of the Innovation Foundation; acknowledgements to Janice Cassidy for her help).

FINAL VERSION

6th November 2010

TABLE OF CONTENTS

Terms of Reference

TERMS OF REFERENCE

This literature review was produced for the Innovation Foundation; a new specialist innovation agency in Dublin (Ireland) whose mission is to facilitate an acceleration of innovation in Irish firms.

The goal of the review is to investigate the international academic literature on firm-level innovation and to evaluate the existing measurement tools used to assess firms' innovation capabilities. The four main aims of the review are:

(i) Explore the topography of the innovation construct in the literature
(ii) Decipher from both the literature the core elements of the construct that lend themselves to sharp and concise assessment of a firm's innovation capacity
(iii) Examine sector (and scale) specific aspects of innovation and their importance
(iv) Document and review previous survey/auditing tools used by both government and commercial interests

At the end of review, the authors translate their findings into a set of suitable questions, incorporating their experience of designing web-survey questionnaires. The set of questions is designed to:

1) Provide an objective indication of a responding firm's innovation position
2) Identify specific strengths and weaknesses in the firm's approach to innovation.

The first section of this document discusses the definition of innovation. The second section develops the concept of innovation. The third section examines the existing theory and insights about the measurement of innovation. The

fourth chapter outlines the existing survey-tools for measuring innovation. We conclude in the fifth section with a recommendation on how to measure innovation in Irish firms.

1. Background and Working Definition

Many reports from the Irish Government repeatedly assert that innovation and creativity are key determinants of success for Ireland. In particular, a number of recent government reports describe the vision of creating Ireland's 'smart economy'. The basic idea, as expressed in three reports – the *Strategy for Science, Technology and Innovation 2006-2013* (SSTI*), Building Ireland's Smart Economy* (BISE), and the *Report of the Innovation Taskforce* (RIT) – is to focus public investment on a set of targeted priority areas in science, engineering and technology. The intention is to create a research, innovation and commercialisation environment that will translates knowledge creation into economic activity and generate highly-paid sustainable jobs.

The consensus is that 'innovation' is the engine for growth and prosperity, and economies must move-up the value-added chain to sustain growth and development. This 'value-added' dimension, as we will see, is increasingly pronounced in the modern definitions of innovation. The OECD/Eurostat (2005) definition of innovation is as follows: [1]

> *An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations.*

Rogers (1998) discusses how innovation is defined in the Australian policy setting. The Australian Department of Industry Science and Tourism (DIST) use a broad definition of innovation (Rogers, 1998):

[1] Variants of this definition, such as product innovation, or process innovation, are presented in the glossary.

> *[I]nnovation, at the level of an individual firm, might be defined as the application of ideas that are new to the firm, whether the new ideas are embodied in products, processes, services, or in work organisation, management or marketing systems.* (DIST, 1996, p.2).

The *ABS Innovation Survey*, Australia's most comprehensive innovation survey, used the following definition of innovation prior to asking firms questions about their innovation capability (Rogers, 1998):

> *[A]n innovation [..] is any new or substantially improved good or service which has been commercialised, or any new or substantially improved process used for the commercial production of goods and services. 'New' means new to your business.* (ABS Innovation Survey questionnaire, Section B).

Finally, in relation to the Australian policy setting, the Business Council of Australia uses the following definition (Rogers, 1998):

> *In business, innovation is something that is new or significantly improved, done by an enterprise to create added value either directly for the enterprise or indirectly for it customers* (Business Council of Australia 1993, p.3)

Here we clearly see that *innovation* is only regarded to have occurred if it has been implemented or commercialised in some way. This is essentially the difference between an innovation and an invention; that is, the creation of abstract knowledge, or the invention of new products or processes, is not normally considered innovation until it has been productively incorporated into enterprise's activities.

This *'value-added'* distinction is strongly emphasised in the American policy literature on innovation. The *Advisory Committee on Measuring Innovation in the 21st Century Economy* reported to the American Secretary of Commerce in 2008, after a year-long study of the topic by business leaders and academics, that

''innovation is more than simply something new; it has the added component of adding value for both customers and firms". They define innovation as:

> *The design, invention, development or implementation of new or altered products, services, organisational structures, or business models for the purpose of creating new value for customers and financial returns for firms.* (ACMI; Executive Summary, p. i)

Chen and Sawhney (2010) discuss how innovation does not necessarily coincide with research and development (R&D). They use the following examples to illustrate. Dell Inc. has become one of the world's largest personal computer manufacturers, not through R&D investments but by bringing products to market more quickly and innovating on processes like direct selling and build-to-order manufacturing. Starbucks is regarded as an innovative company, not because of better-tasting coffee but because the company was able to create a unique customer experience referred to as "the third place"—a communal meeting place between home and work. Enterprise Rent-a-Car has become the leading car-rental company in the United States by focusing an innovative customer need as well as an innovative point of presence. Enterprise focuses exclusively on providing replacement cars to people whose cars are being repaired or have been stolen. And it locates its branches in the neighbourhoods where people live and work, rather than at airports. These examples suggest that innovation comes in many forms, some of which may have little to do with technology or R&D (Chen and Sawhney, 2010).

2. Understanding Innovation

There are usually three stages in conceptual models of innovation. Hansen and Birkinshaw's (2007) *Innovation Value Chain* comprises idea generation, idea conversion and diffusion. Roper et al.'s (2008) *Model of the Innovation Value Chain* comprises knowledge sourcing, knowledge transformation and knowledge exploitation. This section examines these models of understanding innovation, as well as the *Oslo Manual*, the *Solway Business School Model* and the *Innovation Radar*.

2.1 The Innovation Value Chain

Hansen and Birkinshaw (2007) recommend, in their *Harvard Business Review* article, to view innovation as a *value chain* comprising three key phases: idea generation, conversion and diffusion. A figure on the following page illustrates the Hansen and Birkinshaw (2007) *Innovation Value Chain.* The innovation value chain is derived from the findings of five large research projects on innovation that Hansen and Birkinshaw undertook over the past decade. They interviewed more than 130 executives from over 30 multinationals in North America and Europe. They also surveyed 4,000 nonexecutive employees in 15 multinationals, and they analysed innovation effectiveness in 120 new-product-development projects and 100 corporate venturing units.

Across all the phases of the innovation value chain, managers must perform six critical tasks—internal sourcing, cross-unit sourcing, external sourcing, selection, development, and companywide spread of the idea. Each is a link in the chain. Along the chain, there may be one or more activities that a company excels in—the firm's strongest links. Conversely, there may be one or more activities that a company struggles with—the firm's weakest links (Hansen and Birkinshaw, 2007). Another figure on the following page shows practices recommended by Hansen and Birkinshaw to strengthen the weakest links in a firm's innovation value chain. These include: building external networks,

building cross-unit networks, providing cross-unit funding, creating safe havens and designating *idea evangelists*. Examples are provided in each case.

Fig.1. The Hansen and Birkinshaw (2007) *Innovation Value Chain*

The Innovation Value Chain: An Integrated Flow

Viewing innovation as an end-to-end process rather than focusing on a part allows you to spot both the weakest and the strongest links.

	IDEA GENERATION			CONVERSION		DIFFUSION
	IN-HOUSE Creation within a unit	CROSS-POLLINATION Collaboration across units	EXTERNAL Collaboration with parties outside the firm	SELECTION Screening and initial funding	DEVELOPMENT Movement from idea to first result	SPREAD Dissemination across the organization
KEY QUESTIONS	Do people in our unit create good ideas on their own?	Do we create good ideas by working across the company?	Do we source enough good ideas from outside the firm?	Are we good at screening and funding new ideas?	Are we good at turning ideas into viable products, businesses, and best practices?	Are we good at diffusing developed ideas across the company?
KEY PERFORMANCE INDICATORS	Number of high-quality ideas generated within a unit.	Number of high-quality ideas generated across units.	Number of high-quality ideas generated from outside the firm.	Percentage of all ideas generated that end up being selected and funded.	Percentage of funded ideas that lead to revenues; number of months to first sale.	Percentage of penetration in desired markets, channels, customer groups; number of months to full diffusion.

Fig. 2: Hansen and Birkinshaw (2007): *Practices to Strengthen Weakest Links*

STRENGTHEN YOUR WEAKEST LINKS

Your capacity to innovate is only as good as the weakest link in your innovation value chain. The table shows how to select practices that strengthen your weakest links.

If your company has difficulty…	Consider these practices	Examples
Generating ideas	Build external networks	At Procter & Gamble, in-house product developers translate customer needs into technology briefs describing problems needing resolution. Briefs go to technology scouts, suppliers, research labs, and retailers worldwide to elicit solutions.
	Build cross-unit networks	P&G has communities of practice, each comprising volunteers from different parts of the organization and built around an area of expertise. The teams solve specific problems and participate in monthly technology summits with representatives from P&G's business units.
Converting ideas	Provide cross-unit funding	Shell Oil's GameChanger unit funds development of radical ideas, operating across major divisions with a $40 million annual seed-funding budget. Forty percent of projects in Shell's exploration and production sectors started as GameChanger projects.
	Create safe havens	A technology firm established a separate, autonomous business unit to develop new ideas supporting the company's strategy. Successful venture managers earned hefty bonuses. Numerous ventures became viable businesses with combined annual revenues of £100 million.
Diffusing ideas	Designate "idea evangelists"	Sara Lee's Sanex shower products encountered resistance from several country managers. A division president won them over by repeatedly visiting them and hosting them at headquarters. Sanex eventually was introduced in 29 countries.

