Do Services Innovate (Differently)?

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Abstract

Although advanced economies are increasingly dominated by services, relatively little is known about whether and how services innovate. Instead, our understanding of innovation and innovation processes has been very largely derived from studies of manufacturing, and the production of technologically advanced artefacts. As services do not generally produce technologically advanced artefacts, they are often considered to be non-innovative, or 'supplier dominated' recipients of technologies rather than 'true innovators'. An alternative perspective is that services tend to innovate differently from manufacturers, or at least that innovation in services brings to the fore 'softer' aspects of innovation based in skills and inter-organisational co-operation practices which are pervasive across the economy but which do not tend to be prominent amongst manufacturers, and are therefore neglected. We examine these issues through an empirical analysis of a survey of European firms which was carried out in 2002.

1. Introduction and Contextualisation[1]

Despite the fact that the advanced economies of the world are increasingly dominated, in terms of employment and value added, by service activities, within economics and innovation studies services have long had a 'Cinderella status, … being neglected and marginal' (Miles, 2000, p. 371). Innovation, the ultimate source of all economic growth, is still largely associated with manufacturing,[2] and the production of technologically advanced artefacts. Despite the increasing attention paid to innovation in services in recent years (e.g., Evangelista, 2000; Gallouj, 2002; Drejer, 2004, Howells and Tether, 2004; Miles, 2004), almost all of our understanding of innovation and of innovation processes at the micro level has been derived from studies of manufacturing (Gallouj and Weinstein, 1997). Thus the growth of services raises questions about whether services innovate at all and, if they do, whether the understandings of innovation derived from studies of manufacturing are appropriate to service dominated economies.

Until recently, efforts to explore innovation in services have been undertaken in two contrasting traditions. The first tradition is the 'assimilation approach' (Coombs and Miles, 2000), which considers that services, and innovation in services, is fundamentally similar to manufacturing and innovation in manufacturing. Thus, services and innovation in services can be studied by using or adapting the concepts and tools developed for studying innovation in manufacturing. For example, the assimilation approach was used to include services in the second round of the European Community Innovation Surveys (CIS-2). Whilst this marked an important advance for the study of services and their innovation activities (Tether et al., 2001; Tether, 2003), it involved using a tool designed with manufacturing and 'technological product and process (TPP) innovation' in mind (OECD et al, 1996), and making small changes, such as replacing the word product by the word service, where necessary. The CIS-2 revealed that a substantial proportion of service firms (claim to) engage in (technological) innovation activities, but also that service firms were less likely to claim to have innovated than their manufacturing counterparts (Tether et al., 2001).[3]

Although services recorded more innovation in the CIS-2 (and CIS-3) than had previously been anticipated, the assimilation approach is associated with the still widely held 'traditional view' of services, which is that they are relatively unprogressive, with restricted capacities to change, especially from within. Instead, innovation in services is largely dependent upon adopting externally developed technologies that facilitate new service provision and/or enhance service productivity (Pavitt, 1984). Manufacturers and a few 'peculiar services' such as computer services and telecommunications are the source of these new technologies. Significantly, the vast majority of the technologies adopted are standard, 'off-the-shelf' technologies, which are widely available and are used by services only in the manner intended by their producers. Thus there is little creativity on the part of services as users of technologies. Consequently, as the technologies employed are widely available, there is little to differentiate service providers by quality, and competition is based on price. The rate of progress in terms of quality and the price quality ratio is also essentially dependent on the rate of technological progress in the supply industries. As den Hertog (2000, p. 499) puts it: 'The dominant view of innovation in services portrays the process as supplier-dominated, with service firms being dependent on their suppliers for

[1] This paper draws on the findings of a European Commission funded study on 'Innovation in Services: Issues at Stake and Trends (Howells and Tether, 2004). I would like to thank EOS Gallup Europe for the provision of the data used in the paper, and Jeremy Howells, Ian Miles, Judy Matthews, Jan Vang and an anonymous referee for comments on previous versions. I am grateful to the Commission for permission to pursue the academic publication of this work. The views expressed are those of the author and do not necessarily reflect those of the European Commission, EOS Gallup Europe or any of the colleagues mentioned above.

[2] And a few 'peculiar services', such as computer services and telecommunications.

[3] In all European countries except Luxembourg and Portugal.

innovative inputs.' From this perspective, services are rather uninteresting with respect to innovation and technological change, and given the prevalence of this view it is perhaps unsurprising that they have attracted relatively little attention from scholars of innovation.

Until recently, the other major tradition of studies on innovation in services has followed the 'demarcation approach' (Coombs and Miles, 2000). This contends that services and their innovation activities are highly distinctive, following dynamics and displaying features that require new theories and approaches to measurement from those developed in the context of manufacturing. A strong line of demarcation research has been conducted by researchers largely associated with Lille University in France (Gallouj and Weinstein, 1997; Gadrey and Gallouj, 1998; Djellal and Gallouj, 2000; Sundbo and Gallouj, 2000). This group of researchers has specialised in the analysis of innovation in services, and has argued that innovation in services is different in nature to (archetypal) innovation in manufacturing. Intangibility and the interactive nature of services are, they argue, especially prominent amongst the 'peculiarities of services', and service innovation. Indeed, these features can be seen as the keys to understanding service activities (although, see Hill, 1999). Because service outputs tend not to have an independent physical existence, service innovations can be invisible and therefore difficult to record. They can also be difficult to reproduce, consistently or exactly, time after time. This also relates to the flexibility of services. Service firms often constantly adapt and reform their activities to provide solutions to changing and highly differentiated customer requirements. But because service events are often unique, it often difficult to differentiate between service variations and innovations. What may be introduced as a new variant of a service designed to satisfy a particular client's needs may later be seen as the start of a significant change in the activities of the business which led it to branch out in a new direction. The co-production of services – where the provider and client work closely together to produce the outcome – also complicates matters, because the origin and attribution of any innovation may be difficult to determine. Overall, demarcation researchers argue that by failing to recognise the specificities of services and their innovation activities, mainstream economic and innovation studies have overlooked both the important contributions of services to manufacturing (Gadrey et al., 1995) and some of the most important dimensions of innovation behaviour within service firms themselves.

From the demarcation perspective, services are far from dull providers of standard activities, but are instead dynamic and fluid, constantly changing to meet customers' requirements, and achieving this through creative combinations of 'hard' (i.e., equipment, computer software, etc.) and 'soft' (i.e., human skills, operating, and co-operating practices, etc.) technologies. The 'soft' aspects of innovation are particularly significant, and in this view services are certainly not just passively dependent on the supply of new technologies. Importantly, innovation is seen not only in the creation of new technologies, but also in their creative use, which often reflects an ability to interpret often poorly specified individual customer requirements. Critics of the demarcation approach such as Drejer (2004) argue that it spreads the concept of innovation too thin, to one-off changes that are not reproducible, and confuses inputs and processes such as learning with innovations as outcomes.

More recently, a third perspective on services and their innovation activities has begun to flourish. This is the 'synthesis approach' (Coombs and Miles, 2000). The synthesis approach argues that services and manufacturers do not follow entirely different approaches to innovation, but that studies of services and their innovation activities (such as those undertaken in the demarcation tradition) bring to the fore neglected aspects of the innovation process, which, although most prominent in services, are (increasingly) widely distributed throughout the economy. The ultimate aim of the synthesis approach is to create both theoretical (Gallouj, 2002) and empirical approaches to innovation that are able to embrace all economic activities,

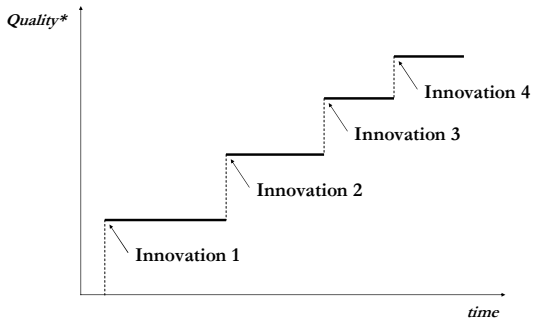
including manufacturing and services, without favouring some activities (and their modes of innovation) over the others.

Innovation is of course very difficult to measure (OECD et al, 1996), and some argue that services are less likely to record their innovation activities in surveys such as the European Community Innovation Surveys (CIS). There are two reasons for this.

Firstly, arguably the intangible and interactive nature of many services (as highlighted by the demarcation perspective) suggest services are more often oriented to continuous change, rather than occasional discrete 'step-wise' change which is central to the conceptualisation of innovation developed in the context of manufacturing (NZIER, 2002). This conceptualisation is applied in the European Community Innovation Surveys. Figure 1 presents two highly stylised representations of innovation. The first is the traditional step-change conceptualisation of innovation (Figure 1a), where improvement occurs through a series of discrete, step-wise jumps, which, taken as a whole, reflects a 'staircase of innovation'. Taking a firm as the unit of analysis, it will develop then introduce a new product (or process), which is tightly defined and reproducible, such that each unit of production is identical. This product (or process) will tend to remain unchanged for a time, but after a while it will be replaced, perhaps in response to competition from rivals, by a superior version. By comparing the two versions it is possible to judge whether a significant step change or 'innovation' has occurred. In time, the second version of the product will be replaced by a third version, and that by a fourth, etc. An example of this sort of punctuated progression would be the Volkswagen Golf, which is now in its fourth generation, with each generation at least a technical improvement on the previous version.[4] In this way we can observe an 'innovation staircase' – a series of step changes between periods of stability, coupled with the opportunity to look back to compare and contrast the performance of the different versions, or generations, of technology. This type of progress also tends to be associated with more mechanistic approaches to business organisation and management (Burns and Stalker, 1961).

