



Prevalence of User Innovation in the EU

**Analysis based on the Innobarometer Surveys of
2007 and 2009.**

INNO-Metrics Thematic Paper

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Contents

Executive Summary	3
1. Introduction	5
2. Past Research	7
Conventional Studies of User Innovation	7
User Product Innovation	9
User Involvement	9
3. Methodology	10
Defining User Innovation	10
Innobarometer Surveys	11
Sector and country classifications	11
4. User Innovation in the EU: Main results	12
Prevalence of User Innovation	12
Differences with other innovative firms: Types of innovation	14
Use of training	15
Sources of ideas and Information	16
Government Support	17
Factors having a positive effect on innovation: User Involvers	18
5. Conclusions	19
References	22
Annex: Additional tables	24

Executive Summary

Users play an important part in innovation processes and outputs. Both firms and consumers have needs that must be understood for a product to stand any chance of success. They also possess expertise that is potentially valuable for product development. Users may even modify existing products or develop new ones in response to their own needs, possibly anticipating future market demand in the process. However, despite a large body of literature exploring these and other aspects of user involvement in innovation, we still know relatively little about the scale and importance of these activities. This study is the first to explore user innovation amongst a large sample of European firms engaged in innovative activities. It provides new insights into the ways in which European firms innovate and how they engage with their user populations.

The report draws on the results of the 2007 and the 2009 Innobarometer surveys to systematically address two inter-related sets of questions:

- *How prevalent is user innovation amongst a large sample of innovating firms in the EU?*
- *How are firms engaged in user innovation different from the whole population of innovating firms?*

One of the major contributions of this study is that it explores three different forms of user innovation: *User Process Innovation*, *User Product Innovation*, and *User Involvers*. Much of the conventional literature on firm-level user innovation has focused on process innovations that arise when firms modify existing technologies or create new technologies for their own use. In this study two other categories of firms are included: those that innovate by improving already existing products and those that involve users in their innovative activities.

The findings show that a substantial minority of innovative firms in the EU are involved in process and product modification (around 30%), and more than half such firms involve users in support of their innovative activities. User innovation is also more or less evenly spread across industrial sectors and across EU countries.

Large firms are more likely to be involved in all forms of user innovation than small firms. For example 39% of all innovative firms with more than 500 employees are *User Process Innovators*, and in the case of *User Involvers* this rises to 61%.

A clear message from the analysis undertaken in this report is that firms engaged in user innovation can be classed as “super-innovators”. Compared to other innovative firms, they are more likely to introduce new products, processes or services. They are also more likely to initiate new organizational methods. Moreover a higher proportion of user innovators carries out both intra and extra mural R&D and applies for patents.

The main internal sources of ideas for user innovators are management and production engineers and technicians. Externally the most important source of

information, advice or support to help customize or modify comes from the original developer or supplier of these products.

These findings raise a series of issues for the future measurement of this form of innovative activity and the policies that may be developed for its support. A number of promising new directions for future research also emerge from the findings.

1. Introduction

It has long been established that users, both firms and individual consumers, play an important part in innovation processes and outputs. Users have needs that must be understood for a product to stand any chance of success (e.g. Rothwell, Freeman, Jervis, Horsley, Robertson, and Townsend, 1974), but they also possess expertise that may be harvested and applied by a supplier within their product development process (Gardiner and Rothwell, 1985). Users may even modify existing products or develop new ones in response to their own needs, possibly anticipating future market demand in the process (von Hippel, 1988). However, despite a large body of literature exploring these and other aspects of user involvement in innovation, we still know relatively little about the scale and importance of these activities. This report throws new light on these issues and provides new insights into the ways in which European firms innovate and also how they engage with their user populations.

The report draws on the results of the 2007 and the 2009 Innobarometer surveys to systematically address two inter-related sets of questions:

1. *How prevalent is user innovation amongst a large sample of innovating firms in the EU?*
2. *How are firms engaged in user innovation different from the whole population of innovating firms?*

The literature on firm-level user innovation has focused on process innovations that arise when firms modify existing technologies or else create new technologies from scratch. This literature has provided valuable insights into this phenomenon including the prevalence of these activities and the valuable spillovers that result (De Jong & Von Hippel, 2008; Henkel & von Hippel, 2004). Our major contribution in this report is that we extend this classical definition of user innovation, based on firms that improve their process technologies, to include two other categories of firms: those that innovate by improving existing products and those that involve users in their innovative activities. More specifically we distinguish between the following three categories:

User Process Innovation: The conventional definition of user innovation refers to an innovation that is developed in response to a local need and is not, in the first instance, intended for sale in a wider market. Such user innovations may be developed by modifying an existing process technology or by creating entirely new processes. In this report our definition is more restrictive, i.e. *User Process Innovation* refers to innovations that are introduced by modifying process technologies first developed by others.

User Product Innovation: This type of innovation refers to a situation where firms create new or improved products for sale to the wider market by customising or modifying products originally produced by other companies. This aspect of user innovation has received little attention in the literature.

User Involvement: User involvement refers to firms that wish to better understand the needs of (actual or potential) users or seek to draw on the expertise of their user populations. In this case user involvers are firms who want to draw on the experience of their user populations or who wish to gain insights into the needs of their potential market. In certain circumstances, for example with highly demanding or innovative customers, it is possible that some forms of user involvement may drive innovation within firms.