Organisations typically fall into one of three broad "weakest link" scenarios. First is the idea-poor company, which spends a lot of time and money developing and diffusing mediocre ideas that result in mediocre products and financial returns. The problem is in idea generation, not execution. By contrast, the conversion-poor company has lots of good ideas, but managers don't screen and develop them properly. Instead, ideas die in budgeting processes that emphasise the incremental and the certain, not the novel. Or managers adopt the "1,000 flowers" approach, letting ideas bloom where they may but never culling them. The need is for better screening capabilities, not better idea generation mechanisms. Finally, the diffusion-poor company has trouble monetising its good ideas. Decisions about what to bring to market are made locally, and not-invented-here thinking dominates. As a result, new products and services aren't properly rolled out across geographic locations, distribution channels, or customer groups (Hansen and Birkinshaw, 2007). [2]

2.2 Modelling the Innovation Value Chain

[2] Appendix A shows the 13 basic questions that make up the Hansen and Birkinshaw (2007) measure of innovation-capability.

An innovation *event*, such as the introduction of a new product or process, represents the end of a series of knowledge sourcing and translation activities by a firm. It also represents the beginning of a process of value creation which, subject to the firm's own attributes and market conditions, may result in an improvement in the performance of the innovating business (Roper et al., 2008). According to Roper et al. (2008), the first link in the innovation value chain is firms' knowledge sourcing activity; these authors focus in particular on the factors which shape firms' engagement with particular knowledge sources.

The second link in the innovation value chain is the process of knowledge transformation, in which knowledge sourced by the enterprise is translated into innovation outputs. This is modelled using an innovation or knowledge production function in which the effectiveness of a firm's knowledge transformation activities is influenced by enterprise characteristics, the strength of the firm's resource-base, as well as the firm's managerial and organisational capabilities Roper et al. (2008).

The final link in the innovation value chain is knowledge exploitation, i.e. the process by which enterprise performance is influenced by innovation. At this stage of the process, firms' acquired knowledge has been codified into specific product or process innovations captured in the innovation output variables. It is these variables, which represent new market offerings, that might drive enhanced business performance, and which provide the link between firms' knowledge sourcing activities and performance. The strength of this linkage, however, will depend on firms' ability to fully commercialise their innovations Roper et al. (2008).

2.3 The Oslo Manual

Governments' interest in innovation dates back to the 1960s, but the OECD countries only began to systematically carry out innovation surveys in the 1980s. There has been some sporadic data collection by government departments (US Department of Commerce), statistical agencies (Statistics Canada) and academic units (Science Policy Research Unit – UK) before then, but rarely in any standardised way. When measuring innovation, governments generally relied on

already-available data like patents or industrial R&D expenditures (Godin, 2008). Eurostat and OECD's methodological work in the early 1990s marked the beginning of standardisation in the field of innovation measurement. This was characterised by a conceptual shift from measuring outputs in the 1970s to measuring activities in the 1990s (Godin, 2008).

This first edition of the *Oslo Manual* (1992) focused on *technological product and process (TPP)* innovation in manufacturing. The second edition, published in 1997, expanded coverage to service sectors of the economy, acknowledging this sector's large and growing significance. The third edition, published in 2005, includes a new chapter on 'innovation linkages'. More substantially, the third edition of the *Oslo Manual* also addresses 'marketing and organisational innovation'. These types of innovation were included in the third edition because of a growing consensus, as discussed above, that non-technological innovation was important (OECD and Eurostat, 2005). The *Oslo Manual* has successfully established itself as the main reference for macro-scale surveys that seek to examine innovation in the business sector.

2.4 The Solvay Business School Model

A survey was developed in 2000 by researchers at the Solvay Business School, Belgium, to examine "the main competences that come into play in the firms' innovation process" (Peeters et al 2003). Their comprehensive questionnaire had the following format (which is a similar structure to the *innovation value chain*):

1. The ability to develop a culture of innovation
    - Mechanisms firms put in place to develop a culture
        - Training programmes, explicit rewards, strategic goals, allotted time for education and training, openness to solutions, and explicit corporate values encouraging innovation.
    - Importance assigned to various innovative areas
        - Improvement of existing products, services, and processes

        - Development of radical innovations
        - Improvement in the firms organisation,
        - Improvement in their information management systems
        - Training

2. The ability to develop a culture of innovation
    - Internal research capacity
        - Basic research budget
        - Applied research budget
        - Development activities budget
    - Collaborative research agreements
        - With companies
        - Vertical partners (customers and suppliers)
        - Universities
        - Consultants
        - Complementary firms
    - Use of external and internal information sources
        - Recruitment of people with new skills
        - Organisation of team-work and brain storming
        - Use of competitive intelligent processes
        - Use of patent databases
        - Use of scientific literature
        - Use of market surveys
3. The capacity to implement ideas
    a. The storage and selection of ideas
    b. The development of technology
        i. Externally (using available licenses, patents, etc.)
        ii. Subcontracting R&D
        iii. Acquiring a smaller firm for it's technology competencies
    c. The innovation marketing
        i. Communication with customers
    d. The financial capacity
        i. Allocation of a proportion of profits

ii. External funding Sources
    - Banks
    - Public sectors (subvention)
    - Venture capital funds

4. The efficient management of intellectual property
    - An active intellectual property strategy

2.5 The Innovation Radar

Chen and Sawhney (2010) identify twelve dimensions of the business system within a holistic framework called the *Innovation Radar*. Each of these dimensions (product, platform, solution, customer need, customer experience, brand, process, value capture, organization, ecosystem, channel, and supply chain) represents a vector along which firms can focus their innovation strategy. Chen and Sawhney operationalise the Innovation Radar by creating a measure for each dimension of innovation and empirically test the construct validity using data from 765 managers from 52 business units of large U.S. corporations. Their empirical results support the concept of multi-dimensional innovation. The dimensions of the business system that Chen and Sawhney (2010) discuss are shown below.

Fig. 3: Chen and Sawhney (2007): *Innovation Radar Business Dimensions*

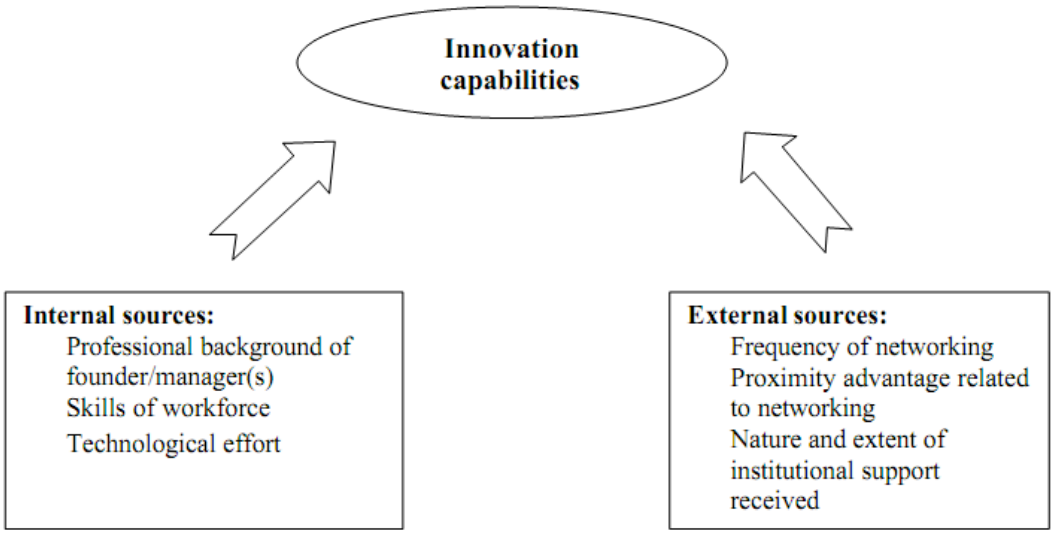
Table 2 Definition and Examples of Different Types of Innovation

Innovation	Definition	Examples
Product	The market introduction of products and services with new or significantly improved features and performance	• Sony's four generations and 150 variations of the Walkman • On-line banking services
Platform	The use of common bases such as modular components, common processes, and shared technologies to create a broad range of new products and services	• The Microsoft Windows platform • Toyota's automotive platform for family sedans
Solution	The introduction of a customized and/or integrated combination of products, services, and information to solve an end-to-end customer problem	• UPS Logistics Services that include warehousing, transportation, network management, and shipping • IBM's solutions that integrate its hardware, consulting, and financing services
Customer	The identification of unmet customer needs or under-served customer segments	• Enterprise Rent-a-Car focuses on the need for customers to find a replacement car • Whole Foods serves the need for high-quality organic food products
Interaction	The redesign of the interactions that customers have with the firm in order to create customer loyalty based on positive emotional response.	• Saturn's "no-haggle" car buying experience and Starbucks's innovations in the experience of buying and drinking coffee
Value Capture	The creation of new ways to get paid for products and services.	• Salesforce.com's subscription pricing for software • Google's paid search advertising service
Process	The design and implementation of a new or significantly improved internal business process in any functional area	• Toyota's Production System • GE's use of Lean Six Sigma
Organization	The invention and implementation of a significant change in organizational structure or management methods (e.g. decision-making process, employee incentive, management practices) to further organizational goals	• The transformation of IBM's organization into a customer-centered organization design • Kaplan's activity-based costing
Ecosystem	The creation of innovative partnerships and collaborative relationships with suppliers, partners, independent vendors, resellers, etc. to create a joint offering	• Apple's iPhone Application Store featuring independent software vendors • Procter & Gamble's "Connect+Develop" initiative to source innovations from external contributors.
Channel	The introduction of new routes to the marketplace or innovative points of presence for customers to find and buy products and services	• Bank of America's mini-branches placed inside grocery stores Dell's direct sale channels.
Supply Chain	The introduction of new or significantly improved methods of sourcing inputs and delivering the offerings to the markets	• Wal-Mart's Vendor-Managed Inventory program • Cisco's e-Hub that improves the coordination among suppliers, partners, and customers
Brand	The extension of the known quality perceptions and associations from an existing parent brand and transfer it to a new product category	• Europe-based easyGroup has extended its "easy" brand to a dozen industries, such as easyJet, easyCar, easyInternetCafe, easyMoney, easyCinema, easyHotel, and easyWatch.