Figures 1a

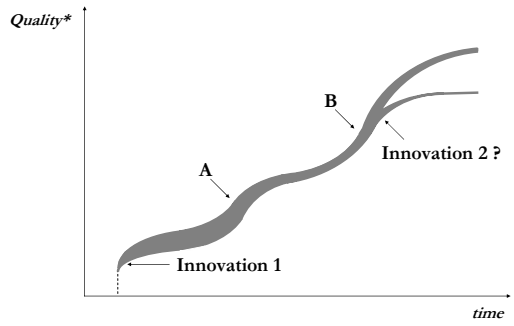
The 'Innovation Staircase' Mode of Innovation
Occasional, Discrete Step-wise Changes



* Quality can be measured or assessed objectively

Figure 1b

The 'Continuous Change' Mode of Innovation
Based on an Evolving Envelope of Capabilities



* Quality may be difficult to measure or assess objectively

Yet arguably the above is only one of several possible modes of innovation. One alternative is a continuous change mode of innovation as outlined in Figure 1b. Here a new product (or service) is introduced, and is perhaps identifiable as an 'innovation', at least for the firm that introduced it. However, this is not a tightly defined product or service, but more a set of

[4] This is not the best possible example, because there are many variants of the Golf within each generation. Moreover, some would contend that the performance of the car has not improved, as it has become bigger and heavier. Nonetheless, it is a well known product that has gone through several generations.

activities, which is difficult to reproduce exactly with each 'performance'. Moreover, the way in which this set of activities is enacted may vary between customers or clients, as each performance is client specific, with the firm combining different teams of individuals (perhaps including some in the client organisation) with different capabilities to deliver 'products' or services to meet (or surpass) individual client's requirements. Managed organically, rather than mechanistically (Burns and Stalker, 1961), the firm will gradually learn new things, as it addresses new and evolving needs amongst its customers. The recruitment of new personnel may also introduce new capabilities to the firm. At each moment in time, therefore, the firm can be perceived as holding an envelope of capabilities (or competences), a selection of which may be deployed to address client specific needs. Because no two performances are exactly the same, it is difficult to control quality, and in any case quality may be difficult to measure in a wholly objective sense. The set of capabilities the firm holds will evolve over time – sometimes changing rapidly (as shown by points A and B in Figure 1b) and sometimes more slowly, and partly through internal 'learning by doing' but also in response to changing market demands. The management of the firm may also deliberately decide to discard certain capabilities (e.g., the ability to programme in an old computer language, such as Fortran). Also possible is a bifurcation in the set of services provided (see 'Innovation 2?' in Figure 1b), such that, for example, the firm decides to offer two levels of service – 'high' / 'complete' or 'luxury', and 'low' / 'scaled-down' or 'economy'. This may be an early stage towards the introduction of a more definite set of products or services, and corresponding sets of processes related to their provision. Overall, what is important about this mode of innovation is the absence of definite step changes in terms of what is produced (or the means of production). This makes the identification of innovations difficult, especially if the 'product' is intangible and cannot serve as a record or memory of past performance. Yet whilst the identification of particular innovations is difficult, taken as a whole it is apparent that the business, in terms of what it provides for its customers and how it undertakes its activities, may have changed considerably over the period of analysis.

Although there are many service firms that introduce definite products (e.g., retail banks, the airlines, insurance companies, etc.) and for which a 'step-change' model of innovation is therefore appropriate, it is also arguable that services are more likely to engage in a continuous change mode of innovation (rather than a 'step-change' mode of innovation), which implies that using a tool such as the European Community Innovation Survey, which is conceived around a step-change model, may significantly under-record the amount of innovation activity in services.[5]

A second problem with innovation in services is that the forms of innovation tend to blur, whereas the conceptualisation built into the Oslo Manual (OECD et al, 1996) and Community Innovation Surveys concerns a clear dichotomous distinction between (technological) product and process innovation. Services, it is argued, often have difficulty assigning their innovations to these categories, because services are often processes, and it may be difficult to know whether to describe the innovation as a 'product innovation', a 'process innovation', or both.[6] A related difficulty is that of distinguishing between organisational and process innovation in services. 'Processes' can be conceived narrowly, as defined and repeated activities associated with the production of particular service products. By contrast, organisational changes tend to be understood more broadly, as changes in the way in which provision is organised, both within the firm (e.g., 'de-layering', the introduction of new divisions or departments, the introduction of teamwork, or changing the division of labour within teams, etc.) and changes to the relationships between the firm and its customers, other businesses, and/or organisations, such as universities

[5] As well as in other activities such as construction where the identification of discrete innovations may be difficult.
[6] Evangelista and Sirilli (1998) found up to 35% of Italian service firms that introduced innovations were unable or found it difficult to distinguish between product and process innovations.

(e.g., entering into collaborative arrangements and making 'open book' agreements, as well as perhaps initiating organisational change in other organisations). But a difficulty with organisational innovations is that they tend to be hard identify, define and grade.[7]

This paper explores some empirical evidence on 'innovation in services' from the European Innobarometer survey of 2002. Based on the review above, we hypothesise that:

1. Service firms will have greater difficulty in determining the orientation of their innovation activities between products, processes and organisational changes.

2. Service firms will be more likely to claim an organisational orientation to innovation than will the manufacturers, and, concomitantly, will be less likely to claim a product and/or process orientation to innovation.

3. Service firms, and especially those with an organisational orientation to their innovation activities, will be less likely to acquire knowledge and technology through 'hard' sources such as R&D and the acquisition of advanced equipment, and will be more likely to source knowledge and technology through 'soft' sources, such as co-operations with suppliers and customers.

4. Also reflecting their more organic nature, service firms, and especially those with an organisational orientation to their innovation activities, will be less likely to claim their strengths at innovation lie in 'hard' advantages in R&D knowledge or efficiency of production, but will be more likely to claim their advantages lie in 'soft' attributes including the skills of their workforce and their co-operation practices with customers and suppliers.

The remainder of the paper is organised as follows. Section 2 introduces the 'Innobarometer 2002' dataset that is examined in the paper. Section 3 examines the findings on the firms' orientations to innovation, between products, processes and organisational changes. Section 4 then examines three sub-sets of manufacturing and service firms with regard to the 'sources of advanced technologies' that they claim to have used for innovation, and their perceived 'strengths at innovation'. Finally, some conclusions and a discussion of the findings are provided in Section 5.

2. The Innobarometer Dataset

The dataset examined in this paper is the 'Innobarometer 2002'. This was a survey, commissioned by the Enterprise Directorate General of the European Commission and undertaken by EOS Gallup Europe, that interviewed managers in 3,014 European firms employing at least 20 people. The interviews were by telephone between the 9th and 30th of September 2002. The sample to be interviewed was selected according to three criteria: firm size, industrial sector, and country.

[7] Traditionalists may balk at the idea that such things as implementing an 'open plan office arrangement' constitutes an innovation. But whether it does or does not surely depends on what is meant by innovation and the purpose of the change. If the intention of the change was to increase communications (and the sense of community) and thereby change behaviours, to raise productivity and/or to improve the service offered, then it seems reasonable to consider such a change an innovation, particularly as the outcome cannot be fully known in advance (i.e., an element of uncertainty is involved). If this change is also not immediately reversible and involved significant sunk costs (in money and/or time), then that also suggests that the change should qualify as an innovation

Firm size was the first criteria of selection. Firms were divided into three size bands: small firms (with 20 to 49 employees), medium firms (with 50 to 249 employees) and large firms (with 250 or more employees). Sampling was divided across these three bands, with a deliberate over sampling, relative to the population, of larger firms (to reflect their greater economic significance).

Sector of activity was the second criteria of selection. Four sectors were identified: construction; industry (defined as manufacturing and the production of raw materials); (wholesale and retail) trade and (other) services. Sampling was divided across these four sectors, broadly in accordance with their economic significance.

Combined, the firm size and industrial sector classifications provide 12 cells. In the largest Member States of the European Union (France, Germany, Italy, Spain and the UK) 300 firms per country were targeted for interview. In the smallest countries (Greece, Finland, Ireland, Luxembourg and Portugal), 100 firms per country were targeted, whilst 200 firms were to be interviewed in the remaining, mid-sized Member States (Austria, Belgium, Denmark, the Netherlands and Sweden). The total number of firms to be interviewed per country was divided amongst the 12 size-sector cells (and rounded up or down to an integer). The required number of firms was then selected at random by Dunn and Bradstreet from their databases of European firms.

The person interviewed in each firm was to be a top level executive from either general management or financial management. The term "innovation" was not defined but 'was interpreted on the basis of the professional experience of the particular manager being interviewed' (European Commission, 2002, p.1.).