These three definitions distinguish between very different types of firm behaviour in the context of innovation. They are based on the work of von Hippel, which views user innovation as an activity whose primary motivation is to produce something that will be used by its originator to fulfil a specific need. According to this view user innovations are driven by a local need and are not, in the first instance, intended for sale to a wider market. Firms that are user-innovators are defined as those ‘that expect to benefit from *using* a product or service’ (von Hippel, 2005: p3). Von Hippel argues that this focus on the functional source of innovation provides a clarity since it focuses on the way in which each actor benefits from an innovation: users benefit by *using* an innovation, manufacturers by *manufacturing* it and suppliers by *supplying* it (von Hippel, 1988: p3). In the context of the firm this form of innovation - user innovation – is most commonly observed in the technologies and systems employed in their production processes. Whilst innovations in products or services intended for wider sale in the market are likely to be associated with some form of research and development or new product development process, innovations in process technologies often take place outside these systems and have been largely ‘hidden’ in official innovation statistics (NESTA, 2007). Our definition of user process innovation is derived from this body of work but focuses on one aspect of the phenomenon, i.e. where innovation arises from the modification of process technology that has been developed by others.

In contrast, the definition user product modification relates to a form of innovation that has largely been overlooked in the literature. This definition describes innovation that is outside the classic linear approach to product innovation and is more akin to the type of product modification behaviours that are commonly associated with forms of user process innovation (many of which are described in von Hippel, 2005). However, it is precisely because this definition challenges both the traditional view of innovation embodied within the linear model and our understanding of users in the innovation process that it has been included here.

The definition of user involvement draws on the early SAPPHO studies (Rothwell, Freeman, et al 1974) and recognises that a detailed understanding of the needs of actual and potential users is a key aspect of innovative activity. The definition also recognises that firms benefit from the learning that takes place once an innovation is in use and that there is value in including certain types of user (e.g. Lead Users) in firm innovation processes (von Hippel, 1988).

The structure of the report is as follows. The next section forms the background to our report as it contain a review of the literature on user innovation with a special emphasis on the main ways in which the concept has been operationalized at an empirical level. Section 3 outlines our methodology and in Section 4 we present our

results. In the final section we present our main conclusions together with suggestions for improvements in the measurement of user innovation.

2. Past Research

The range of roles played by users in innovation is very well established and has been explored from a variety of perspectives. This review will explore the roles of users within the innovation process in terms of their propensity to innovate and potential to improve products by drawing them into the innovation process. The remainder of this section will provide a brief review of the literature concerning each of these roles.

Conventional Studies of User Innovation

The recent recognition of policy relevance of user innovation (e.g. Gault & Huttner, 2008) builds on a large body of research that shows that user innovation activity is significant, widespread and a valuable source of new ideas and constructs in both industrial and consumer goods. The review by von Hippel (von Hippel, 2005) shows that significant proportions of users innovate in fields as diverse as software (Urban and von Hippel, 1988; Morrison et al, 2002; Franke and von Hippel); medical instruments (Lettl et al, 2006); and sporting equipment (Luthje et al, 2005). Studies in this field have also explored a series of features of user innovation including horizontal networks (von Hippel, 2007); how firms make use of Open Source (Dahlander and Magnusson, 2008) and hacker communities (Flowers, 2008), the role of toolkits in user innovation (e.g. von Hippel and Katz, 2002) and the role of users as co-developers (Jeppesen and Molin, 2003). The observation that many users will apparently freely reveal their innovations has also been explored (von Hippel and von Krogh, 2003), as have the voluntary information spillovers that emerge (Harhoff, et al, 2003).

This body of research provides extensive evidence of forms of innovation activity that lie outside the linear model view of innovation and raises many potential issues for policy. Although much of this literature has been based on detailed case studies of user activity, recent firm-level studies have begun to explore the scale and scope of user innovation within larger populations of firms, the most notable being studies in Canada, the Netherlands and the UK.

Statistics Canada was one of the first bodies to systematically examine aspects of user innovation using large-scale surveys of industrial activity. The first such survey providing evidence of firm-level user innovation was the 1998 Statistics Canada survey of Advanced Manufacturing Technologies. Designed to investigate the extent to which Canadian manufacturing firms use advanced technologies in their processes at the unit or 'plant' level, the survey was based on a sample of 4,200 firms with more than 10 employees. The results showed that although the preferred method of acquisition of advanced manufacturing technology was simply purchasing off-the-shelf equipment (with 84% of firms reporting such activity, see Sabourin and Beckstead, (1999)), a significant fraction (26%) of the firms reported that they had created their manufacturing technologies by either customising or significantly

modifying an existing technology. Further, a notable proportion (28%) had developed new process technologies in-house (Arundel and Sonntag, 1999).

These findings were further explored in the 2007 survey of Advanced Manufacturing Technology which included separate follow-up studies for: i) firms who modify existing process technologies; and ii) firms that develop brand new process technologies. These two surveys were designed to examine a range of issues including the way in which technologies were created or modified, how innovations were diffused, and expenditures on such activities. The results (reported in Gault, & von Hippel, 2009) indicated that a significant fraction of firms (35% of modifying firms and 50% of firms that develop brand-new technologies) were engaging in user innovation on an ongoing basis. The surveys also found that formal R&D budgets were not necessarily the main source of funds for such activities. For example the most important source of funds for firms that modify technologies was the maintenance budget (52%). On the other hand for firms that develop new technologies the most important source was the R&D budget (54%). Taken together these two surveys indicate that proportion of Canadian manufacturing firms that adopt technologies by modifying or developing them is broadly the same: around 20% in each case.