2.6 Romijn and Albaladejo's Concept of Innovation-Capability

According to Romijn and Albaladejo (2000), *innovation capability* refers to the ability to make major improvements and modifications to existing technologies, and to create new technologies. The concept of innovation capability applies to process technology, product technology as well as the way in which production is organised and managed. Its importance derives from the fact that it is presumed to contribute to dynamic competitive advantage of companies since it enhances their capacity to keep up with, respond to, and initiate technological change on an ongoing basis. According to Romijn and Albaladejo (2000), the innovation capabilities of firms accumulate as a result of various internal and external inputs. These are illustrated in the figure below.

Fig. X: Romijn and Albaladejo (2000): *Internal and External Sources of Innovation*


Innovation capabilities
Internal sources:
Professional background of founder/manager(s)
Skills of workforce
Technological effort
External sources:
Frequency of networking
Proximity advantage related to networking
Nature and extent of institutional support received

3. Measuring Innovation: Survey-Tools

This section examines the existing survey-tools for measuring innovation. We focus on *Romijn and Albaladejo's Innovation Index*, *Hansen and Birkinshaw's Capability Measure*, the *Solvay Business School Survey*, the *Community Innovation Survey*, the *Innovation Index* and the *EU Improve Project*. We also discuss a meta-analysis by Mairesse and Mohnen (2007), and the *Ireland Innovation Panel*.

3.1 Romijn and Albaladejo's Innovation Indices

Romijn and Albaladejo (2000) operationalise their concept of innovation capability (see section 2.6) using two *Innovation Indices*. The first measure, called Innovation Index 1 (II1), is based on a straightforward recording of the presence or absence of 'major' innovations during the three years preceding the survey. 'Major' in this context is defined as an activity to which the firms' owners/managers attached considerable importance for the firm as a whole. The variable is a simple unweighted average of the absence (0) of presence (1) of major product innovations, process innovations, and organisational innovations (ranging from an overall possible maximum score of 3 to a minimum of 0). Firms would get a score of 1 for each sub-category if they had accomplished at least one major innovation during the reference period. II1 is quite similar to innovation proxies used in other SME surveys, except that an average of three different types of innovation was used, rather than three separate indices (Romijn and Albaladejo, 2000).

The second measure, Innovation Index 2 (II2) is more complex. In addition to capturing the incidence of major innovations, it embodies an assessment of their originality and technological complexity. Also, it includes a rating for the importance of 'incremental' innovations. It is based on extensive qualitative information about the extent and significance of each firm's innovative outputs generated during the three years prior to the survey. This information was used to assign scores to the firm's innovations based on the degree of innovativeness embodied in them. The main advantage of II2 is that it

is a great deal more detailed than II1, so it is much more precise. But this inevitably comes at a cost of higher subjectivity (Romijn and Albaladejo, 2000). According to Romijn and Albaladejo (2000), the best assessment is done with a combination of different indicators in order to offset the risk of possible bias arising from their individual weaknesses.

3.2 Hansen and Birkinshaw's Capability Measure

Appendix B shows the 13 questions that make up Hansen and Birkinshaw's (2007) questionnaire to measure innovation-capability. This is based on the *Innovation Value Chain*, as discussed previously in section 2.1. Hansen and Birkinshaw recommend that approximately 30 employees fill out the questionnaire in each firm. These employees should represent a cross-section of functions within the firm. To recommend to firms how innovative capabilities can be improved, Hansen and Birkinshaw indicate that an average score should be calculated for each activity, and attention focused on how the highest one or two numbers. These will be the weakest links in the firm's innovation value chain.

3.3 The Solvay Business School Survey

This survey was developed in 2000 by researchers at the Solvay Business School, Belgium, to examine "*the main competences that come into play in the firms' innovation process*" (Peeters et al 2003). The main difference with this survey was a stronger focus on firm *competencies* that relate to the innovation *process*, and the avoidance of discrete 'yes—no' survey answers in favour of a Likert scale ranging from 0 to 5.

The four core competencies measured were:

1. The ability to develop a culture of innovation
2. The ability to develop a culture of innovation
3. The capacity to implement ideas

4. The efficient management of intellectual property

Peeters (2003) examined these innovation competencies and performances in Belgium firms and concluded that "*firms recognise the strategic importance of innovation but fail to undertake the 'practical' steps to develop it*".

3.4 The Community Innovation Survey

In the late 1980s, co-ordinated by the Organisation for Economic Co-operation and Development (OECD), scholars and statisticians interested in the measurement of innovation collaborated to produce the *Oslo Manual* (OECD, 1992), which has since undergone two revisions (OECD, 1996 and 2005). A new type of survey, the innovation survey, was worked out. In all EU countries a common core questionnaire was agreed upon which is known as the *Community Innovation Survey.* [3]

According to Mairesse and Mohnen (2007) the new Oslo manual grew out of a concern to capture the following items:

- **A wider range of innovation activities** than R&D expenditures, such as the acquisition of patents and licenses, product design, personnel training, trial production, and market analysis;
- **A wider range of innovation output indicators** other than patents and bibliometrics, such as the introduction of new products and processes, organisational changes and marketing innovations, the percentage of sales due to new products, the percentage of sales due to products new to the industry, and the share of products at various stages of the product life-cycle; and
- **Information about the way that innovation proceeds**, such as the sources of knowledge used the reasons for innovating, and the perceived obstacles to innovation.

[3] Canada, Australia, New Zealand and South Africa perform surveys comparable to the CIS.

The *Community Innovation Survey* (CIS) has been conducted a total of six times; 1992, 1996, 2001, 2002-4, 2004-6 and 2006-8. Since the first CIS, innovation surveys based on the *Oslo Manual* have become institutionalised, particularly in Europe where the CIS is now implemented every two years in all EU-25 member states. The CIS defines a firm as being innovative if it introduces at least one product or process that is new to the firm itself (Arundel, 2008).

The Irish *Community Innovation Survey* for 2006-08 was jointly conducted by the Irish Central Statistics Office (CSO) and Forfás. According to the CSO, the survey collected information about product and process innovation as well as organisational innovations and other key variables: "Most questions covered new or significantly improved goods or services or the implementation of new or significantly improved processes, logistics or distribution methods." Appendix B shows the questions that make up the Irish (and indeed, international) *Community Innovation Survey*.

3.5 Mariesse & Mohnen's Meta-Analysis

A recent international meta-analysis of *Community Innovation Surveys* was conducted by Mariesse and Mohnen (2010). They provide an overview of the typical list of questions based on *Oslo Manual* guidelines. Many of these questions have been modified or introduced, or have disappeared in the various waves of the Community Innovation Survey (CIS). "Old" questions considered as less relevant or informative make space for new questions. For example, questions on the relative importance and effectiveness of different appropriation mechanisms, initially borrowed from a Yale Survey, were progressively abandoned after CIS2; whereas questions regarding environmental innovations have recently made an appearance. Many questions in the CIS are also not fully harmonised across EU countries. While the core CIS questionnaire is nearly the same in all countries, almost every country has its own peculiarities, be it additional questions, differences in the sequence of questions or somewhat different formulations of the same questions (Mariesse and Mohnen, 2010).

3.6 The NESTA Innovation Index

In the UK Government White Paper *Innovation Nation* (DIUS, 2008), NESTA was charged with developing a new Innovation Index to measure the UK's performance as an *Innovation Nation* (Adams, et al, 2008). This NESTA Innovation Index records information from firms about their behaviour separately for all stage of the innovation process. While the *Community Innovation Survey* (CIS), for example, looks at some aspects of the process such as the use of external knowledge sources to gain ideas for innovation, the *NESTA Index* allows more detailed metrics, broken down by sector, across the whole process (Roper et al., 2009).

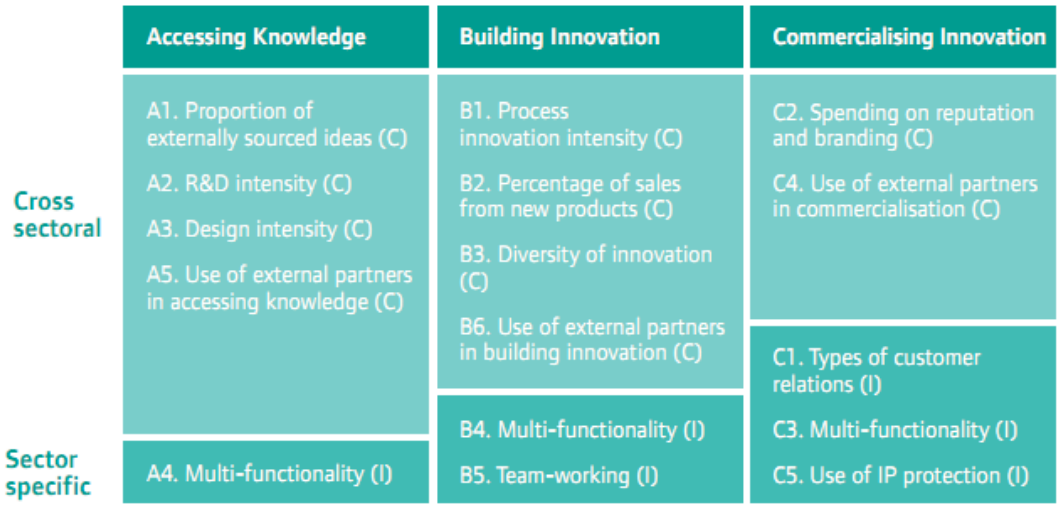
In the NESTA Innovation Index, firms were asked about their use of external knowledge in three different phases of innovation – when they are hunting for new ideas, developing them in the business and commercialising their outputs. This makes it possible to analyse how types and stages of innovation relate to value creation – where the CIS measures innovation activities, this approach measures innovation capabilities (Roper et al., 2009).