For the analysis in this paper we do not use the full sample, as we have omitted the construction sector, and the production of raw materials component of the 'industry' sector, to leave only manufacturing and services (where services includes both trade and other services).[8] Table A in the appendix reports the number of responses to the survey by country, firm size, and sector of activity. Further details of the Innobarometer survey and the methods used for its compilation can be found in the European Commission's 'Innobarometer 2002' report (European Commission, 2002).

3. Firms' Innovation Orientations according to the Innobarometer Survey

We begin our analysis of the Innobarometer survey data by examining the firms reported orientations to innovation. The survey asked: "Have your innovation efforts focused mainly on: the development of new products; the development of new production processes, or the development of new organisational changes". According to the rules of the survey, firms could identify up to two but not all three of these.

According to our hypotheses we would expect that service firms may be less likely to claim any particular innovation orientation (i.e., be more likely to say none/'don't know). Furthermore, amongst those that do claim an orientation to innovation this will be more likely to include an orientation to organisational change, and be less likely to be an orientation to product or process innovation.

[8] Services includes the wholesale and retail trades, finance, transport and communications, business services and services to consumers.

Table 1 shows the proportion of manufacturing and service firms which claimed each of these innovation orientations, as well as the proportions that said none was applicable or that they did not know. In accordance with our first hypothesis we find the proportion of service firm that said 'none' or 'don't know' to this question was significantly larger, indeed more than double, that amongst the manufacturers (12% c.f., 5%). However, this said, in both sub-samples, this proportion was relatively, and reassuringly, small.

The table also shows some marked and interesting differences between manufacturers and services amongst those that did report orientations to innovation. Although all of the differences are statistically significant at the 1% level or above,[9] most notable are the large differences between the proportions of firms that declared orientations to the development of new production processes and to new organisational changes. Whilst more than half the manufacturers declared the development of new production processes was a focus of their innovation activities, less than a quarter of the service firms made the same claim. By contrast, more than half the service firms claimed a focus of their innovation activities was on organisational changes, compared with less than a quarter of the manufacturers. The inclusion of the word 'production' in association with processes may have had some influence here, as this terminology may not be considered appropriate to services, effectively encouraging service firms to choose organisational rather than process change. It is also notable that more than half the manufacturers claimed a focus of their innovation activities was the development of new products, compared with just over a third of the service firms.

Table 1: The Declared Innovation Orientations of the Manufacturing and Service Firms

	None / Don't Know	New Product	New Production Processes	Organisational Changes
Manufacturing	5%	54%	56%	25%
Services	12%	34%	24%	53%

All differences between manufacturing and services are statistically significant at the 1% level

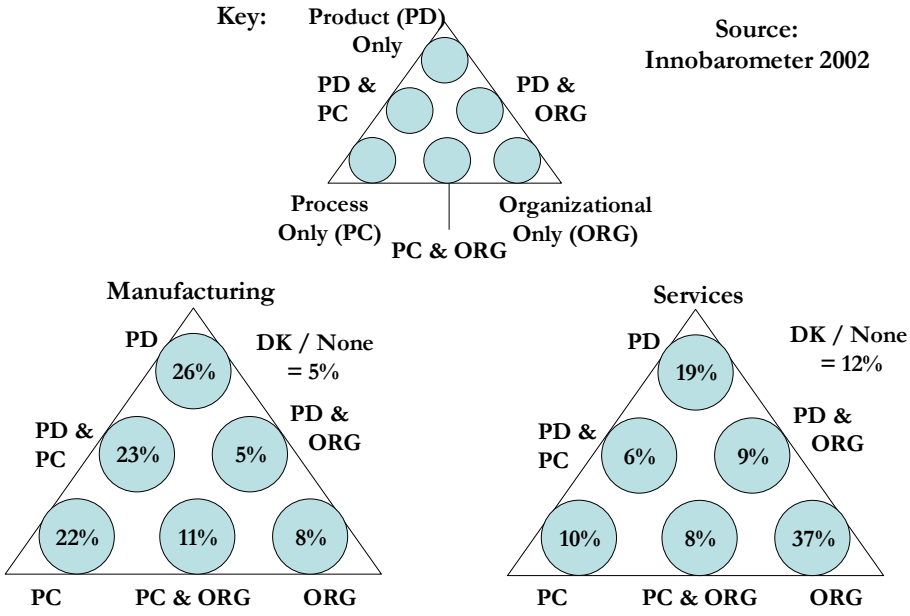
Figure 2 shows these 'innovation orientations' of manufacturing and service firms in more detail, with all the possible answers displayed separately. The top corner of the triangle shows the proportion of firms that reported an innovation orientation solely to the 'development of new products', the bottom left corner shows the proportion that declared an orientation solely to 'the development of new production processes', whilst the bottom right shows the proportion that declared an orientation solely to 'the development of new organisational changes'. The midpoint on the left side shows the proportion that focused on both new products and new production processes, the midpoint on the right side shows the proportion that focused on both new products and organisational changes, whilst the mid-point on the bottom side shows the proportion that focused on developing new production processes and new organisational changes. Recall that, according to the rules of the survey, it was not permissible to identify all three.

The much greater orientation of service firms to organisational change (more than a third declared this to be their only innovation orientation, compared with just 8% of the manufacturers) provides powerful support for our hypothesis that service firms tend to be more likely to have (or perceive they have) an organisational change innovation orientation, whilst they are less likely to place an emphasis on developing new products or new production processes.

[9] Based on Chi-square tests.

Figure 2

The Innovation Orientations of Manufacturing and Service Firms



To explore these responses further, three logisitic regressions were undertaken, one for each 'innovation orientation'. The regressions included a dummy for new firms, a variable for firm size (the natural log of the firm's employment), a dummy for 'service sector' firms, a dummy for engaging in exporting, a variable with the proportion of exports in total sales, and a series of country dummies, with the Netherlands acting as the base case. The Netherlands was selected as the base case because, according to the European Commission's report (European Commission, 2002), the distribution of innovation orientations in the Netherlands was the closest to that of the European Union as a whole. These country dummies were intended to control for differences in economic conditions, differences in business cultures and/or differences in the interpretation of the concepts investigated by the survey.

The exporting variables were included because it was expected that firms that had an exporting orientation would be more likely to focus on product innovation, and be less likely to focus on organisational innovation. The reasoning for this is that exporting is associated with dealing with something definite and tradable, usually products, whereas organisational innovation tends be associated with relationships and intangibles, which are by their nature difficult to trade at arms length and therefore difficult to export.

Table 2 shows the results of these logistic regressions, the main findings of which are:

- **Firm size**: The regressions showed that orientations to the development of new products and to the development of new production processes tended to be associated with larger firms. In other words, the larger the firm, the more likely it was to identify these innovation orientations. By contrast, an orientation to organisational innovation had a weak negative association with size – larger firms were slightly less likely to identify organisational changes as one of their main directions of innovation. This perhaps indicates that larger firms tend to be more mechanistic in their approaches to innovation, whilst small firms are more organic (Burns and Stalker, 1961), although the importance of size with regard to this

should not be exaggerated. Interestingly, there was no significant difference between new and existing firms in their innovation orientations.

- **Exporting** was, as expected, positively associated with a new product development orientation to innovation, and negatively associated with an organisational change orientation to innovation. This was true both in terms of any engagement with exporting, and with the degree to which a firm's sales were derived from exports. These findings are in line with expectations, as exporting implies dealing with something definite, usually a product, whereas organisational changes are associated with relationships and intangibles, which by their nature are difficult to export. There was no relationship between firms exporting and their having a new production process orientation to their innovation activities.

Table 2: Logistic Regressions for Engaging in Different Types of Innovation

	Product Innovation	Process Innovation	Organisational Innovation
Constant	-1.592 ***	-1.690***	0.454 **
Firms established since 1997 (d)	0.201	0.101	-0.131
Ln Employment	0.138 ***	0.118 ***	-0.063 *
S: Manufacturing	Base	Base	Base
S: Services (d)	-0.537 ***	-1.240 ***	1.117 ***
Exporter (d)	0.551 ***	0.080	-0.295 ***
Exports as a proportion of Sales	0.473 **	0.042	-0.429 **
C: Finland (d)	0.640 **	0.956***	-1.203 ***
C: Sweden (d)	0.531 **	-0.335	-0.660 ***
C: Germany	0.469 **	0.065	0.162
C: UK (d)	0.346 *	-0.530**	-0.239
C: Greece (d)	0.050	0.406	0.504 (11%)
C: Netherlands	Base	Base	Base
C: Denmark (d)	-0.024	-0.081	-0.079
C: Luxembourg (d)	-0.033	0.011	0.674 **
C: Belgium (d)	-0.065	-0.063	0.182
C: France (d)	-0.096	-0.278	0.197
C: Austria (d)	-0.185	0.186	0.861 ***
C: Italy (d)	-0.224	0.631 ***	0.336 (12%)
C: Spain (d)	-0.255	0.526 ***	0.257
C: Portugal (d)	-0.275	0.013	0.438
C: Ireland (d)	-0.305	-0.709 **	0.554 *
Number of Observations (N.)	2,404	2,404	2,404
Model Chi-square	219.7 ***	320.0 ***	309.5 ***
-2 Log Likelihood	3,037.8	2,809.4	2,874.3
Nagelkerke R^2	0.118	0.171	0.162

d = dummy variable, *** significant at 1%; ** significant at 5%; * significant at 10%