While the Statistics Canada surveys focused on all enterprises with more than 10 employees, recent work in the Netherlands (De Jong and von Hippel, 2008) has examined user innovation in SMEs (defined as firms with less than 100 employees)¹. The survey identified firms that either modified, or created from scratch process technologies and, in common with the Statistics Canada survey, collected data on diffusion and expenditures on user innovation.

At a headline level the survey revealed that around 22% of Dutch SMEs were user innovators, (Modifiers: 18%; New Technology Developers: 4%). The Manufacturing sector had the highest proportion of user innovators (Modifiers: 31%; New Technology Developers: 11%), followed by Business Services (Modifiers: 21%; New Technology Developers: 6%), and Farming (Modifiers: 20%; New Technology Developers: 4%). The study also found a strong positive correlation between firm size and the propensity to engage in user innovation (i.e. that larger firms have a higher probability to engage in user innovation than smaller firms), a finding that is in line with the observation on the earlier Statistics Canada study (Arundel and Sonntag, 1999).

A further survey by EIM Business and Policy Research of high-technology SMEs in 2007 also explored the incidence and nature of user innovation. Based on responses from 498 high-technology SMEs (firms with less than 100 employees) drawn from a panel sample² that was composed of firms operating in knowledge-intensive activities including, chemicals, rubber and plastics, machinery and equipment, IT and software, and in commercial R&D services. In this more focused sample it was found that 54% of firms had been engaged in some form of user innovation in the previous three years. User modification was also lower than user creation (Modifiers: 32%; Creators: 41%),

¹ This survey, organised by EIM Business and Policy Research on behalf of the Dutch Ministry of Economic Affairs, was based on 2, 416 responses from firm with between 1-100 employees

² A panel sample is group of respondents who are surveyed periodically concerning a topic over an extended period, for example one year.

probably reflecting the fact that the latter activity requires a higher level of capability than the former.

A more recent survey for the UK, funded by NESTA as part of their Innovation Index project, focused on firms with 10-250 employees, found that 15% of firms were engaged in some form of user innovation. Results show that modification was the dominant form of user innovation activity (10.3%) and that a significant minority of firms (8.6%) were creating their own process technologies from scratch. User innovation activity varied widely between sectors, with Software and IT services, Manufacturing and Architecture and design reporting the highest levels at 50%, 24.7% and 23.2% respectively. Modification activity was very high in Software and IT services at 40.6%, with Manufacturing, Architecture and Design reporting levels at just over 15%. Construction reported the lowest levels of user innovation overall, at just 5.8%.

User Product Innovation

The ability of firms and individuals to innovate by modifying existing products has been widely documented (e.g. von Hippel, 1988; Jeppesen et al, 2003; Flowers, 2008) and is seen as a key component of user innovation behaviour. In certain contexts (e.g. software) some users are able to develop and extend technologies and the distinction between user and producer (or ‘users’ and ‘doers’ as Castells would have it (Castells, 1996)) essentially disappears. The emergence of this behaviour has led to what has been termed a democratising of innovation (von Hippel, 2005), which is particularly apparent in digital environments. The growth of the FLOSS³ movement, where there is open access to the production and design of software, with source code being made freely available and where groups of highly skilled individuals contribute to systems development (Weber, 2004), is a clear example of this phenomenon.

Although customisation and modification has been widely explored in the user innovation literature, less is known about this behaviour in the context of new product development within firms. Manufacturing customisation usually refers to a firm’s own products rather than the modification of those of its suppliers (e.g. Pine et al, 1999). Given that the received wisdom within manufacturing is to ensure a timely supply of standardised components that do not require modification, evidence of modification of a supplier’s products within the production process offers an intriguing counterpoint to this dominant view. Evidence that throws new light on the role of modification of the intermediate products that form part of a supplier’s new product development process would deepen our understanding of firm manufacturing processes.

User Involvement

The issue of user involvement in firm innovation processes tends to be examined as an adjunct to concerns surrounding new product development and market demand. For example, it has long been recognised that users or consumers possess needs that must be understood for a product to stand any chance of being a commercial success (e.g. Rothwell, Freeman et al. 1974). Further, the expertise and experience of certain

³ FLOSS refers to Free/Libre Open Source Software.

kinds of user may be harvested and applied within a supplier's product development activities. For example, demanding customers (Gardiner and Rothwell, 1985) may have a positive benefit on innovation by driving suppliers to further develop products, thereby widening their potential market.

In a similar vein, certain types of user - lead users - (von Hippel, 1986) may modify or develop a firm's existing products in response to their own non-standard needs, potentially pointing the way to future market demand. The involvement of (firm-level) users in firms' product development processes by developing and distributing supplier-designed 'toolkits', enabling users to engage in innovation by developing their own custom products (von Hippel and Katz, 2002; Thomke & von Hippel, 2002) has also been documented. The notion of a lead user has been extended to that of a 'lead market', which refers to a country that adopts an innovation that is subsequently adopted worldwide (Beise, 2001). Although this concept was originally developed in the context of electronic devices such as Facsimile machines and mobile telephony, it has also been applied to other areas, including public sector procurement.

It has been argued (e.g. Georghiou, 2007) that, as major purchasers, there is a strong rationale for governments to build lead markets. However, although there is a widespread agreement that user involvement is a potentially valuable resource, there is a lack of evidence of scale and scope of this activity at the European level. The impact of public procurement in attempting to drive firm-level innovation is also largely unknown.