In addition, the structure of the CIS does not include any questions tailored towards sector-specific metrics of innovation or any differentiation as to which types of metrics might be more appropriate for which sectors. It therefore understates some elements of innovation which may be important to particular sectors. The NESTA Index asks a number of new, more sector-specific questions, which provide for a better account of innovation in different sectors. It also delves into a wider range of innovations (Roper et al., 2009).

Overall, the NESTA Index makes it possible to capture the specific forms of innovation which are most relevant for different sectors, and to compare innovation between sectors. It provides a starting-point for sectors and firms to consider the respects in which they might learn from other sectors in order to improve their innovation performance (Roper et al., 2009). The Nesta Innovation Index follows the structure of an innovation value chain which has three phases: assessing knowledge, building innovation, and commercialising innovation. This is illustrated in the figure on the following page. An important distinction is the

difference between cross-sectoral and sector-specific activities. The survey questions in the NESTA Innovation Index are shown in Appendix E.

Fig. 4: Roper et al (2009): *NESTA's Innovation Value Chain*



3.7 The Ireland Innovation Panel

The *Irish Innovation Panel* (IIP) comprises five linked surveys each covering firms' innovation activities over a three-year period. These have been designed to provide sector-by-sector results and to reflect the innovation activities of smaller firms in Ireland and Northern Ireland. The IIP is the source of data used by Roper et al. (2008) in their *Model of the Innovation Value Chain*. The IIP is managed by InnovationLab (Ireland) Ltd, a specialist research consultancy focusing on issues relating to R&D, innovation and economic development. InnovationLab (Ireland) Ltd. was established in 2003 as an academic spin-out from the Northern Ireland Economic Research Centre.

4. Innovation and Performance

In business, to stand still is to go backwards.

This section reviews performance indicators related to survey measurement of firm-level innovation. Particular attention is given to the *Irish Community Innovation Survey* and the *European Innovation Scoreboard*. This serves to establish an Irish-macro picture to contextualise survey design. Findings from the Solvay Business School Survey and the NESTA Innovation Index are also reviewed. This serves to establish a context for understanding firm-level competencies.

4.1 The Irish Community Innovation Survey

The Irish *Community Innovation Survey* (CIS) only sampled enterprises with ten or more persons engaged in the selected NACE categories as included in the table below. A total of 4,650 survey forms were issued to the sampled enterprises from the Irish Central Statistics Office's Business Register. Responses were returned for 2,181 enterprises (a response rate of 47%). The following section provides a snap-shot of the innovation activities of Irish firms.

<u>Key Facts: Innovation in Irish Business</u>

- **Spending:** Irish enterprises spend an estimated €5.3bn per annum on innovation-related activities.
- **Industrial Firms:** The vast majority (86%) of large industrial enterprises were engaged in innovation, while just over two-thirds (69%) of medium-sized industrial enterprises are engaged, and just less than a half (45%) of small industrial enterprises were engaged. Overall, more than half (52.3%) of all industrial enterprises in Ireland engage in some type of innovation activity.
- **Service Firms:** Overall Irish service enterprises are less likely to innovate than their industrial counterparts. However, as like the industrial enterprises the larger service enterprises also display a higher propensity to innovate

than smaller-sized firms – 64%, 53% and 38% respectively. Overall, less than half (40.6%) of Ireland's service enterprises are engaged in innovated.

- **Product Innovation:** More than a quarter (28%) of Irish enterprises engage in product innovation, with this activity accounting for an estimated 11% of total turnover in Ireland's industrial and services sectors; 61% of large enterprises, 42% of medium enterprises, and only 23% of small enterprises. A third (33%) of industrial businesses engages in product innovation while only a quarter (25%) of service enterprises engages in product innovation.
- **Process Innovation:** About a third (35%) of Irish enterprises engage in process innovation; 64% of large enterprises, 46% of medium enterprises and 31% of small enterprises. Fewer than half (43%) of enterprises in the industrial sector were process innovators compared to only 30% of service enterprises.
- **Organisational Innovation:** About a third (32%) of Irish businesses engage in organisational innovation.
- **Innovation Collaboration:** Roughly 1 in 8 (12%) of Irish businesses engage in innovation collaboration. But almost a quarter (24%) of Irish companies which are actively engaged with some kind of innovation report involvement in innovation collaboration.

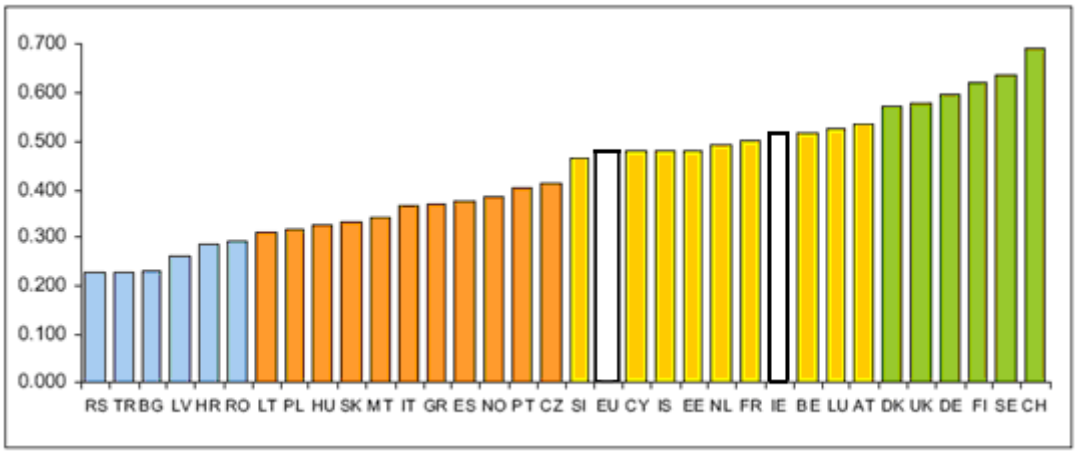
4.2 The European Innovation Score Board

Data from the *Community Innovation Surveys* are used for the annual European Innovation Scoreboard and for academic research on innovation, with over 200 papers using the CIS data published. The European Innovation Scoreboard (EIS) is an instrument of the European Commission, developed under the Lisbon Strategy to provide a comparative assessment of the innovation performance of EU Member States.

The latest EIS report, for 2009, was published in March 2010. According to the report, Ireland is in the group of Innovation followers, with an innovation performance above the EU27 average. This position is illustrated in the figure on below: Ireland is half-way through the *yellow* section. Ireland's relative

strengths, compared to the country's average performance, are in Human Resources (the availability of high-skilled and educated people) and Economic Effects (the economic success of innovation in employment, exports and sales due to innovation activities.). Ireland's relative weaknesses are in Firm Investments (a range of different investments firms make in order to generate innovations) and Throughputs (the Intellectual Property Rights generated in the innovation process).

Fig. 5: Summary Innovation Index (EIS 2009)



4.3 The Solvay Survey Results

Peeters (2003) examines innovation competencies and performances in Belgium firms and concludes that "*firms recognise the strategic importance of innovation but fail to undertake the 'practical' steps to develop it*". The main findings of the Solvay Business School Innovation Survey are as follows.

Culture

The majority of firms rated their 'strategic' competences as more important than their 'concrete' competences for cultivating an environment of innovation. Competencies and practices like the explicit corporate values that encourage innovation and learning, the openness to innovative management solutions, and the explicit introduction of innovation in the firms' business

strategy, were cited more often than the more action-oriented and resource-laden competencies of rewarding people for innovation or knowledge improvements, development of specific training programmes for high-skilled professionals, the use of a knowledge management process.

According to Peeters (2003), this suggests that while firms are aware of the importance of developing a culture of innovation, they do not necessarily allocate the resources to sustain this objective. Additionally, most firms give greater importance to product innovation, over process innovation, and they generally target more effort to incremental and short-term innovation than radical, longer term renewal, innovation.

The work also finds that small firms cultivate internal entrepreneurship the most, while large firms are less likely to reward their employees for innovation and improved knowledge. Small firms are least concerned with training and their organisational structure. In contrast, service firms were found to pay most attention to training, and the management of their information systems.

Ideas Generation

Team work and brainstorming are by far the most widely used *internal* practices for generating ideas, while very few firms report the recruitment of executives from outside their main business sector as part of their idea generation practices, and even fewer firms reported using patent literature and competitive intelligence processes. Large firms were found to pay more attention to almost all measure of internal competencies, and service firms show a higher likelihood of accessing new skills through their recruitment process.