- **Country differences**. Compared with those in the Netherlands, which served as the base for reasons already explained, firms in Belgium, Denmark, France and Portugal showed no significant differences in terms of their innovation orientations. Meanwhile, firms in Finland, Sweden, Germany, and to a lesser extent the UK had a greater orientation to new product development, whilst those in Finland, Italy and Spain had a greater orientation to

new production process development. Meanwhile, firms in the UK and Ireland were less likely to claim a new production process orientation to their innovation activities. Firms in Austria and Luxembourg, and to a lesser extent Ireland, Greece and Italy, were more likely to claim an orientation to organisational changes, whilst those in Finland and Sweden were less likely to claim this orientation. Explaining these findings is extremely difficult. They may be due in part to differences in the prevailing economic conditions, to 'real' cultural differences and approaches to business (e.g., the extent to which mechanistic or organic approaches dominate), but they may also be due to differences in the understandings of the concepts used in the survey (such as the extent to which 'production', and hence 'production processes', is or is not closely associated with 'products' and hence manufacturing, or whether these concepts translate easily into services). My knowledge of both the variety of business cultures and European languages is insufficient to make any informed comment on these matters.

- **Services vs. Manufacturing**. Even after controlling for the other factors in the regressions (age and size of firms, exporting behaviour, and country) the models found significant differences between manufacturing and service firms in their innovation orientations. Put simply, and in support of our second hypothesis, service firms were less likely to engage in new product developments, and were less likely to engage in developing new production processes, but were more likely to claim to be developing new organisational changes.

In this section we have shown that the Innobarometer survey found significantly different innovation orientation patterns for manufacturing and service firms. In support of our two initial hypotheses, we have found that service firms are more likely than manufacturers to be unsure of (or to have no) innovation orientation, but also that amongst those firms that did declare orientations to innovation service firms were much more likely to claim an orientation to organisational changes rather than to new product and/or process developments.

There is a danger, however, that these differences are not 'real', but are due to differences in interpretation of the concepts used in the survey (e.g., the understanding of what constitutes a 'production process' may differ between manufacturing and service firms). In the next section, we investigate whether these differences in innovation orientations are reflected in other differences, notably in how the firms sourced advanced technologies and what they consider to be their strengths at innovation.

4. Sources of Advanced Technology and Perceived Strengths at Innovation

To investigate whether the differences found in the previous section are substantial, rather than just differences in interpretation, we explore the data further, examining whether the firms differed in their sources of advanced technology and in their perceived strengths at innovation. Here we hypothesise that:

1. Service firms, and especially those that claimed an organisational orientation to their innovation activities, will be less likely to claim that they sourced advanced technologies through undertaking R&D and/or acquiring advanced technologies. Instead, they will place an emphasis on acquiring technological knowledge through co-operative interactions with customers and suppliers.

2. Services, and especially those with an organisational orientation to their innovation activities, will be more likely to consider that their strengths at innovation lie in 'soft' attributes, such as the skills of their workforce and their co-operation practices with suppliers and customers, rather than through 'hard' advantages in technological knowledge and the efficiency of production.

To keep the analysis relatively simple, we will restrict our analysis to a comparison of three types of firms:

1. Manufacturers that focused on product and/or process innovation (PPI) but not organisational innovation [629 firms].

2. Service firms that focused on product and/or process innovation (PPI) but not organisational innovation [573 firms].

3. Service firms that focused on organisational innovation (OrgI) but not product or process innovation [602 firms].

If manufacturers and services firms innovate in essentially the same way, but just tend to label their innovations differently, we would expect few differences in their sources of advanced technologies or in their perceived 'strengths at innovation'. Conversely, if - as our hypotheses contend - substantial differences are found in these, that would support the argument that there are real differences in the innovation orientations of these different groups of firms.

4.1 Sources of Advanced Technology

The firms were asked how they accessed advanced technologies. The survey suggested five sources: [1.] 'the acquisition of advanced machinery and equipment'; [2.] 'co-operation practices with suppliers and/or customers'; [3.] 'conducting in-house research and development'; [4.] 'co-operation practices with universities or R&D specialists'; and [5.] 'the acquisition of external intellectual property – such as licensing in'. The firms were also permitted to identify 'other' sources if these were more important, or to state that no source was more important than the others. In general, however, the firms were asked to identify up to two of these sources as being the most important.

Table 3 shows the simple proportions, for each of the three firm types, which identified each of these sources as being particularly important. This shows that, for all three firm types, 'co-operations with customers and/or suppliers' were the most widely used means of accessing advanced technologies, although this source also appears to be more widely used amongst service firms than amongst manufacturers. The 'acquisition of advanced machinery and equipment' was the second most widely identified source amongst both types of service firm, and was the third most widely identified source amongst manufacturers, although, perhaps surprisingly given the widely held perception that services are 'supplier dominated', a larger proportion of manufacturers identified this source than did either of the two types of service firms. Amongst manufacturers, in-house R&D was the second most widely identified source of advanced technologies, being identified by almost half the firms. Amongst services, by contrast, in-house R&D was much less likely to be used, being identified as a source of advanced technologies by just over a third of those that focused on product and/or process innovation, and by just one in six of the service firms that focused on organisational innovation.

In broad terms these descriptive findings support the expectations set out in our hypotheses. In short services place less emphasis on 'hard' sources of technology and knowledge (such as from

R&D or acquired technologies) and place greater emphasis on 'softer' sources of knowledge and technology, such as the use of co-operation practices. However, we emphasise that there is certainly no 'black and white' difference between manufacturers and services in their sourcing of advanced technologies.

Table 3 Sources of Advanced Technologies and Perceived Strengths at Innovation

	M-PPI (a.)	S-PPI (b.)	S-OrgI (c.)
Main Sources of Advanced Technologies			
Co-operations with Suppliers &/or Customers	51% [1]	57% [1]	63% [1]
Acquisition of Advanced Equipment	44% [3]	36% [2]	36% [2]
In-house R&D	47% [2]	36% [3]	17% [3]
Co-operations with Universities or Research Institutes	19% [4]	13% [4]	7% [5]
Acquisition of External Intellectual Property	6% [5]	10% [5]	10% [4]
Other Answers	1%	<1%	3%
Don't know / None identified	<1%	2%	5%
Main Strengths at Innovation			
Skills and Professionalism of the Workforce	34% [2]	46% [1]	60% [1]
Co-operation practices with Customers, Suppliers or the Trade Association	34% [2]	35% [2]	49% [2]
Flexibility or Adaptability of Production to Market Needs	48% [1]	34% [3]	23% [3]
Leadership in Market Trends	13% [6]	20% [4]	17% [4]
Technological Advance and/or R&D	22% [5]	18% [5]	9% [5]
Having Efficient Production Methods	25% [4]	15% [6]	9% [5]
Don't know / None identified	1%	2%	2%

a. Manufacturers with a New Product &/or New Production Process orientation to innovation
b. Service firms with a New Product &/or New Production Process orientation to innovation.
c. Service firms with an Organisational Change orientation to innovation.

To investigate these differences further we undertook logistic regressions for each source of advanced technology. Each model included a dummy for recently established firms (those established since 1997), a variable for firm size (the natural log of employment), a series of country dummies largely to control for differences in approaches to business and understandings of the concepts (Germany, as the largest European economy, was used as the base, but we do not report the coefficients), plus dummy variables identifying service firms with product and/or process orientations to their innovation activities and service firms with organisational orientations to their innovation activities (manufacturers with a product and/or process orientation to their innovation activities acted as the base case). These models (see Table 4) found the following:

- **Recently Established Firms** were significantly less likely to access advanced technologies through cooperation arrangements with suppliers or customers. This is understandable as newer firms are less likely to have formed long term, trust based relationships with suppliers and/or customers with which to form such partnerships. There was also some evidence that newer firms were more likely to access advanced technologies through the acquisition of external intellectual property (such as licensing in). Otherwise, recently established firms did not differ from older firms once their other characteristics were controlled for.

Table 4 Logistic Regressions – Sources of Advanced Technologies

	Supply Chain Co-operations	Acquisition of Adv. Equipment	Conducting In-house R&D	Co-operations with Universities	Acquisition of External IP
Constant	0.887***	-0.247	-0.659***	-1.563***	-3.546***
Firms established since 1997 (d)[1]	-0.499***	-0.181	0.201	0.253	0.450(12%)
Ln Employment	-0.130***	-0.083**	0.239***	0.164***	0.142**
Services – Product/Process Innovation (d)[2]	0.190(12%)	-0.309**	-0.467***	-0.339**	0.520**
Services – Organisational Innovation (d)[2]	0.439***	-0.362***	-1.467***	-1.035***	0.517**
Number of Observations	1,804	1,804	1,804	1,804	1,804
Model Chi-square	91.1***	142.0***	213.6***	83.2***	32.0**
-2 Log Likelihood	2,376.2	2,272.2	2,090.7	1,312.7	1,039.3
Nagelkerke R^2	0.066	0.103	0.155	0.084	0.039

Notes: 1. Dummy for 'new firms' established since 1997 – compared against 'established firms' which existed prior to 1997
2. Dummies for two types of innovating service firms – compared against manufacturers that focused on product &/or process innovation.
3. Also include are 'country dummies' for all countries except Germany, which is the reference country. Coefficients are not reported.
*** - significant at 1%; ** - significant at 5%; * significant at 10%.