3. Methodology

This report is based on information gathered in the Innobarometer surveys of 2007 and 2009. The complete results of these surveys can be found at:

- http://www.proinno-europe.eu/admin/uploaded_documents/FI215_Analytical_Report_2007.pdf
- http://www.proinno-europe.eu/admin/uploaded_documents/Innobarometer_2009.pdf.

Defining User Innovation

In particular we use the information from the 2007 survey to identify user process innovators and user product innovators, and we use the 2009 survey to identify firms that involve users in their innovative activities (user involvers). More specifically we divide firms according to the following categories:

1. ***User Process innovators***⁴: firms that have introduced new or significantly improved *processes* by customizing or modifying those developed by other firms, organizations or individuals

⁴ This variable was constructed using Q10b) (2007 dataset): "In the last two years, has your company introduced new or significantly improved **processes** (including production equipment, logistics, delivery or maintenance systems, etc.) using the following method: b) Customizing or modifying

2. ***User Product Innovators***⁵: firms that have introduced new or significantly improved *products* by customizing or modifying products developed by other firms, organizations or individuals.
3. ***User Involvers***⁶: firms that *involve users* in support of their innovative activities.

Innobarometer Surveys

Very briefly, the Innobarometer surveys are based on a random sample of companies employing more than 20 persons identified from Dunn & Bradstreet data for each EU country. The sample is stratified according to size and sector from each country. The surveys are administered by means of telephone interviews of top-level executives responsible for strategic decision making.

The 2007 survey elicited responses from 5238 firms of which 4400 were self declared innovators. The 2009 survey had 5234 respondents of which 4377 were self declared innovators. The rest of this report focuses on innovating firms only⁷.

Sector and country classifications

The results below are based on the sectoral aggregation reported in Table 1.

The country classification used in the report is based on a categorization of countries derived from the 2007 European Innovation Scoreboard based on the overall innovative capability of a country. Table 2 presents this classification.

processes originally developed by other companies, organisations or individuals”. A firm that answered ‘yes’ to question Q10b) is considered a *user process innovator*.

⁵ This variable was constructed using Q8b) (2007 dataset): “In the last two years, has your company introduced new or significantly improved **products** to your customers using each of the following methods of innovating? Products might include goods or services: b) Customizing or modifying products that were originally developed by other companies, organisations or individuals”. A firm that answered ‘yes’ to Q8b) is considered a *user product modifier*.

⁶ This variable was constructed using Q11a), b), and c) (2009 dataset): “Since 2006, has your company used any of the following methods to support its innovative activities?: a) Create or participate in internet-based discussion forums, b) Give away or allow free access to test products or services to potential users, c) Involve potential users in your in-house innovation activities. A firm that answered ‘yes’ to Q11a), and/or b) and/or c) is considered a *user involver*.

⁷ Innovating firms are firms that engaged in any or all of the following innovative activities: introduced new goods, services, processes, logistics processes, organisational methods, applied for one or more patents, carried out in-house R&D or contracted out R&D.

Table 1. Grouping of Industrial Sectors

Sector Group	NACE classification
High & medium high tech manufacturing	Chemicals, rubber and plastics, machinery, office machinery, electrical machinery, telecom equipment, instruments, automobiles, other transport equipment.
Low & medium low tech manufacturing	Agriculture, fishing, oil extraction, mining, food, textiles, wearing apparel, leather, wood products, pulp and paper, printing, petroleum products, non metallic mineral products, basic metals, fabricated metal products, furniture.
Knowledge intensive services	Telecommunications, finance, insurance, real estate, computer and software, R&D, other business activities, education, health, recreation and entertainment.
Less knowledge intensive services	Wholesale, retail, hotels and restaurants, land, sea and air transport, rentals, personal services.

Table 2. Grouping of Countries

Country class	Countries
Innovation leaders	Sweden, Switzerland, Finland, Denmark, Germany, UK, Luxembourg
Innovation followers	Ireland, Austria, Netherlands, France, Belgium
Moderate innovators	Estonia, Norway, Czech Republic, Slovenia, Italy, Cyprus, Spain, Malta, Lithuania
Catching-up countries	Hungary, Greece, Slovakia, Poland, Portugal, Bulgaria, Latvia, Romania

4. User Innovation in the EU: Main results

In this section we address two sets of interrelated issues. The first relates to the prevalence of user innovation in the EU and the second is the difference between user innovators and other innovative firms.

Prevalence of User Innovation

Table 3 reports the proportion of innovative firms that are user innovators in the three categories discussed above. The results show that of the 4,400 innovative firms in the 2007 IB survey 30.3% are *User Process Innovators*, and 27.7% are *User Product Innovators*. In contrast a much higher proportion of the 4377 innovative firms in the 2009 Survey are *User Involvers*: 53.1%.

The results for *User Process Innovators* can be compared with the other recent work discussed above in Section 2, which has adopted a much wider definition of user innovation by including both process modification and the creation of entirely new

processes. For example, in the Statistics Canada study⁸ 21% of firms reported innovating by modifying their process technologies. At the same time the Dutch⁹ and the UK studies¹⁰ of SMEs (10-249 employees) found the proportions of firms modifying their process technologies to be 18% and 10% respectively. In contrast our results show a much higher level of prevalence (30.3% of innovative firms) despite the fact that our definition of *User Process Innovation* is much narrower, based on modification activity only.