For *external* idea generation, the customers come out on top with 77% of firms ranking this as very important. Only 7% of firms relied on information from external consultants in their ideas generation process. Competitors' information and suppliers' information rank next, with as few as 12% of firms rating Universities as an important part of idea generation in their business. Overall, large and medium firms are more likely to engage externally in their ideas generation than smaller ones.

The majority of firms also report some engaged in *collaborative research* agreements; with the majority of these collaborations with vertical partners (suppliers, customers) and other firms within their group. Consultants and Universities rank poorly and collaborative research with competitors was very rare. Large firms are the most likely to participate in a joint R&D project and service firms least likely.

Ideas Implementation

Across all types of firms, projects and multidisciplinary teams were more popular than hierarchical functions. High-technology firms, in particular, were most likely to have a project organisation than other firms.

The selection and storage of ideas is poor across most firms, with organisations lacking structures and standardised practices in this area. Large firms do however have a more systematic approach.

To implement new ideas firms will buy external assistance and subcontract research projects. Petters reports that large firms are much more likely to source the required technology externally, with smaller firms relying on internal knowledge and technology to get ideas of the ground. Service firms are the least likely to use external sub-contractors.

The marketing competencies of firms were well mastered. Large firms score best across the board. They place most emphasis on the systematic monitoring of customer satisfaction, which smaller firms seem less engaged in. Small firms are also less likely to use specific marketing activities for their innovations.

In terms of information exchanges (i.e., feed-back loops) between marketing and technology departments, small firms do very well, and medium firms do poorly.

When it comes to funding, most firms rely on internal sources. Public sources are sometimes used by small and large firms, but not medium. In addition, most firms rarely use private capital (e.g., banks) to fund their innovation projects, and less than 10% collaborate with venture capital funds.

Intellectual Property Rights Management

Fewer than 50% of firms had an active IPR strategy and only few firms use formal patent protection system. The patent system was generally regarded as of lesser importance to them compared to market lead. Most firms felt unable to prevent competitors from copying their technology, even if protected by patent. The cost of litigation and fees were perceived as a barrier to formal patent procedures, with most firms reporting the greater use of secrecy.

Measuring Commitment to Innovation

The average share of turnover allocated to basic and applied research was 3.3 %; and 4.3% to development. Small and Large firms were found to have the highest percentages, as opposed to medium firms.

The share of sales due radical innovation (i.e., new products and procedures) was smaller across all firms' sizes and sectors than the share of sales due to incremental innovation (i.e., improved products and procedures). For the services sector the distinction was less pronounced – with new products and procedures being only slightly less important than improved products and procedures, as a percentage of turnover. Overall roughly 30% of firms' turnover was due to innovation.

Barriers to Innovation

Costs- and risk-related issues were by far the greatest barrier to innovation for all firms. The presence of rigidities in the firm and the lack of qualified personnel were also large barriers. Issues like lack of leadership and poor communication and external regulation were not considered thwarting.

4.4 Sectoral Performance in the NESTA Index

Here we review the proposed metrics that were identified by Adams and colleagues (2008) as being of high importance to innovation performance within particular sectors of economic activity. The metrics were proposed after carrying out a comprehensive review of the literature on measuring innovation in various sectors. Adams and colleagues (2008) also gathered information from firms

about their opinions on the indicators of innovation that were most relevant to their operations.

Overall there is a general commonality of measures across sectors. In particular innovation-related financial performance (percentage of overall sales from new product) and innovativeness (number of new products/services introduced in the last 3 years relative to the market leader) consistently come to the fore.

The focus in this section is to identify the important divergences which could later inform a weighting schema for firms responding from different sectors of activity. Ultimately we are interested in creating a parsimonious set of questions that can best capture a broad spectrum of innovation performance but here we focus on additional questions for business sectors that may have unique aspects.

Below we list the aspects that came to the fore, i.e., were regarded as of moderate to high importance, in each of 11 business sectors. They are listed in order of importance - the aspects marked with a star are of most importance when measuring innovation within that sector.

Business Services Sector:

Timeliness * – proportion of innovations that were first to market/early followers in the past 3 years.

Commercialisation * – number of other organisations licensing products/services developed by us

Business performance – number and value of new customers reached by the innovation and new market niches entered.

Financial performance – Profitability, sales, savings, % of income earned from innovation

Innovativeness – new products/services introduced in the late 3 years relative to the market leader.

Construction:

Process improvement * – what new skills have been acquired by (and retained within) the firm as a result of the innovation?

Future business value – to what extent has the innovation enhanced the sales of firm's other products or lead to future opportunities

Financial performance – sales profitability improvement due to innovation and/or costs saved.

Technological application – what proportion of the service you offer comprises new products, materials, technologies, etc.

Innovation collaborations – number of innovation outputs made feasible with the collaborative relationship

Creative Industries:

Examples: the arts, advertising, fashion, film, photography, graphic design.

Reputational enhancement – customer and peer perceptions of us as an innovative organisation

Content creation – number of copyrights, trademarks etc in last 3 years

Financial performance – percentage revenue from offerings that didi not exist 3 years ago

Business model innovation (i) – number and scale of significant business model changes in the last 3 years

Business model innovation (ii) – number and diversity of productive collaborations in last 3 years

Financial Services:

Timeliness* – proportion of innovations that were first to market/early followers in the past 3 years?

Reputational enhancement* – customer and peer perceptions of us as an innovative organisation

Process improvement * – what new skills have been acquired by (and retained within) the firm as a result of the innovation?

Financial performance – sales profitability improvement due to innovation and/or costs saved.

Innovativeness – number of new products launches and pipeline content

Business performance – number and value of new customers reached by the
innovation and new market niches entered.

Hi-Tech Manufacturing:

Strategic importance of innovation * – the extent to which strategic objectives have been met by the innovation

Product advantage – the extent to which the product/service is superior to competing products in terms of meeting customers' needs?

Innovativeness – new products/services introduced in the late 3 years relative to the market leader.

Financial performance – sales profitability improvement due to innovation and/or costs saved.

Business performance – number and value of new customers reached by the innovation and new market niches entered.

Information and Communication Technology:

Innovativeness * – new products/services (degree off newness**)** introduced in the late 3 years relative to the market leader.

Knowledge conversion *– number of new business start-ups/commercial opportunities/collaborations etc arising from technology and knowledge department

Business performance * – number and value of new customers reached by the innovation and new market niches entered.

Financial performance – sales profitability improvement due to innovation and/or costs saved.

Knowledge utilisation – Proportion of new knowledge assets incorporated into new products

Pharmaceuticals:

Innovativeness * – degree of change represented by the innovation (making prevailing technologies obsolete)

Financial performance * -- sales profitability improvement due to innovation and/or costs saved.

Market performance – relative market share growth from the innovation (relative to important competitors)

Product advantage – the extent to which the product/service is superior to competing products in terms of meeting customers' needs?

Public Sector:

Public impacts * – customer/user perceptions of us as an innovative organisation

Technology application – number of non-person (online/phone) interactions between service provider and citizen as proportion of all contacts

Reinforcement of innovation orientation – employees are more incentivised and managers more tolerant of risk/failure as a result of the innovation

Innovativeness – degree of change represented by the innovation

Outreach – new and hard to reach customer/user/stakeholder groups reached by innovation.

Retail and Wholesale:

Innovativeness * **–** new products/services introduced in the late 3 years relative to the market leader.

Strategic importance of innovation * **--** the extent to which strategic objectives have been met by the innovation

Technological application – what proportion of the service you offer comprises new products, materials, technologies, etc.

Reinforcement of innovation orientation – employees are more incentivised and managers more tolerant of risk/failure as a result of the innovation

Telecommunication:

Financial performance * – sales profitability improvement due to innovation and/or costs saved.

Reputational enhancement * – customer and peer perceptions of us as an innovative organisation

Technological application – what proportion of the service you offer comprises new products, materials, technologies, etc.

Innovativeness – new products/services introduced in the late 3 years relative to the market leader.

Business model innovation (i) – number and scale of significant business model changes in the last 3 years

5. Questionnaire Design

This section outlines how our questionnaire represents an improvement on the current set of available tools. According to Arundel (2008), the Community Innovation Survey (CIS) defines a firm as being innovative if it introduces at least one product or process that is new to the firm itself. This means that a firm can be innovative even if it purchases new technology off-the-shelf with minimal effort on its own part, while other respondent firms might have extensive in-house R&D projects to develop innovations. The consequence of this is that the widely available indicator for the percent of firms that innovate is of minimal value to policy because it provides no information about innovative capabilities (Arundel, 2008).

According to Arundel (2008), the solution to this problem is to develop a set of indicators that describe *how* firms innovate. Roper et al. (2009) describe how the metrics in NESTA's Innovation Index go beyond many of those found in the CIS. This is because the metrics in the *Index* are designed to indicate the capabilities of firms for developing innovation of various types, and therefore require detailed information on each element of the Innovation Value Chain.

Where the activity measures in NESTA'S Innovation Index align with those collected by the CIS, the *Index* goes further, asking more detailed and in many cases sector specific questions (Roper et al., 2009). Hansen and Birkinshaw's Capability Measure is based on the concept of the Innovation Value Chain and is very similar to NESTA's Innovation Index. Finally, it should be highlighted that NESTA's Innovation Index and Hansen and Birkinshaw's Capability Measure capture many aspects of the Community Innovation Survey.

Given the requirement of this project to measure firm-level *innovation capabilities*, questionnaire design is more influenced by Hansen and Birkinshaw's *Capability Measure* than by the Community Innovation Survey (CIS). However, some attention is given to the CIS given its standing in the innovation-measurement literature. The survey design also draws on the NESTA Innovation Index and the Solvay Business School Survey.