Table 5 Logistic Regressions – Strengths at Innovation

	Staff & their Qualifications	Co-operation Practices	Flexibility & Adaptability	Leadership in Market Trends	Technology & R&D	Efficiency of Production
Constant	-0.292	-0.288	1.083***	-2.659***	-2.108***	-1.571***
Firms established since 1997 (d)[1]	-0.203	-0.309(12%)	-0.241	0.110	0.539**	-0.332
Ln Employment	0.008	-0.132***	-0.145***	0.091*	0.250***	0.063
Services - Product/Process Innovation (d)[2]	0.512***	-0.033	-0.651***	0.644***	-0.139	-0.637***
Services – Organisational Innovation (d)[2]	1.191***	0.533***	-1.226***	0.371**	-0.954***	-1.220***
Number of Observations	1,804	1,804	1,804	1,804	1,804	1,804
Model Chi-square	150.3***	68.2***	118.4***	84.3***	106.6***	98.5***
-2 Log Likelihood	2,342.6	2,348.6	2,215.8	1,542.4	1,500.6	1,505.5
Nagelkerke R^2	0.107	0.050	0.088	0.077	0.097	0.090

Notes – as above

- **Firm Size.** In line with expectations, the use of in-house R&D as a source of advanced technologies tended to increase with firm size, perhaps indicating a more formalised approach to innovation amongst larger firms. Sourcing technologies through co-operations with universities and/or research institutes and the acquisition of external intellectual property also increased with firm size. By contrast, the use of cooperation arrangements with customers or suppliers as a key source of advanced technologies tended to decline with firm size, as did sourcing advanced technologies through the acquisition of advanced equipment. Of course, it is possible that larger firms used these sources, but relative to smaller firms these were less likely to be regarded as their main sources of advanced technologies.

- **Services vs. Manufacturers.** After controlling for firm size and age, service firms with a product and/or process orientation to their innovation activities were more likely than their manufacturing counterparts to access advanced technologies through the acquisition of external intellectual property and (to a lesser extent) through the use of co-operation arrangements with customers and suppliers. By contrast, they were less likely to source advanced technologies through conducting in-house R&D, through co-operation arrangements with universities and/or research institutes or through the acquisition of advanced equipment. Service firms with an organisational change orientation to their innovation activities showed the same differences in comparison with manufacturers as did the services with a product and/or process innovation orientation, but in most cases the differences were even more pronounced: this is especially true of the lower likelihood of conducting in-house R&D and of co-operating with universities and/or research institutes, and the higher likelihood of accessing advanced technologies through co-operations with suppliers and/or customers.

These findings confirm our expectations that, overall, manufacturers are more likely to use 'hard' sources of knowledge and technology, whilst overall services, and especially those with an organisational orientation to innovation, emphasise 'softer' forms of knowledge and technology.

Another way to explore these patterns of response is through graphical representations. In Figures 3, 4 and 5 there are six circles, one for each of the sources of advanced technologies, plus one for the non-identification of any source. The size of each circle is proportionate to the number of firms providing each answer.[10] In the case of the manufacturers with a product and/or process orientation to their innovation activities (Figure 3), it can be seen that roughly similar proportions of the firms identified 'in-house R&D', 'co-operations with customers and suppliers' and 'the acquisition of advanced machinery and equipment' as (one of) their main source(s) of advanced technologies (remember that each firm could only identify up to two 'main sources'). The number of firms that identified co-operations with universities and/or research institutes was smaller (as indicated by the smaller circle), and fewer still identified the acquisition of external intellectual property as (one of) their main source(s) of advanced technologies. Finally, relatively few firms failed to identify any source of advanced technologies as being important.

The circles are then divided as pie charts. The first segment, identified in black, is the proportion - amongst the firms that identified the source - that only recognised this source of advanced technologies (i.e., they did not identify any other source). Amongst the manufacturers with a product and/or process orientation to their innovation activities, these black segments tend to be relatively small (being largest - but still less than a quarter of the firms - for those that identified

[10] This analysis treats each firm equally (i.e., large firms are not given greater weight than small firms).

the acquisition of advanced machinery or equipment as their main source of advanced technologies). The other slices of each circle are coupled with another circle. This shows the proportion of firms that identified a particular source that also identified another source of advanced technologies. For example, amongst the manufacturers with a product and/or process orientation to their innovation activities, about a third of the firms that identified 'in house R&D' as a key source of advanced technologies also identified 'co-operations with customers and/or suppliers' as a key source.

The three figures show these mappings for manufacturers with a product and/or process orientation to their innovation activities (Figure 3), service firms with a product and/or process orientation to their innovation activities (Figure 4), and service firms with an organisational orientation to their innovation activities (Figure 5). Each mapping contains considerable information, which is best gathered through visual inspection and through making comparisons. Rather than describe each in detail, we draw out some particular points:

- R&D is clearly most important amongst manufacturers, with almost half citing this as a source of advanced technologies. But also notable is that more than half of the manufacturers that sourced advanced technologies through R&D also sourced technologies through collaborations, with either customers or suppliers, or with universities or research institutes. The use of in-house R&D as a key source of advanced technologies is less amongst services, especially amongst those with an organisational change orientation to their innovation activities.

- Services are often considered 'supplier dominated' users of technology (Pavitt, 1984; Miozzo and Soete, 2001). However, service firms tended to be slightly less likely than manufacturers to claim acquired technologies (either in the form of advanced machinery and equipment, or in the form of intellectual property) were their key source of advanced technologies, and moreover only a small proportion (~15%) of all three firm types indicated they accessed advanced technologies only through the acquisition of advanced machinery and equipment and/or through the acquisition of external intellectual property.

- As we hypothesised, the source of advanced technologies that is perceived as being particularly important in services, and more so amongst those with an organisational orientation to their innovation activities, is co-operations, particularly with customers or suppliers. A third of the service firms with an organisational change orientation to innovation only identified the co-operative sources of advanced technologies (including those with universities and research institutes), compared with a quarter of the service firms with a product and/or process focus, and just 16% of the manufacturers in the analysis. This clearly shows the significance of co-operations as a 'knowledge channel' for service firms, and especially for those with an organisational orientation to their innovation activities.