Table 3¹¹. Overall Prevalence of User innovation in the EU (unweighted results)

	User Process Innovation	User Product Innovation	User Involvers
Number of firms	1331	1220	2326
Percentage of all innovative firms ¹²	30.3%	27.7%	53.1%

The results regarding *User Product Innovation* and *User Involvement* are not comparable with other recent studies. However, the higher values for *User Involvers* are likely to reflect the lower complexity of the challenges associated with drawing on the ideas, suggestions and activity of actual and potential users as part of wider innovation strategy. The level of *User Product Innovation*, relating as it does to innovations based on the modification of products that have been bought-in, may be an indicator of a range of innovation behaviours. For example, this may include major modifications of part-finished products, repurposing existing products, or integration and modification existing products – possibly all three. However, it is clear that for innovating firms the modification of products that have been bought-in is likely to be a significant component of their product innovation activities.

Table 4 reports the prevalence of user innovation in a number of different dimensions. In general regardless of the category (size, sector, country), between a quarter and one-third of all innovative firms in the EU are involved in *User Process* and *User Product Innovation*. This represents a significant level of activity. The proportion of innovative firms engaging in *User Involvement* is much higher ranging from 49% to 61%, depending on the category under consideration.

⁸ Gault and von Hippel , 2009.

⁹ de Jong, J., von Hippel, E. (2008) User innovation in SMEs: incidence and transfer to producers. SCALES working paper, H200814.

¹⁰ Flowers, von Hippel, de Jong, Sinozic, 2009, Measuring user Innovation in the UK, NESTA, Innovation Index.

¹¹ The first two columns in Table 3 and the first two columns in Table 4 do not correspond to Tables 17A and 19B in the Innobarometer 2007 report because of differences in weighting (Table 3 and 4 are unweighted, the Innobarometer report tables are weighted) and differences in denominators.

¹² User innovators and user modifiers as % of all innovative firms in the 2007 dataset (N=4400), and firms involving users as % of all innovative firms in the 2009 dataset (N=4377).

Table 4. Prevalence of User Innovation according Firm Size, Sector and Country (percentage of all innovative firms¹³) (unweighted results)

Firm characteristics	User Process Innovators	User Product Innovators	User Involvers
<i>Number of employees</i>			
N (unweighted)	1331	1220	2326
20-49	26.9%	28.0%	48.6%
50-249	28.7%	24.7%	52.9%
250-499	34.6%	32.8%	58.0%
500+	39.5%	31.8%	61.3%
<i>Sector</i>			
N (unweighted)	1210	1130	2159
High & medium high tech	33.2%	33.0%	56.6%
Low & medium low tech	32.6%	26.8%	53.3%
Knowledge intensive services	29.5%	31.2%	58.7%
Less knowledge intensive services	29.1%	26.9%	52.9%
<i>Country class</i>			
N (unweighted)	1331	1220	2326
Innovation leader	32.6%	32.0%	56.3%
Innovation follower	29.9%	27.5%	54.4%
Moderate innovators	34.1%	29.1%	50.8%
Catching-up countries	31.8%	30.2%	52.3%

*p<0.1, **p<0.05, ***p<0.001

The one clear message from this table is that large firms are more likely to be involved in user innovation than small firms. For example 39% of all innovative firms with more than 500 employees are *User Process Innovators*, compared to 27% of innovative firms with 20-49 employees. In relation to *User Involvers* these proportions are 61% and 49% respectively.

There are very few differences according to sectors, with *high and medium technology* industries having a slightly higher level of prevalence than the other three categories. In terms of country differences, there are some signs of *innovation leaders* having a higher share of user innovators, especially in the case of *User Product Innovators* and *User Process Innovators*.

Differences with other innovative firms: Types of innovation

In this section we discuss how firms engaged in user innovation are different from other innovative firms. In each table below we indicate whether such differences are statistically significant using a chi-squared test.

¹³ User innovators and user modifiers % of all innovative firms in the 2007 dataset (N=4400); firms involving users % of all innovative firms in the 2009 dataset (N=4377).

We begin with a discussion of the levels of innovation (see Table 5) amongst user innovators. The main point to note from this analysis is that regardless of the category user innovators are more likely to introduce a new product, process or service than other innovators. For example 65% of *User Process innovators* introduced a new product and this rises to more than 76% in the case of *User Product Innovators*. Some differences across the different types of user innovators are as expected. For example *User Product innovators* are more likely to engage in new product introductions compare to *User process innovators*. At the same time the latter are more likely to introduce new processes than the former.

Table 5. Innovative activities of Firms engaged in different types of User Innovation (unweighted results)

	User Process Innovators	User Product Innovators	User involvers
<i>N (unweighted)</i>	1331	1220	2326
Introduced new goods	64.8% ***	76.6% ***	67.2% ***
Introduced new services	64.2% ***	71.2% ***	62.6% ***
Introduced new processes for manufacturing products or producing services	77.5% ***	68.2% ***	68.3% ***
Introduced new logistics, delivery or distribution processes ¹⁴	51.8% ***	46.5% ***	
Introduced new support processes, such as maintenance, purchasing, accounting, or computing systems ¹⁵	75.8% ***	65.7% ***	
Introduced new organizational methods ¹⁶	69.2% ***	65.7% ***	
Applied for patents	20.8% ***	19.1% **	22.1% ***
Carried out in-house R&D	57.0% ***	56.9% ***	60.8% ***
Contracted out R&D	37.6% ***	34.5% ***	42.3% ***

*p<0.1, **p<0.05, ***p<0.001

Use of training

Firms engaged in all forms of user innovation are more likely to provide training or skill upgrading for staff than other innovative firms. There are some differences across the different types of user innovators. *User Process Innovators* are more likely to engage in process innovation training (78.1%) and *User Product Innovators* are more likely to engage in training concerned with product innovation (68.1%).