A particular requirement of this project is to provide feedback to firms about how improvements can be made in *innovation capability*. The only existing

schema for providing feedback about innovation capabilities (that the authors are aware of) is Hansen and Birkinshaw's *Capability Measure*. Given this, we recommend that Hansen and Birkinshaw's schema for compiling feedback should form the basis for providing feedback to survey respondents.[4] Survey content drawing on other sources will be directed to into this schema for respondent-feedback. Feedback will be provided in an overall index (ranging from 20-120 points), and in four sub-indices (standardised to a 1-5 scale), as follows:

(i) ideas generation
(ii) ideas conversion
(iii) innovation diffusion
(iv) innovation performance

In conclusion, the questionnaire provides a new online tool developed to assist Irish companies, of all sizes, to grow and develop their businesses through innovation. The questionnaire synthesises much of the international work in innovation auditing (including work from NESTA, Solvay, Roper, Hansen & Birkinshaw and CIS) to create a unifying and robust, new framework through which Irish companies can evaluate their innovation-capability. It will provide companies with an objective measure of their current innovation capability and will also provide best-practice pointers indicating areas for potential improvement. All of the survey-questions are shown on the following pages, under the heading of *Irish Innovation Index*.

[4] Hansen and Birkinshaw use a three-point response Likert scale; this is extended to five points.

Irish Innovation Index

How would you describe the size of your organisation?

How would you describe the output of your business?

* Mostly products
* Products and services
* Mostly services

How would you describe the status of your business?

* Independent
* Subsidiary

In which country is your company's HQ?

In what sector does your business operate?

Where do you currently export to?

UK	Asia
EU	Rest of World
USA	

Over the last three years, did your business introduce any new or significantly improved products or services?

* Yes
* No

Over the last three years, did your business introduce any new, or significantly different, processes to your operations?

i.e., the implementation of a new or significantly improved production processes, distribution or delivery methods, or support activities for your goods and services

* Yes
* No

What percentage of your company's sales is allocated to R&D or Innovation?

0 5 10 15 20 25 30 35 40 45 50

For each of the following questions, please state the extent to which you agree or disagree:

Our culture makes it hard for people to put forward novel ideas.

* Strongly disagree
* Disagree
* Neither agree nor disagree
* Agree
* Strongly Agree

People in our unit come up with lots of good ideas on their own.

* Strongly disagree
* Disagree
* Neither agree nor disagree
* Agree
* Strongly Agree

Few of our projects involve team members from different units or subsidiaries.

* Strongly disagree
* Disagree
* Neither agree nor disagree
* Agree
* Strongly Agree

Typically, our people collaborate on projects internally, across units, businesses, or subsidiaries.

* Strongly disagree
* Disagree
* Neither agree nor disagree
* Agree
* Strongly Agree

Our people often exhibit a “not invented here” attitude—ideas from outside are not considered as valuable as those invented within.

* Strongly disagree
* Disagree
* Neither agree nor disagree
* Agree
* Strongly Agree

Lots of good ideas for new products and businesses come from outside the company.

* Strongly disagree
* Disagree
* Neither agree nor disagree
* Agree
* Strongly Agree

From the following list of possible external collaboration partners, please select the ones with whom you collaborate for your innovation projects (you may select more than one partner type):

Suppliers	Universities
Customers	Competitors
Research Institutes	Industry Experts
Government Agencies	Other
Consultants	None

What percentage of your company's turnover is accounted for by products/services launched within the last three years?

0 10 20 30 40 50 60 70 80 90 100

How would you describe the focus of your business?
Domestic Market Only Domestic and Exports Export Orientated

Were your new product or service innovations the first of their kind to the market?

* Yes
* No

Were your new product or service innovations new to your firm, only?

i.e did they already existed on the market?

* Yes
* No

For each of the following questions, please state the extent to which you agree or disagree:

We're slow to roll out new products.

* Strongly disagree
* Disagree
* Neither agree nor disagree
* Agree
* Strongly Agree

Competitors are slow to copy our product introductions.

* Strongly disagree
* Disagree
* Neither agree nor disagree
* Agree
* Strongly Agree

We don't penetrate all possible channels, customer groups, and regions with new products and services.

* Strongly disagree
* Disagree
* Neither agree nor disagree
* Agree
* Strongly Agree

We have tough rules for investment in new projects—it's often too hard to get ideas funded.

* Strongly disagree
* Disagree
* Neither agree nor disagree
* Agree
* Strongly Agree

We have a risk-taking attitude toward investing in novel ideas.

* Strongly disagree
* Disagree
* Neither agree nor disagree
* Agree
* Strongly Agree

New-product-development projects often don't finish on time.

* Strongly disagree
* Disagree
* Neither agree nor disagree
* Agree
* Strongly Agree

Managers receive lots of support developing new ideas.

* Strongly disagree
* Disagree
* Neither agree nor disagree

* Agree
* Strongly Agree

Does your company have a specific, formal innovation or new product development strategy?

* Yes
* No

Block of PDMA Performance Questions
Does your innovation strategy have specific metrics and objectives for success?

* Yes
* No

Does your organisation have a formal innovation process: a structure and process for making innovation happen?

* Yes
* No

Do you have a dedicated full-time leader for innovation projects?

* Yes
* No

Do you have a dedicated innovation or R&D budget?

* Yes
* No

Do you use cross functional teams to manage innovation projects?

* Yes
* No

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Glossary[5]

Product Innovation: The introduction of a new good or service or a significantly improved good or service with respect to its capabilities. The product innovation could either be new to the market or new to the firm.

Process Innovation: The introduction of a new or significantly improved production process, distribution method, or support activity for goods and services. The process innovation could either be new to the market or new to the firm.

New to Market Innovation: An innovation activity, which saw the introduction of a new good or service by the firm onto its operating market before other competitors.

New to Firm Innovation: An innovation activity which saw the introduction of a significantly improved good or service to the firm, that was already available from competitors in the operating sector.

Innovation Expenditure: Spending on activities to support and implement production or process innovations.

Organisational Innovation: The implementation of new or significant changes in firm structure or management methods that are intended to improve firms' use of knowledge, the quality of firms' goods and services or the efficiency of work flows.

Marketing Innovation: The implementation of a new marketing concept or strategy that differs significantly from the firm's existing marketing methods and which has not been used before.

[5] Based on definitions from the Irish Central Statistics Office

Environmental Innovation: An environmental innovation is a new or significantly improved product (good or service), process, organisational method or marketing method that creates environmental benefits compared to alternatives.

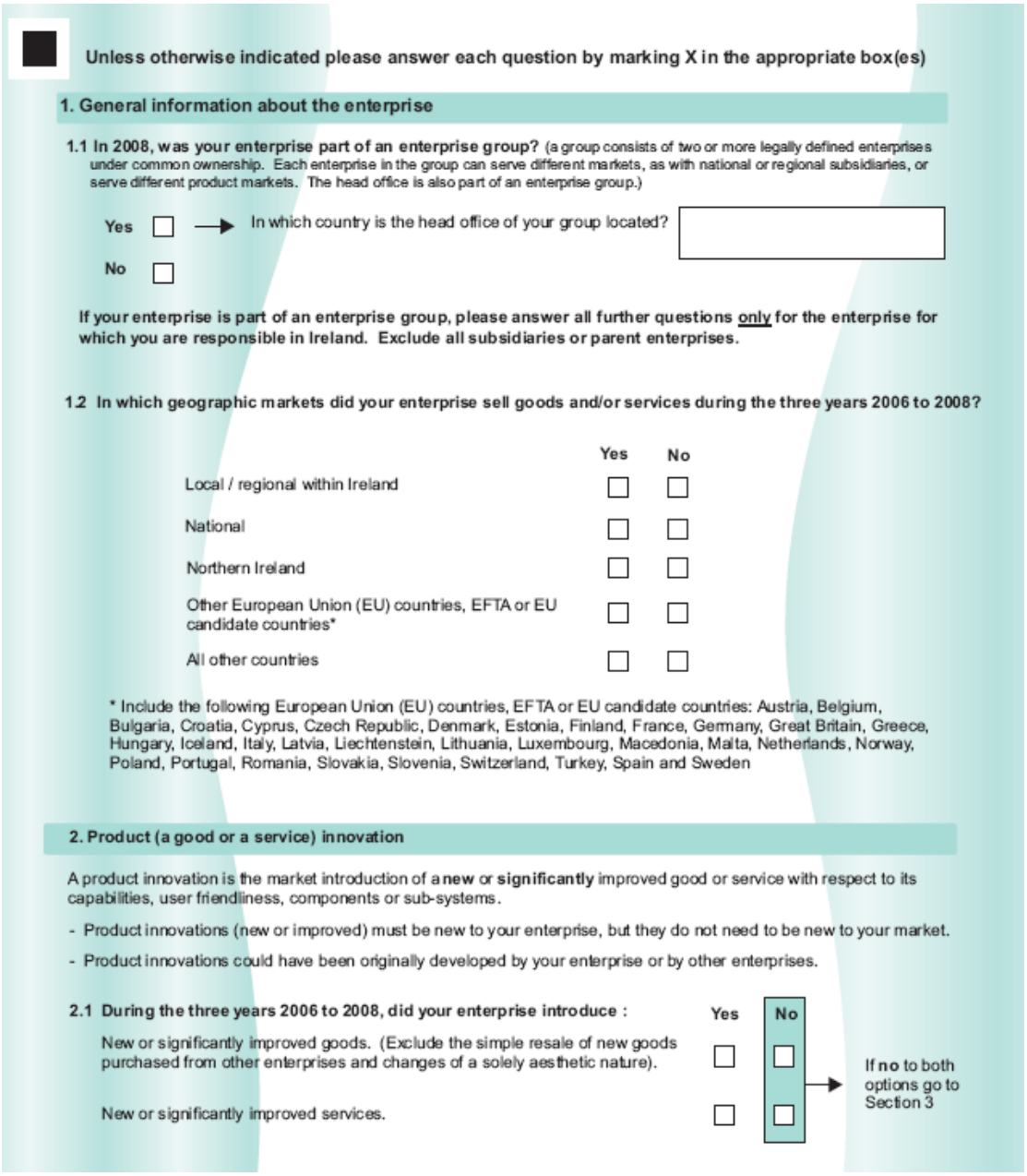
Appendix A: Hansen and Birkinshaw's Capability Measure

Rate Your Company's Innovation Value Chain

If you want to improve your company's innovation performance, here is a good place to start. Have about 30 employees from a cross-section of functions within the company fill out this questionnaire. Calculate the average score for each activity, and focus your attention on the highest one or two numbers—these are your weakest links.