Figure 3

Accessing Technologies – Manufacturers, Product & Process Innovation

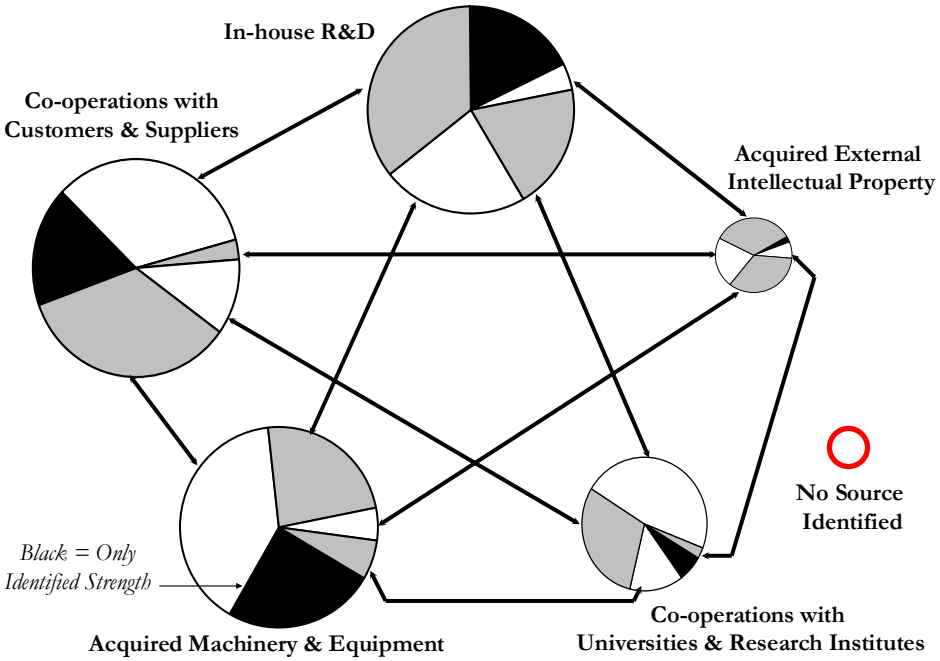


Figure 4

Accessing Technologies – Service Firms, Product & Process Innovation

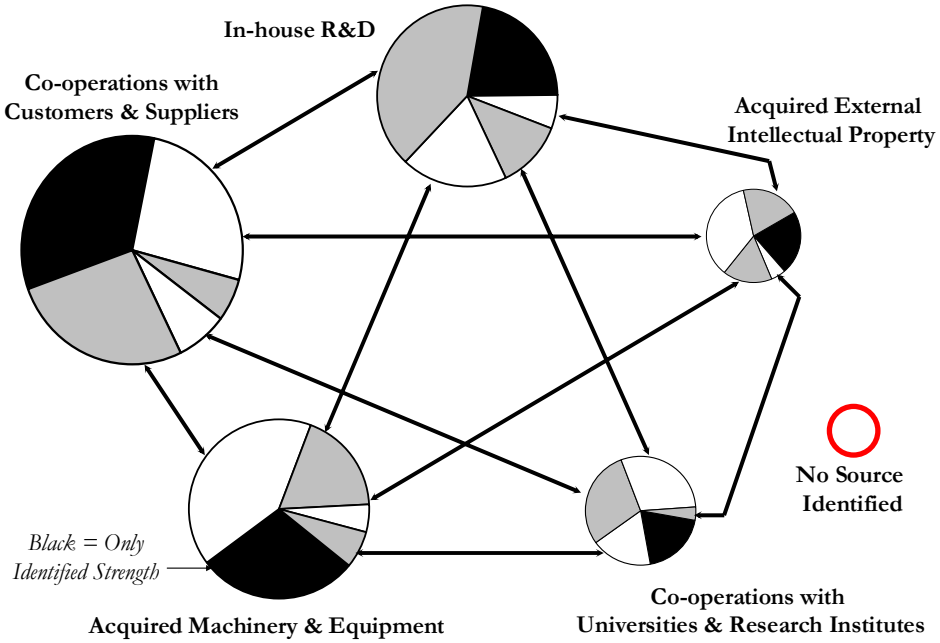
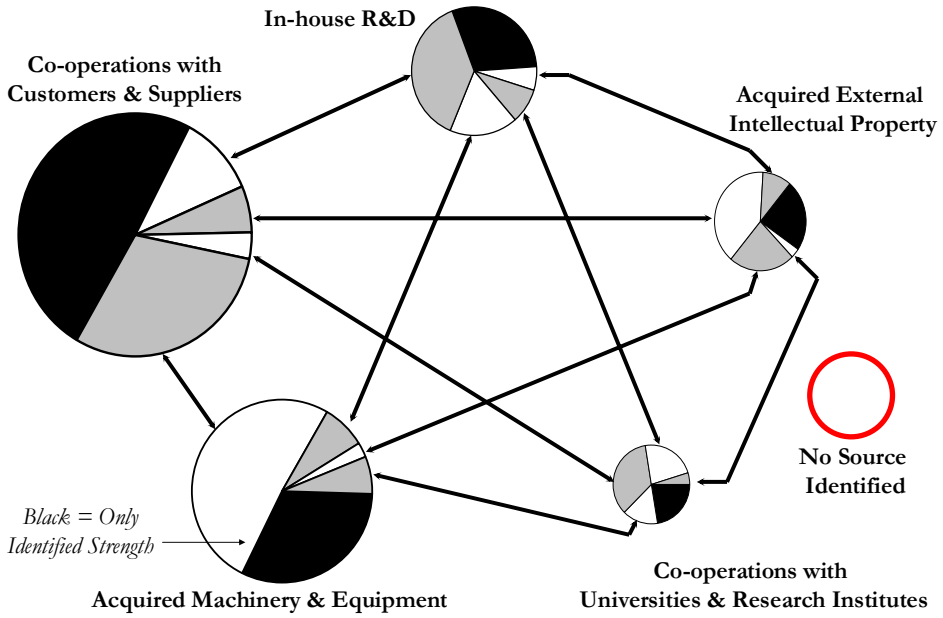


Figure 5

Accessing Technologies – Service Firms, Organisational Innovation



4.2 Perceived Strengths at Innovation

Having examined the sources of advanced technologies and how these differ between the three types of firms examined in this paper, we now turn to the firms perceived 'strengths at innovation'. The survey suggested that these might reside in six attributes: [1.] 'technological advance and research and development (R&D) competencies'; [2.] 'efficient production methods and making the best use of resources'; [3.] 'flexibility and adaptability of production to market needs'; [4.] 'leadership in finding out and exploiting new market trends'; [5.] 'good co-operation practices with suppliers, customers or trade associations'; and [6.] 'qualifications of staff and their professionalism'. Again, according to the 'rules' of the survey, the firms could identify up to two of these.

We hypothesised that the manufacturers would place an emphasis on 'hard' strengths found especially in R&D and efficiency, whereas services, and especially those with an organisational orientation to their innovation activities, are expected to place an emphasis on 'softer' attributes, such as the skills of their workforce and their co-operation practices with suppliers and customers.

Table 3 reports the simple proportions of firms that identified each of the attributes as 'a strength'. Amongst manufacturers with a product and/or process orientation to their innovation activities the most widely recognised 'strength at innovation' was the adaptability or flexibility of production to meet market needs. This was identified by almost half of this group of firms. But, perhaps surprisingly, this strength was not as widely recognised amongst the service firms (it was cited by a third of service firms with a product and/or process orientation to innovation, and by less than a quarter of the service firms with an organisational change orientation to innovation), and nor was it the most widely recognised strength amongst the service firms. Amongst both groups of service firms the skills and professionalism of the workforce was the most widely identified 'strength at innovation', with 'co-operation practices with customers, suppliers or trade associations' second. The service firms were also more likely to claim 'leadership in the

identification and exploitation of market trends' as (one of) their strength(s) at innovation. Meanwhile, a quarter of the manufacturers identified having efficient production methods and making the best use of resources as being (one of) their key strength(s) at innovation, and over a fifth claimed technological advance and/or R&D was (one of) their key strength(s). In line with expectations, these strengths tended to be less widely recognised by the service firms.

To examine whether or not these differences are statistically significant, and whether differences remain after controlling for firm size, age and country differences, we modelled each 'strength' through a logistic regression (specified in the same way as the regressions for the sources of advanced technologies outlined above). These models (see Table 5) show that:

- **Firm Size.** In line expectations, the identification of 'technological advance and R&D' as a strength at innovation tended to increase with firm size. There was also a weak positive relationship between firm size and citing 'the identification and leadership in market trends' as a strength at innovation. By contrast, the identification 'good co-operation practices with suppliers, customers and trade associations' as a strength at innovation tended to decline with firm size, as did the identification of 'flexibility and adaptability to meet market needs'. Both of these might be considered to relate to flexible, organic approaches to business, rather than to mechanistic approaches based on standardised products and processes. There was no statistically significant relationship between firm size and the identification of 'staff qualifications and professionalism' or 'efficiency of production and making the best use of resources' as strengths at innovation.

- Perhaps surprisingly, **Recently Established Firms** were significantly more likely to identify technological advance and R&D as (one of) their key strength(s) at innovation. This finding might be due to these being relatively fast growing new firms (as they had to have at least 20 employees to be included in the survey). Past research has shown that technologically innovative firms tend to grow more rapidly than their more mundane counterparts (Westhead and Cowling, 1995; Tether and Massini, 1998). There was weaker evidence that newer firms were less likely to claim 'co-operation practices with suppliers, customers and trade associations' as (one of) their strength(s) at innovation, perhaps because, being recently established they have had less time to form such relationships. These apart, there were no statistically significant differences in the strengths at innovation identified by recently established firms relative to older firms.

- **Services vs. Manufacturers.** After controlling for firm size and age (and country differences), service firms with a product and/or process orientation to their innovation activities were more likely than their manufacturing counterparts to claim strengths at innovation from their 'staff qualifications and professionalism' and from 'leadership in the identification and exploitation of market trends'. By contrast, they were less likely to claim their strengths lay in 'flexibility and adaptability of production to market needs' and in 'efficient production methods and making the best use of resources'. There was no significant difference between the two groups in the extent to which they identified strengths in 'co-operation practices with suppliers, customers or trade associations' or (perhaps surprisingly) in 'technological advances and R&D competencies'. In comparison with the manufacturers the service firms with an organisational change orientation to their innovation activities were significantly more or less likely to identify each of the sources as a strength at innovation, and in general the differences were greater than those found in the first comparison of manufacturers and service firms where both claimed product and/or process innovation orientations. In particular, the service firms with an organisational change orientation were significantly more likely to identify 'staff qualifications and

professionalism', 'co-operation practices with suppliers, customers and trade associations' and 'leadership in the identification and exploitation of market trends' than were the manufacturers. However, they were also less likely to claim 'flexibility and adaptability of production to market needs', 'efficiency of production and making the most of resources' and 'technological advance and R&D competences' as their key strengths at innovation. The existence of statistically significant differences in the extent to which all six of these 'strengths' were identified between the manufacturers and the service firms with an organisational change orientation to innovation suggests real differences between the approaches to innovation of these two groups – the first of which tends to be based around more mechanistic, step-change approaches, the second of which tends to be based on organic approaches and continuous change.