^{14, 14, 15} Information on these innovation activities is only available for User Process Innovators and User Product Innovators, not for User Involvers (firms were asked about these activities in the 2007 survey and not in the 2009 survey).

Table 6. Training by innovating firms¹⁷ (unweighted results)

Types of training	User Process Innovators	User Product Innovators	User Involvers
Product innovations	56.3%***	68.1%***	
Process innovations	78.1%***	67.3%***	
Organizational innovations	49.8%***	45.4%***	
Team working			68.5%***
Negotiation skills			58.4%***
Communication with other cultures			43.9%***
General communication			72.7%***
Creativity			61.5%***

*p<0.1, **p<0.05, ***p<0.001

In the 2009 IB survey firms that seek to involve users in their innovation processes reported significant levels of training in the soft skills associated with communication, team working, negotiation and creativity. This may reflect the need to develop internal skill sets in the context of a greater openness in innovation processes.

Sources of ideas and Information

In terms of the sources of ideas for innovative activities, the results in Table 7 show that by far the most likely source for both *User Process* and *User Product Innovators* was company Management, with more than 84% of firms citing this as a source. In contrast between 33% and 38% of user innovators cited Research departments and Design staff as sources of ideas. This may reflect a lower level of involvement by research departments in process or product innovations that revolve around the modification of products that have been acquired from other firms.

Production engineers or technicians, at 57.1% and 56.5%, were an important category in both cases. This may reflect the well-established observation that such personnel are often the source of many ideas for these forms of innovation¹⁸. The marketing department was also an important source of ideas, although comparatively less so in the case of *User Process Innovators* compared to *User Product Innovators*. Given the generally outward-facing role of marketing departments this result is probably to be expected.

As discussed above *User Process* and *User Product Innovators* innovate by modifying products and processes that have been acquired from another firm. As may be expected the most likely source of information, advice or support to help customize or modify comes from the original developer or supplier of these products, with

¹⁷ This table combines information on training by innovative firms from the 2007 and 2009 surveys. The questions are not exactly the same for the two surveys and therefore the information available for user product and user process innovators (2007 survey) are slightly different from the information available for user involvers (2009 survey).

¹⁸ For example in 1771 Adam Smith, noted that “A greater part of the machines made use of in those manufactures ... were originally the inventions of some common workman” and 1832 Babbage, commented that “In contriving tools and simplifying processes, the operative workmen are, perhaps, most successful...”

between 59% and 64% of firms citing this factor. This is comparable to the evidence from other surveys of user innovation, which have found suppliers to be important in this respect. For example, a recent Canadian study found that of those respondents that collaborated with other plants, firms or institutions, 83% reported working with suppliers¹⁹.

Table 7. Major sources of ideas for innovative activities (unweighted results)

	User Process Innovators	User Product Innovators
Production engineers or technicians	57.1%***	56.5%***
Marketing department	50.6%***	55.3%***
Design staff	36.7%***	37.7%***
Management	84.3%***	84.0%***
Research department	32.7%***	34.2%***

*p<0.1, **p<0.05, ***p<0.001

There are some differences between the two categories of user innovation, with *User Product Innovators* citing *customers* as relatively more likely source of information, advice and support and *User Process Innovators* citing *Other Companies* that use similar products/processes and *External experts*. This may suggest that, in terms of modification-based innovation, vertical linkages within a supply chain may be more important than horizontal linkages between firms engaged in similar activities.

Table 8. Sources of information, advice or support to help customize or modify processes/products (unweighted results)

	User Process Innovators	User Product Innovators
<i>N (unweighted)</i>	1331	1220
Original developer or supplier of these products/processes	63.5%	58.9%
Other companies that use similar products/processes	46.2%	40.3%
Customers for these products/processes	45.6%	55.7%
Experts such as consultants, universities, etc.	51.7%	43.1%

Government Support

The results shown in Table 9 show that *User Process* and *Product Innovators* are more likely than other innovators to apply for, or receive, some form of support for publicly funded schemes designed to support innovation. However only a small minority of user innovators participate in such schemes. Table 9 also shows that policy initiatives that support inter-organisational networking are the more commonly applied for than others. There is very small likelihood of firms applying or receiving

¹⁹ Schaan & Uhrbach, 2009.

direct support or subsidies, and even a smaller likelihood of firms either applying for, or receiving any form of tax reduction.