	Do not agree	Partially agree	Agree	Activity	Phase
Our culture makes it hard for people to put forward novel ideas.	1	2	3	In-house idea generation	High scores indicate that your company may be an **idea-poor company.**
People in our unit come up with very few good ideas on their own.	1	2	3		
Few of our innovation projects involve team members from different units or subsidiaries.	1	2	3	Cross-pollination among businesses	
Our people typically don't collaborate on projects across units, businesses, or subsidiaries.	1	2	3		
Few good ideas for new products and businesses come from outside the company.	1	2	3	External sourcing of ideas	
Our people often exhibit a "not invented here" attitude—ideas from outside aren't considered as valuable as those invented within.	1	2	3		
We have tough rules for investment in new projects—it's often too hard to get ideas funded.	1	2	3	Selection	High scores indicate that your company may be a **conversion-poor company.**
We have a risk-averse attitude toward investing in novel ideas.	1	2	3		
New-product-development projects often don't finish on time.	1	2	3	Development	
Managers have a hard time getting traction developing new businesses.	1	2	3		
We're slow to roll out new products and businesses.	1	2	3	Diffusion	High scores indicate that your company may be a **diffusion-poor company.**
Competitors quickly copy our product introductions and often make pre-emptive launches in other countries.	1	2	3		
We don't penetrate all possible channels, customer groups, and regions with new products and services.	1	2	3		

Appendix B: The Irish Community Innovation Survey 2006-08



Unless otherwise indicated please answer each question by marking X in the appropriate box(es)

1. General information about the enterprise

1.1 In 2008, was your enterprise part of an enterprise group? (a group consists of two or more legally defined enterprises under common ownership. Each enterprise in the group can serve different markets, as with national or regional subsidiaries, or serve different product markets. The head office is also part of an enterprise group.)

Yes ☐ → In which country is the head office of your group located? [ ]

No ☐

If your enterprise is part of an enterprise group, please answer all further questions only for the enterprise for which you are responsible in Ireland. Exclude all subsidiaries or parent enterprises.

1.2 In which geographic markets did your enterprise sell goods and/or services during the three years 2006 to 2008?

	Yes	No
Local / regional within Ireland	☐	☐
National	☐	☐
Northern Ireland	☐	☐
Other European Union (EU) countries, EFTA or EU candidate countries*	☐	☐
All other countries	☐	☐

* Include the following European Union (EU) countries, EFTA or EU candidate countries: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Great Britain, Greece, Hungary, Iceland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Macedonia, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Switzerland, Turkey, Spain and Sweden

2. Product (a good or a service) innovation

A product innovation is the market introduction of a **new** or **significantly** improved good or service with respect to its capabilities, user friendliness, components or sub-systems.

- Product innovations (new or improved) must be new to your enterprise, but they do not need to be new to your market.
- Product innovations could have been originally developed by your enterprise or by other enterprises.

2.1 During the three years 2006 to 2008, did your enterprise introduce :

	Yes	No
New or significantly improved goods. (Exclude the simple resale of new goods purchased from other enterprises and changes of a solely aesthetic nature).	☐	☐
New or significantly improved services.	☐	☐

If **no** to both options go to Section 3

29700

2.2 Were any of your product innovations during the three years 2006 to 2008 :

	Yes	No
New to your market? Your enterprise introduced a new or significantly improved good or service onto your market before your competitors (it may have already been available in other markets)	☐	☐
Only new to your firm? Your enterprise introduced a new or significantly improved good or service that was already available from your competitors in your market	☐	☐

Using the previous definitions, please estimate how your total turnover in 2008 was distributed between the following categories.

New or significantly improved goods and service innovations introduced during 2006 to 2008 that were **new to your market**	☐☐☐ %
New or significantly improved goods and service innovations introduced during 2006 to 2008 that were **new to your enterprise but not new to the market**	☐☐☐ %
Goods and services that were **unchanged or only marginally modified** during 2006 to 2008 (include the resale of new goods or services purchased from other enterprises)	☐☐☐ %
Total turnover in 2008	1 0 0 %

3. Process innovation

A process innovation is the implementation of a **new** or **significantly** improved production process, distribution method, or support activity for your goods or services.

- Process innovations must be new to your enterprise, but they do not need to be new to your market.
- The innovation could have been originally developed by your enterprise or by other enterprises.
- Exclude purely organisational innovations - these are covered in section 9.

3.1 During the three years 2006 to 2008, did your enterprise introduce :

	Yes	No
New or significantly improved methods of manufacturing or producing goods or services	☐	☐
New or significantly improved logistics, delivery or distribution methods for your inputs, goods or services	☐	☐
New or significantly improved supporting activities for your processes, such as maintenance systems or operations for purchasing, accounting or computing	☐	☐

4. Ongoing or abandoned innovation activities for process and product innovations

Innovation activities include the acquisition of machinery, equipment, software and licenses; engineering and development work, industrial design, training, marketing and R&D when they are **specifically** undertaken to develop and/or implement a product or process innovation. Also include basic R&D as an innovation activity even when not related to a product and/or process innovation.

4.1 During 2006 to 2008 did your enterprise have any innovation activities that did not result in a product or process innovation because the activities were:

	Yes	No
Abandoned or suspended before completion	☐	☐
Still ongoing at the end of 2008	☐	☐

If your enterprise had no product or process innovations or innovation activity during 2006 to 2008 (no to all options in questions 2.1, 3.1 and 4.1) then go to section 7. Otherwise, go to section 5.

5. Innovation activities and expenditures for process and product innovations

Example

Please enter all monetary values in € and to the nearest 1,000 .

€10,000 = € 000's: [ ][ ][ ], [ ][1][0], [0][0][0]

5.1 During the three years 2006 to 2008, did your enterprise engage in the following innovation activities and if so what were those expenditures in 2008 only?

	Yes	No	2008 Expenditure € 000's
In-House R&D (Include capital expenditures on buildings and equipment specifically for R&D) Creative work undertaken within your enterprise to increase the stock of knowledge for developing new and improved products and processes (include software development in-house that meets this requirement).	☐	☐	[ ][ ][ ], [ ][ ][ ], [0][0][0]
Purchase of External R&D Same activities as above, but performed by other enterprises (including other enterprises or subsidiaries within your group) or by public or private research organisations and purchased by your enterprise	☐	☐	[ ][ ][ ], [ ][ ][ ], [0][0][0]
Acquisition of machinery, equipment and software (Exclude expenditures on equipment specifically for R&D) Acquisition of advanced machinery, equipment and computer hardware or software to produce new or significantly improved products and processes	☐	☐	[ ][ ][ ], [ ][ ][ ], [0][0][0]
Acquisition of other external knowledge Purchase or licensing of patents and non-patented inventions, know-how and other types of knowledge from other enterprises or organisations for the development of new or significantly improved products and processes	☐	☐	[ ][ ][ ], [ ][ ][ ], [0][0][0]
Total Innovation Expenditure 2008			[ ], [ ][ ][ ], [ ][ ][ ], [0][0][0]

6. Co-operation for innovation activities

6.1 During the three years 2006 to 2008, did your enterprise co-operate on any of your innovation activities with other enterprises or institutions? Innovation co-operation is active participation with other enterprises or non-commercial institutions on innovation activities. Both partners do not need to commercially benefit. Exclude pure contracting out of work with no active co-operation.

Yes ☐ No ☐ → If no go to Section 7

6.2 Please indicate the type of co-operation partner by location (tick all that apply)

Type of co-operation partner	Ireland	Northern Ireland	Other Europe*	United States	China or India	All other countries
A. Other enterprises within your enterprise group	☐	☐	☐	☐	☐	☐
B. Suppliers of equipment, materials, components or software	☐	☐	☐	☐	☐	☐
C. Clients or customers	☐	☐	☐	☐	☐	☐
D. Competitors or other enterprises in your sector	☐	☐	☐	☐	☐	☐
E. Consultants, commercial labs or private R&D institutes	☐	☐	☐	☐	☐	☐
F. Universities or other higher education institutions	☐	☐	☐	☐	☐	☐
G. Government or public research institutes	☐	☐	☐	☐	☐	☐

7. Factors hampering innovation activities

7.1 During the three years 2006 to 2008, how important were the following factors in hampering your innovation activities or projects or influencing a decision not to innovate?