To examine these distributions further we again present the mappings following the methodology that was outlined earlier with regard to the sources of advanced technology. In this case each diagram has seven circles, one for each of the six 'strengths at innovation' plus one for those firms that were unable to identify any of these as their strengths at innovation. Again, the size of the circles is proportional to the share of the firms identifying each strength, the black slices relate to those firms that identified a single strength, whilst the other slices are connected showing the couplings of jointly identified strengths at innovation.

These diagrams (Figures 6, 7 & 8) contain considerable information, which is difficult to summarise. Instead, we highlight the main finding, which is the striking significance of 'co-operations' and 'staff qualifications' amongst the service firms with an organisational orientation to their innovation activities. Amongst the manufacturers with a product and/or process orientation to innovation, 40% of the firms did not identify either of these as 'strengths at innovation', and only 8% claimed both as strengths. The corresponding figures for service firms with a product and/or process orientation to innovation are 32% and 13%. Amongst the service firms with an organisational orientation to innovation, however, only 15% did not claim either of these as a strength, whilst a quarter claimed both as their 'strengths at innovation'. This would appear to indicate the significance of this 'soft' mode of innovation amongst these firms. Meanwhile the significance of technological advance and R&D competences is notably reduced amongst the service firms that focused on organisational change, relative to both the other service firms and the manufacturers in the analysis. Overall, these findings suggests that restricting our attention to 'hard' indicators of technology and innovation will favour manufacturers relative to service firms.

Figure 6

Strengths at Innovation – Manufacturers, Product & Process Innovation

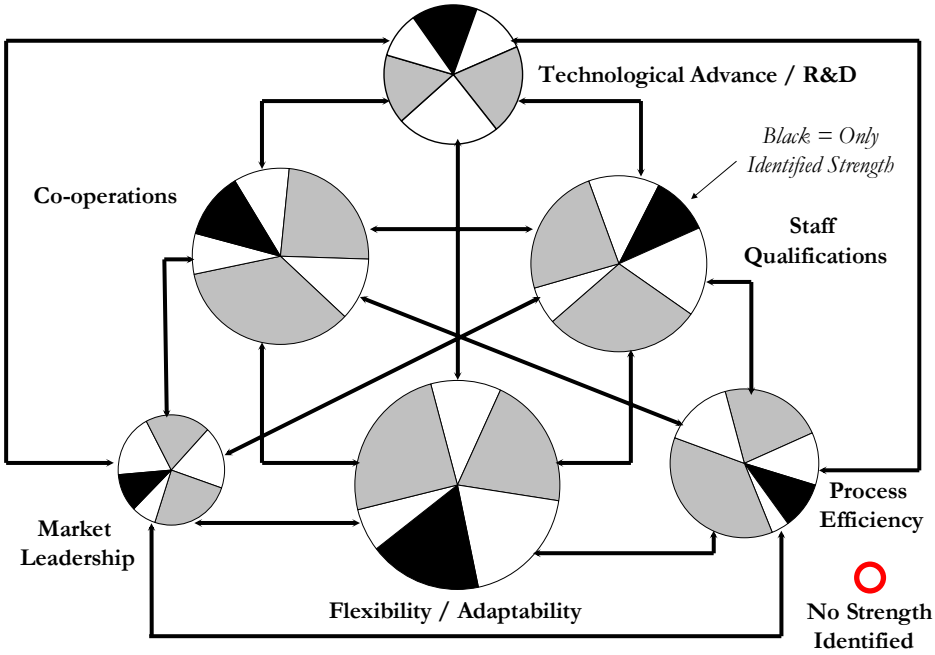


Figure 7

Strengths at Innovation – Service Firms, Product & Process Innovation

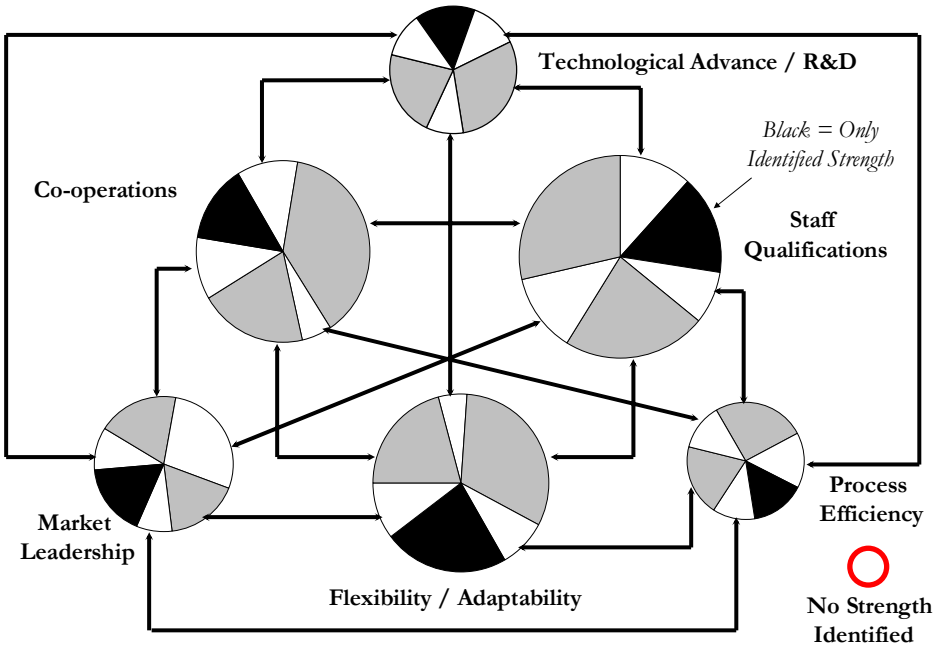
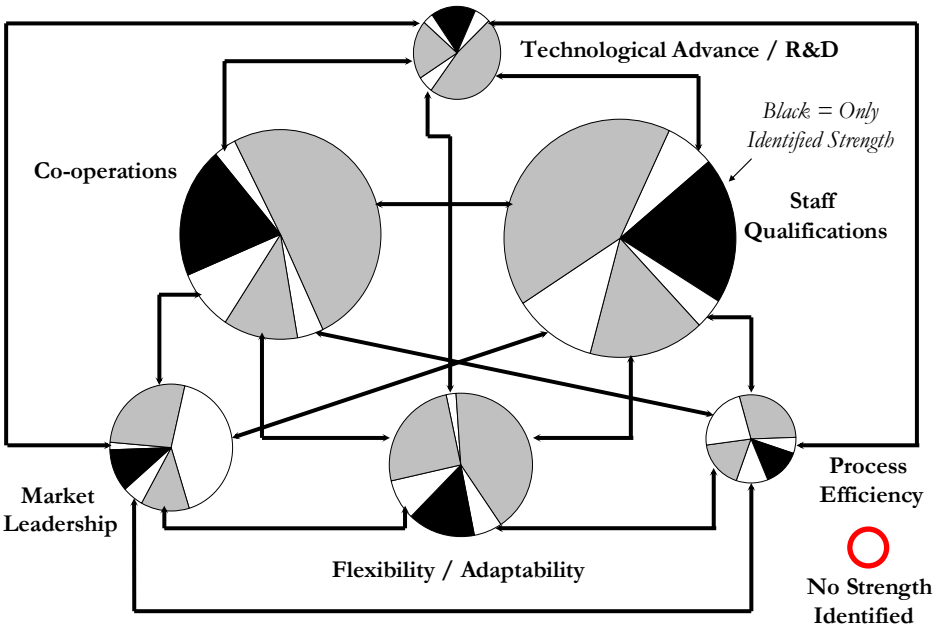


Figure 8

Strengths at Innovation – Service Firms, Organisational Innovation



5. Conclusions and Discussion

In this paper we have explored the 'Innobarometer 2002' survey data to investigate innovation in services, and to compare the pattern and approaches to innovation in services with those amongst manufacturers. The context for this investigation is the widespread perception that services are, at best, less innovative than manufacturers, if not largely passive adopters of technology, as is implied by the labels 'supplier dominated' (Pavitt, 1984; Miozzo and Soete, 2001) and 'technology users' (Evangelista, 2000). If that perception is correct, then as our economies shift away from manufacturing and towards services it follows that their capacities to 'truly innovate' (as opposed to their capacities to absorb technologies) would appear to be diminishing.

An alternative perspective is that services tend to innovate differently, with a greater emphasis on continuous change, based on 'soft' capabilities, such as the skills of their workforce and co-operation practices with suppliers and customers, rather than taking the traditional 'staircase of innovation' approach based around the punctuated change of well defined products (and processes), which is itself based on more mechanistic approaches to business.

Thus we have asked: 'do services innovate (differently)?', effectively asking: 'do services innovate?', and: 'do services innovate differently from manufacturers?'. The first answer is simply 'yes'. At very least the evidence of the Innobarometer survey examined here, as well as a host of other evidence including that from the second and third European Community Innovation Surveys (CIS) shows that services innovate (e.g., Tether et al., 2001; Tether 2003, Gallouj, 2002; Howells and Tether, 2004; Miles, 2004; Roper and Hewitt-Dundass, 2004). More interesting questions include whether services are more or less innovative than manufacturers, and the evidence of the Community Innovation Surveys (CIS) suggests they are less innovative, or tend to be less likely to engage in (technologically) innovative activities (Tether et al, 2001). The issue then becomes whether this difference is 'real', or whether it is due to the approach to

identifying and measuring innovation operationalised in the CIS, which may be better at identifying the innovative activities of manufacturers than those of service firms.