Table 9. Participation in Publicly funded policy programs (unweighted results)

	User Process Innovators	User Product Innovators
Inter-organisational networking		
Attending or participating in trade fairs or trade missions	26.3%**	29.3%***
Information on market needs, market conditions, new regulations, etc.	25.8%***	24.8%***
Networking with companies	24.3%***	23.2%***
Networking with universities and research institutes	17.3%***	16.5%***
Support and subsidies		
Subsidies for machinery, equipment, or software	19.2%***	18.5%***
Direct support for R&D based innovation projects	17.0%***	15.5%***
Subsidies for buildings or other infrastructure for innovation	13.5%***	11.0%*
Direct support to finance innovation projects with no R&D involved	12.5%***	11.6%**
Tax reductions		
Tax reductions for R&D expenditures	8.9%	9.0%
Tax reductions for innovation expenditures other than R&D	7.4%***	6.7%*

*p<0.1, **p<0.05, ***p<0.001

Factors having a positive effect on innovation: User Involvers

The 2009 IB survey revealed that for firms involving users in their innovative activities market-facing issues such as pressure from competitors (71%), new market opportunities (70.1%) and new demands from commercial clients (69.5%) were the most likely factors to have a positive effect on innovation. Opportunities that arose from new technologies were likely to be relatively less important (51.9%), as were opportunities to collaborate with universities and research institutes.

The results also reveal that the new demands that public sector clients may make through public procurement was the least likely factor to have a positive effect on innovation. In the context of calls for the public sector to use their market power to drive innovation (e.g. Georghiou, 2007) it appears that much work remains to be done in this respect.

Table 10. Factors affecting having a positive effect on innovation (percentage of all innovating firms) (unweighted results)

Factors affecting innovation	User involvers	All innovating firms
<i>N (unweighted)</i>	2326	4377
Pressure from Competitors	71%***	63.4%
New market opportunities	70.1%***	60.8%
New demands from commercial clients	69.5%***	60.1%
New technologies to be exploited	51.9%***	42.2%
Opportunities to collaborate with universities and research institutes	30.8%***	23.3%
New demands from Government/public sector clients (through public procurement)	27.8%***	22.4%

*p<0.1, **p<0.05, ***p<0.001

5. Conclusions

There is a long history of studying the role of users, both as individuals and as firms, in the innovation process. Much of the conventional literature on user innovation is based on detailed case studies of individual firms, sectors or specific products. This has changed recently with systematic surveys undertaken in the Netherlands and Canada. However the current study is the first to explore user innovation amongst a large cross section of EU firms. Further, in contrast to many of the previous studies, which focused mainly on process innovation, this study analyses different form of user innovation, distinguishing between: *User Process Innovation*, *User Product Innovation*, and *User Involvers*.

The findings, based on analysis of Innobarometer surveys of 2007 and 2009, show that while a substantial minority of innovative firms in the EU are involved in process and product modification (around 30%), more than half such firms involve users in support of their innovative activities. User innovation is also more or less evenly spread across industrial sectors and across EU countries categorized according to their innovative capabilities.

Large firms are more likely to be involved in all forms of user innovation than small firms. For example 39% of all innovative firms with more than 500 employees are *User Process Innovators*, and in the case of *User Involvers* this rises to 61%.

A clear message from the analysis undertaken in this report is that firms engaged in user innovation can be classed as “super-innovators”. Compared to other innovative firms, they are more likely to introduce new products, processes or services. They are also more likely to initiate new organizational methods. Moreover a higher proportion of user innovators carries out both intra and extra mural R&D and applies for patents.

The main internal sources of ideas for user innovators are management and production engineers and technicians. Externally the most important source of information, advice or support to help customize or modify comes from the original developer or supplier of these products.

These findings raise a series of issues for the future measurement of this form of innovative activity and the policies that may be developed to support it. A number of promising new directions for future research also emerge from the findings.

Measurement

Innovation by modification has been shown to be a significant activity for both process and product innovators, but our analysis leaves a number of questions unanswered. For example in the case of product modification, it is unclear from the IB survey responses the form that such modifications take. This could involve firms that engage in complex systems integration, repurposing products in ways their suppliers had not anticipated, or simply re-working partly finished products as part of more conventional manufacturing process. Being able to distinguish between these very different forms of behaviour would enable a more complete picture of *User Product Innovation* to emerge.

Similarly, *User Process Innovation* only focuses on one aspect – modification – while the broader conventional definition of user innovation also includes the creation of new process technologies from scratch. Being able to distinguish between the conditions under which each form of innovative activity takes place and the precise role of external actors, e.g. suppliers, would be a valuable addition to our understanding. For example, it would enable innovations to begin to be tracked within value chains and enable spillovers between user firms and their suppliers to be identified and monitored. It would also enable a more detailed picture of the parameters within which activities such as process modification and creation take place, and give us a better understanding of the various measures used by firms to manage their intellectual property.

Further Research

Future studies of user innovation at firm level could explore in more detail the expenditures associated with this activity, both in terms of direct costs and staff time. Collecting more detailed data on the sources of funding for this form of innovation and how that is related to more traditional forms of R&D would further illuminate the importance of the phenomenon.

Our understanding of *User Involvement* remains at an early stage of development. Although it is clear that users are being involved it is unclear at what stage, and by what mechanisms, their contributions are become relevant to firm innovation processes. It could be that users are involved passively, simply providing suggestions or they may be more actively engaged in design, testing or idea generation. Similarly, it is unclear whether we are looking at business-to-business relationships (in which the user is another firm) or business to consumer relationships (in which the user is an

individual or a community of individuals). At the same time we know little about the role played by internet communities in firm innovation processes. The Innobarometer survey presents a firm-based account of innovation and overlooks the role of individual consumers and communities of individual consumers in innovation. Early research in this area²⁰ suggests that consumers are also active user innovators, with significant positive spillover effects. Extending the survey to incorporate this aspect would provide a more complete account of innovation within the EU.