		Degree of Importance			
		High	Medium	Low	Factor not experienced
Cost factors	Lack of funds within your enterprise or group	☐	☐	☐	☐
	Lack of finance from sources outside your enterprise	☐	☐	☐	☐
	Innovation costs too high	☐	☐	☐	☐
Knowledge factors	Lack of qualified personnel	☐	☐	☐	☐
	Lack of information on technology	☐	☐	☐	☐
	Lack of information on markets	☐	☐	☐	☐
	Difficulty in finding cooperation partners for innovation	☐	☐	☐	☐
Market factors	Market dominated by established enterprises	☐	☐	☐	☐
	Uncertain demand for innovative goods or services	☐	☐	☐	☐
	Need to meet Government regulations	☐	☐	☐	☐
	Excessive perceived economic risks	☐	☐	☐	☐
Reasons not to innovate	No need due to prior innovations	☐	☐	☐	☐
	No need because of no demand for innovations	☐	☐	☐	☐

8. Innovation objectives during 2006 to 2008

8.1 How important were each of the following objectives for your activities to develop product (good or service) or process innovations between 2006 and 2008?

If your enterprise had several projects for product and process innovations, make an overall evaluation

	High	Medium	Low	Not relevant
Increase range of goods or services	☐	☐	☐	☐
Replace outdated products or processes	☐	☐	☐	☐
Enter new markets	☐	☐	☐	☐
Increase market share	☐	☐	☐	☐
Improve quality of goods or services	☐	☐	☐	☐
Improve flexibility for producing goods or services	☐	☐	☐	☐
Increase capacity for producing goods or services	☐	☐	☐	☐
Improve health and safety	☐	☐	☐	☐
Reduce labour costs per unit output	☐	☐	☐	☐

9. Organisational innovation

An organisational innovation is a new organisational method in your enterprise's business practices (including knowledge management), workplace organisation or external relations that has not been previously used by your enterprise.

- It must be the result of strategic decisions taken by management
- Exclude mergers or acquisitions, even if for the first time

9.1 During the three years 2006 to 2008, did your enterprise introduce:

	Yes	No
New **business practices** for organising procedures (i.e. supply chain management, business re-engineering, knowledge management, lean production, quality management etc.)	☐	☐
New methods of **organising work responsibilities and decision-making** (i.e. first use of a new system of employee responsibilities, team work, decentralisation, integration or de-integration of departments, education/training systems, etc)	☐	☐
New methods of **organising external relations** with other firms or public institutions (i.e. first use of alliances, partnerships, outsourcing or sub-contracting, etc)	☐	☐

→ If **no** to all options go to Section 10 otherwise go to Question 9.2

9.2 How important were each of the following objectives for your enterprises' organisational innovations introduced between 2006 and 2008 inclusive?

If your enterprise introduced several organisational innovations, make an overall evaluation

	High	Medium	Low	Not relevant
Reduced time to respond to customer or supplier needs	☐	☐	☐	☐
Improved ability to develop new products or processes	☐	☐	☐	☐
Improved quality of your goods or services	☐	☐	☐	☐
Reduced costs per unit output	☐	☐	☐	☐
Improved employee satisfaction and/or lower employee turnover	☐	☐	☐	☐
Improved communication or information sharing within your enterprise	☐	☐	☐	☐
Improved communication/information sharing with other enterprises or institutions	☐	☐	☐	☐

10. Marketing innovation

A marketing innovation is the implementation of a new marketing concept or strategy that differs significantly from your enterprise's existing marketing methods and which has not been used before.

- It requires significant changes in product design or packaging, product placement, product promotion or pricing
- Exclude seasonal, regular and other routine changes in marketing methods

10.1 During the three years 2006 to 2008, did your enterprise introduce:

	Yes	No
Significant changes to the aesthetic **design** or **packaging** of a good or service (exclude changes that alter the product's functional or user characteristics - these are product innovations)	☐	☐
New media or techniques for **product promotion** (i.e. first time use of a new advertising media, a new brand image, introduction of loyalty cards, etc)	☐	☐
New methods for **product placement** or sales channels (i.e. first time use of franchising or distribution licenses, direct selling, exclusive retailing, new concepts for product presentation, etc)	☐	☐
New methods of **pricing** goods or services (i.e. first time use of variable pricing by demand, discount systems, etc)	☐	☐

→ If **no** to all options go to Section 11 otherwise go to Question 10.2

29700

10.2 How important were each of the following objectives for your enterprise's marketing innovations introduced between 2006 and 2008 inclusive?

If your enterprise introduced several marketing innovations, make an overall evaluation

29700

	High	Medium	Low	Not relevant
Increase or maintain market share	☐	☐	☐	☐
Introduce products to new customer groups	☐	☐	☐	☐
Introduce products to new geographic markets	☐	☐	☐	☐

11. Innovations with environmental benefits

An environmental innovation is a new or significantly improved product (good or service), process, organisational method or marketing method that creates environmental benefits compared to alternatives.

- The environmental benefits can be the primary objective of the innovation or the result of other innovation objectives.
- The environmental benefits of an innovation can occur during the production of a good or service, or during the after sales use of a good or service by the end user.

11.1 During the three years 2006 to 2008, did your enterprise introduce a product (good or service) process, organisational or marketing innovation with any of the following environmental benefits?

	Yes	No
Environmental benefits from the production of goods or services within your enterprise		
Reduced material use per unit of output	☐	☐
Reduced energy use per unit of output	☐	☐
Reduced CO_2 'footprint' (total CO_2 production) by your enterprise	☐	☐
Replaced materials with less polluting or hazardous substitutes	☐	☐
Reduced soil, water, noise, or air pollution	☐	☐
Recycled waste, water, or materials	☐	☐
Environmental benefits from the after sales use of a good or service by the end user		
Reduced energy use	☐	☐
Reduced air, water, soil or noise pollution	☐	☐
Improved recycling of product after use	☐	☐

11.2 During 2006 to 2008, did your enterprise introduce an environmental innovation in response to:

	Yes	No
Existing environmental regulations or taxes on pollution	☐	☐
Environmental regulations or taxes that you expected to be introduced in the future	☐	☐
Availability of government grants, subsidies or other financial incentives for environmental innovation	☐	☐
Current or expected market demand from your customers for environmental innovations	☐	☐
Voluntary codes or agreements for environmental good practice within your sector	☐	☐

11.3 Does your enterprise have procedures in place to regularly identify and reduce your enterprise's environmental impacts?
(For example preparing environmental audits, setting environmental performance goals, ISO 14001 certification, etc).

(select the most appropriate option only)

- ☐ Yes: implemented before January 2006
- ☐ Yes: implemented or significantly improved after January 2006
- ☐ No

Your comments and feedback

We welcome your feedback. Please tell us what you think about this form and also let us know what type of published data would be useful to your business.

How long did it take you to complete this form? ☐☐☐ mins

Comments:

Signature .....

Position in enterprise .....

Date ...../...../ **2009**

Phone ( ) .....

e-mail .....

Website www.....

Thank you for taking the time to complete this form.

Appendix C: NESTA Innovation Index: Survey Questions

Name of metric	Description of metric	Purpose of metric
Accessing Knowledge		
A1 – The proportion of externally sourced ideas (%)	Proportion of new products or services typically coming from ideas initially developed outside the firm	Reflects the openness of firm's knowledge gathering activities
A2 – R&D intensity (%)	R&D expenditure as a percentage of sales	A measure of firms' commitment to technological innovation
A3 – Design intensity (%)	Design expenditure as a percentage of sales	A measure of firms' commitment to design as part of their innovation activities
A4 – Multi-functionality in accessing knowledge (%)	Firms score 100 per cent if all of the five or six identified skill groups were involved in accessing knowledge	An intensity index intended to reflect firms' use of multiple skill groups in accessing knowledge
A5 – External knowledge sources for accessing knowledge (%)	Firms reporting all eight potential external partners as either 'very important' or 'fairly important' score 100 per cent	An intensity index intended to reflect firms' engagement with external knowledge sources for innovation
Building Innovation		
B1 - Process innovation intensity (expenditure per sales) (%)	Expenditure on process development as a percentage of sales	A measure of firms' commitment to process innovation
B2 – Percentage of sales of innovative products (%)	Percentage of firms' sales derived from new or improved products or services over the last three years	An output measure of how successfully the firm 'builds' innovative products and services
B3 – Diversity of innovation activity (%)	Takes value 100 if a firm engaged in all six types of innovation activity, 50 if the firm undertook three different forms of innovation etc.	An intensity index designed to reflect the range of innovative activities carried out by the firm
B4 – Multi-functionality in building innovation (%)	As A4 for building innovation	
B5 Embeddedness of team-working in building innovation (%)	Takes value 100 if firms engaged in all five different attributes of firms' team working activity	Intended to reflect the extent of commitment to team-working
B6 – External knowledge sources for building innovation (%)	As A5 for building innovation	
Commercialising Innovation		
C1 – Range of customer relation modes (%)	An intensity index. Firms using all of the modes of customer interaction score 100 per cent etc.	Reflects the range of customer interaction that firms employ
C2 – Branding, marketing intensity (expenditure per sales)	Expenditure on branding, marketing as a percentage of sales	A measure of firms' commitment to commercialisation through their spending on branding and marketing
C3 – Multi-functionality in commercialising innovation (%)	As A4 for commercialisation	
C4 – External knowledge sources for commercialisation (%)	As A5 for commercialisation	
C5 – Use of IP protection (%)	Firms using all six forms of IP protection score100 per cent etc.	Reflects the diversity of firms' use of different forms of legal IP protection