We therefore turn to the question: 'do services innovate differently from manufacturers?' The answer to this is both 'yes', and 'no'. The answer is yes in the sense that the evidence shows services tend to have an orientation to innovation that differs from that of manufacturers. In particular, many service firms have an organisational change orientation to their innovation activities whereas this appears to be relatively uncommon amongst manufacturers. But this is not just a difference in terminology, for there were also further differences between manufacturing and service firms in terms of their sources of advanced technologies and in their perceived strengths at innovation. Manufacturers are more likely to source advanced technologies through in-house R&D, the acquisition of advanced machinery and equipment and through collaborations with universities and research institutes, whereas services, and particularly those with an organisational orientation to their innovation activities, are more likely to source new technologies through collaborations with customers and suppliers, or through the acquisition of external intellectual property. In terms of their perceived strengths at innovation, manufacturers are more likely to emphasise technological advances and R&D competencies, alongside the flexibility and adaptability of production to market needs and having efficient production methods. Meanwhile services are much more likely to place an emphasis on the skills and professionalism of their workforce, and (particularly amongst the service firms with an organisational orientation to innovation) on their collaborative interactions with customers, suppliers and trade associations. Overall this suggests manufacturers tend to have place greater emphasis on 'hard' strengths and sources of technology, whereas services emphasise 'soft' advantages and attributes.

But the answer to the question 'do services innovate differently?' is also 'no' in the sense that there is no distinctively different, or unique, 'services pattern of innovation'. Others have claimed that: "Innovation in services is … best seen as a form of collective or collaborative problem solving, in which networks of companies work together to meet a market need or opportunity. The key dynamic for innovation in services is therefore one of interactivity rather than – as in manufacturing – firms' internal capabilities" (Roper and Hewitt-Dundass, 2004, p. 3) But this is incorrect because it gives the impression that there is a distinctly different mode of innovation in services from that in manufacturing. The truth is there are a variety of modes of innovation, but some – such as that identified by Roper and Hewitt-Dundass - are more commonly found amongst services whilst others are more commonly found amongst manufacturers. In other words it is possible to find service firms that report using the sources of advanced technologies and having the strengths at innovation that are much more typical of manufacturers, just as it is possible to find manufacturers using the sources of technology and having the strengths at innovation that are more commonly found amongst service firms. There is not a 'manufacturing mode' and a separate 'service mode' of innovation.

This should not be a surprising conclusion, for services contain a wide variety of activities, from large scale providers of mass services (such as retail banks and airlines) to specialist providers of highly interactive and often co-produced services (such as consultancies). A serious challenge remains to unpack these different types of services and to explore their different approaches to innovation, including the extent to which they use 'hard' and 'soft' technologies. But the ultimate aim of research such as this should not be just a better and more nuanced understanding of innovation in particular services, but to better understand innovation in all economic spheres, including manufacturing, construction, the utilities and services, including public services. This requires that we re-consider the fundamental questions: 'what is innovation?', and 'what role does technology play in innovation?'

Taking the second question first, it would appear that much of innovation studies, and particularly that associated with 'innovation measurement' considers technology rather narrowly, as the production and use of functionally new or significantly improved artefacts. This has led to the focus on two forms of innovation: technologically new and improved products, and technologically new and improved processes. There are probably two reasons for this focus. Firstly, these types of innovation are relatively easy to identify and measure, whereas organisational changes have been considered too idiosyncratic to identify and classify. Secondly, there is an underlying assumption that the supply of 'hard' technologies is the key driver of economic growth, which is the key to much interest in innovation. However, whilst at the aggregate level and in the long run the supply of new 'hard' technologies is clearly important for innovation and growth, this is not necessarily the case at the micro level and in the short run – the level at which innovation is measured by surveys such as the Community Innovation Survey. Interestingly, the Innobarometer 2002 found that only about a fifth of the surveyed firms claimed 'accessing or using new technologies' was a key inhibitor of their innovation activities (European Commission, 2002, p. 39). More firms were hampered by their access to financial resources and to human resources (both at around 30%), whilst the most widely identified barrier to innovation (at one third of the firms) was 'access to innovative customers and/or markets' (ibid). This suggests understanding the 'demand side' and understanding how to apply both innovative and existing technologies to new and existing business models is a more significant and immediate issue for most firms than the supply of new technologies. Unfortunately, alongside services, the demand side has tended to be neglected by scholars of innovation.

Regarding the definition of innovation, Schumpeter considered innovation to be broader than technological product and process innovation, and a fuller conceptualisation of innovation (by firms) should, in my opinion, focus on three domains.[11] The first domain is the firm's outputs - what is provided and to whom? Product innovation is clearly an important element of this, but so too is market innovation, in the sense of opening up, or breaking into, new markets. The second domain concerns the internal organisation of the firm – how it organises its own activities for the provision of its outputs. This includes both process innovation and other changes in the way in which firms organise their activities. The third domain concerns the external organisation of provision – this includes changes in the sources of supply, as well as changes in the firm's relations with its suppliers, customers and other agents in its 'innovation network', such as competitors or universities. Arguably the third of these has received relatively little attention. But it should also be stressed that these 'domains' are not wholly independent, but overlapping, and in general they are probably less independent (i.e., more overlapping) amongst services than amongst manufacturers. For a change in the internal (or external) organisation of provision may have an impact on the nature of the products or services provided, and the outsourcing of activities previously undertaken in-house implies a change to both the internal and external organisation of provision. Nevertheless, this conceptualisation is useful in understanding the various dimensions of innovation.

But innovation implies more than just change; it involves (previously) non-routine activities intentionally aimed at improvements in what is provided, or to the efficiency of provision (and in the context of firms) in return for expected entrepreneurial rents relative to doing nothing other

[11] By invoking Schumpeter I do not wish to argue for a 'strictly Schumpeterian' definition of innovation (Drejer, 2004). In the first place Schumpeter's definitions were not precise, but beyond that much has changed in the world in the 50 years since Schumpeter's death. He cannot have anticipated many changes to the way in which firms approach innovation (e.g., the increasing in importance of platform technologies, rather than products or processes). Rather than taking a strictly Schumpeterian approach, I would argue for an approach inspired by Schumpeter.

than carrying on with the existing routines. Some degree of uncertainty as to the actual outcome is also an important feature of innovation, and sunk costs are symptomatic of innovation. It is doubtful that a change that is easily reversible at little or no cost should be considered an innovation. Another issue is the extent of change implicit in the term innovation. Arguably, the most widely held conceptualisation is 'the innovation staircase' as outlined in the introduction to this paper, where innovations occur as occasional, discrete 'steps' in the quality of what is provided or in the means of provision. But, as we have stressed throughout this paper, changes in quality can also occur through continuous changes, or 'the accretion of little details' (Gilfillan, 1935). Here each 'little detail' may not itself constitute an innovation, but the sum of the changes does suggest innovation. Arguably, this form of continuous innovation is more common in services than in manufacturing (and particularly in traditional, scale oriented manufacturing). An example is runway operations at major airports, which were investigated by Tether and Metcalfe (2003). Although runway operations were observed to have become significantly more efficient over the last 20 years, we had some difficulty identifying discrete innovations, despite the improvements being gained through sources other than simple 'learning by doing' (i.e., benefits of experience). One senior air traffic control manager told us frankly: 'we do not innovate'! This perhaps indicates that the manager associates innovation with step changes (and perhaps also with 'hard' technology), rather than with continuous improvement and 'soft' changes in practice.

The last decade has seen a considerable flourishing of research on innovation in services. We still know far less about services and their innovation activities than we do about manufacturing, and especially high technology (i.e., R&D intensive) manufacturing. But it is increasingly clear that services are not just 'supplier dominated - technology users'. There are many are 'true innovators' amongst service firms. What is important is that they often innovate through means that are more subtle (including an emphasis on human skills and inter-firm co-operations) and more easily overlooked by traditional indicators such as R&D expenditures. But importantly these approaches to innovation are not peculiar to services. Although more prominent amongst services they are also found amongst manufacturers and other economic agents.

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Appendix Table A – Summary of the Response to the Innobarometer 2002

	Manufacturing	Services	Other *	Total Response
By Country				
Austria	60	108	32	200
Belgium	61	119	27	207
Denmark	66	103	33	202
Finland	34	56	13	103
France	71	189	45	305
Germany	76	174	50	300
Greece	36	36	29	101
Ireland	23	59	18	100
Italy	142	123	36	301
Luxembourg	15	52	25	92
Netherlands	46	128	26	200
Portugal	46	42	12	100
Spain	70	154	76	300
Sweden	66	106	28	200
UK	84	195	24	303
By Firm Size[#]				
Small	487	1113	328	1928
Medium	235	334	97	666
Large	174	197	49	420
Total	896	1644	474	3014

* - Construction, Civil Engineering and Raw Material production – not included in the analysis
[#] - Firm size: Small: 20 to 49 employees; Medium: 50 to 249 employees; Large: 250+ employees

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