Policy

Our results show that modification in both products and processes apparently makes relatively little use of the skills and expertise within an R&D department and relies more on production engineers and managers. This suggests that subsidies for R&D will have little direct effect on this form of innovation and policy to support such innovative activities need to rely on alternative mechanisms, possibly focusing on capability development.

The part played by modification within firm innovation processes also raises issues for policy on intellectual property. Innovation is clearly a dynamic process and little is known about what happens to intellectual property when firms engage in product and process modification. Similarly, for firms that seek to draw their users into their innovation processes the status of the intellectual property that is created within this process remains unclear.

The understanding of user innovation and the implications for policy remains incomplete. Further research, based on surveys or qualitative case studies, needs to focus on the possible role of policy, for example in relation to the barriers faced by firms in undertaking user innovation. In the case of financial barriers, this would require policy instruments designed to provide direct support, and incentives to optimise the economic benefits of user innovation. Further research should be aimed at providing the evidence base for devising policies that are sensitive to the contexts in which user innovation arises and the mechanisms by which it flourishes.

²⁰ Flowers, S, von Hippel, E., de Jong, J. Sinozic, T., Measuring User Innovation in the UK, NESTA, forthcoming.

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Annex: Additional tables

Table A1 Firm characteristics count data (unweighted results)

Firm characteristics	User innovators	User modifiers	All innovative firms (2007)	Firms involving users	All innovative firms (2009)
<i>Number of employees</i>					
N (unweighted)	1331	1220	4400	2326	4377
20-49	411	427	1526	801	1649
50-249	510	438	1774	760	1437
250-499	172	163	497	467	805
500+	238	192	603	298	486
<i>Sector</i>					
N (unweighted)	1210	1130	3918	2159	3956
High & medium high tech	192	191	578	259	458
Low & medium low tech	397	326	1216	633	1188
Knowledge intensive services	281	298	954	457	778
Less knowledge intensive services	340	315	1170	810	1532
<i>Country class</i>					
N (unweighted)	1331	1220	4103	2326	4377
Innovation leader	300	294	919	541	961
Innovation follower	218	200	728	492	905
Moderate innovators	478	407	1401	688	1355
Catching-up countries	335	319	1055	605	1156

Table A2 Different types of innovations count data (unweighted results)

	User innovators	User modifiers	All innovative firms (2007)	Firms involving users	All innovative firms (2009)
Introduced new goods	863	935	2455	1563	2645
Introduced new services	854	869	2356	1455	2525
Introduced new processes for manufacturing products or producing services	1031	832	2499	1588	2777
Introduced new logistics, delivery or distribution processes	689	567	1660		
Introduced new support processes, such as maintenance, purchasing, accounting, or computing systems	1009	801	2917		
Introduced new organizational methods	921	802	2524		
Applied for patents	277	233	708	514	716
Carried out in-house R&D	759	694	2094	1415	2247
Contracted out R&D	501	421	1230	983	1477

Table A3 Firms that provided training or skill upgrading for innovation count data (unweighted results)

Types of training	User innovators	User modifiers	All innovative firms (2007)	Firms that involve users	All innovative firms (2009)
Product innovations	749	831	1982		
Process innovations	1040	821	2489		
Organizational innovations	663	554	1615		
Team working				1594	2684
Negotiation skills				1359	2243
Communication with other cultures				1022	1636
General communication				1691	2820
Creativity				1431	2322

Table A4 Firms that found internal sources of ideas important for innovation count data (unweighted results)

	User innovators	User modifiers	All innovating firms (2007)
Production engineers or technicians	760	689	2040
Marketing department	674	675	1941
Design staff	489	460	1285
Management	1122	1025	3401
Research department	435	417	1160

Table A5 User innovators and user modifiers by information sources count data (unweighted results)

	User innovators	User modifiers
<i>N (unweighted)</i>	1331	1220
Original developer or supplier of these products/processes	844	718
Other companies that use similar products/processes	615	492
Customers for these products/processes	607	679
Experts such as consultants, universities, etc.	687	526

Table A6 Policy use for User innovating firms and all innovating firms count data (unweighted results)

	User innovators	User modifiers	All innovative firms
Policy			
Direct support for R&D based innovation projects	226	189	544
Direct support to finance innovation projects with no R&D involved	167	141	402
Subsidies for buildings or other infrastructure for innovation	180	134	414
Subsidies for machinery, equipment, or software	255	226	658
Tax reductions for R&D expenditures	119	110	354
Tax reductions for innovation expenditures other than R&D	98	82	242
Attending or participating in trade fairs or trade missions	350	357	1012
Networking with universities and research institutes	230	201	573
Networking with companies	323	283	810
Information on market needs, market conditions, new regulations, etc.	344	303	925

Table A7 Public procurement activities (count data) (unweighted results)

Public procurement activity	Firms involving users	All innovative firms
<i>N (unweighted)</i>	2326	4377
Winning of procurement contract	847	1423
Submission of tender (none successful)	148	280
Investigation of opportunities to sell to governments or public bodies (no tender)	109	166
None of the above	791	1625
Not applicable	370	765
DK/NA	61	118

**Table A8 Distribution of firms by factors affecting innovation (count data)
(unweighted results)**

Factors affecting innovation	Firms involving users	All innovative firms
<i>N (unweighted)</i>	2326	4377
Opportunities to collaborate with universities and research institutes	716	1020
New technologies to be exploited	1208	1858
Pressure from Competitors	1651	2777
New market opportunities	1631	2660
New demands from Government/public sector clients	646	980
New demands from commercial clients	1616	2632