INNOVATION STRATEGIES AND PERFORMANCE OF THE EUROPEAN FIRMS

A PhD project description submitted by
Koson Sapprasert, 3.3.2007

My PhD Research in a Nutshell

With a decent opportunity of being able to get hold of several novel empirical materials, namely the CIS3 (Community Innovation Survey) firm-level data from five European countries, the Norwegian CIS4 and the Norwegian CIS panel data, my PhD research is focused on exploiting these fruitful datasets in the pursuit of new findings in connection with innovation strategies and performance of firms with particular concern on: (i) how firms search for new knowledge and what factors are crucial for their search strategies; (ii) how these diverse strategies affect firm’s innovative performance; (iii) how size matters for the organizational innovation propensity and its consequence (this part has been first set off and some preliminary findings are discussed below); and (iv) how ICT (Information and Communication Technology) fosters service innovation. This nontrivial research is based on important theories and prior works from several arenas in the field of innovation studies chiefly inspired by Schumpeter (1934, 1950). First and foremost, these micro-level analyses see the firms through Nelson and Winter’s (1982) lenses; considering them as living by many routines. To search for new knowledge conducive to an innovation is an important one (Levitt and March, 1988; Kogut and Zander, 1992). Firms may either search internally or explore outside for knowledge and apply it in a process of innovation (Cohen and Levinthal, 1990; March, 1991; Grant, 1996) in which results from risking through diverse strategies can be measured by, e.g., new product and process (Katila and Ahuja, 2002), share of turnover due to innovation (Laursen and Salter, 2005) and innovation speed (Heirman and Clarysse, 2004). My PhD research is also extended to investigate the importance of organizational innovation and its effect that can be explained by firm size and other diversities (Downs, 1967; Hannan and Freeman, 1984). The final is to scrutinize the productive relationship between ICT and service innovation seen as contribution to prior works such as by Gershuny and Miles (1983), Barras (1986), Evangelista (2000), Miles (2000, 2005) and Sapprasert (2006).
Datasets

Recent years have seen many attempts to exploit the CIS data to explore the world of innovation. This data based on the Oslo manual is of essence when it comes to the evolutionary study having an adverse view vis-à-vis orthodoxy, which struggled in getting to understand the impact of innovation and technical change primarily using R&D data in an ad hoc fashion (Nelson and Winter, 1982). Smith (2005) enumerates a comprehensive list of various works on the basis of CIS micro-aggregated data that take into account the importance of non-R&D inputs to innovation as well as their diverse outcomes not only radically new products and processes. Examples are the work by Evangelista and Savona (2002) using CIS1 & 2 data from Italy, the study of innovation strategies by means of CIS1 data from Belgium (Veugelers and Cassiman, 1999) and using of CIS2 data from the UK to investigate firm’s innovation through collaboration (Tether, 2002), just to mention a few. Nonetheless, it can be said that previous versions of CIS (especially the first and second) embraced some flaws; limiting other important aspects of innovation studies. For example, service and non-technological innovations were relatively neglected. The time span of CIS data is also quite short which may not be suitable for many types of analysis that require a dataset with longer time lag than three years. In addition, an access to the CIS micro-data in a number of countries is limited; hindering a coherent comparability of findings at the firm level across countries.

Three subtle uses of CIS data are thus proposed for the work on a few questions in my PhD research. First, as part of the MICRO-DYN (WP1: Exploring knowledge and innovation activities of European firms) project, CIS micro-data (most likely CIS3) from at least five European countries will be exploited for the investigation of innovation strategies (knowledge search strategies) and their effects on European firms in the first two research papers. Besides the Norwegian CIS3 on hand, four countries promised to supply their CIS3 datasets for this work are France, Germany, Sweden and the Netherland. The third paper will be done with the use of the first Norwegian CIS panel data. As an access to the firm’s identification in the Norwegian CIS1 – CIS4 has already
been obtained, the panel dataset is to be newly constructed and utilized to study the firm’s innovation speed. Finally, the newest version of CIS data from Norway, CIS4, is to be advantageously employed in the last two papers. The fourth research paper will benefit considerably from the novel information in the CIS4 dataset with regard to the organizational innovation in the firm as well as its estimated outcome that is more extensively emphasized on in this version. The last paper will also exploit the novel information from CIS4 on service innovation as to what extent it may be explained by R&D in ICT in the preceding period (data derived from CIS3).

Four Research Questions and Methodologies

Question 1: How and why do firms differ in the way they search for knowledge?


To search (e.g., for new ideas and solutions) is one of the firm’s most crucial behavioral patterns or ‘routines’ for survival, competitiveness and growth (Cyert and March, 1963; Nelson and Winter, 1982). Knowledge as conferred by Grant (1996) as the most strategically important firm’s resource thus has to be discovered/recognized, accumulated/combined and applied into commercial practices, i.e., searching for knowledge essential to firm’s innovation. Some firms may search for knowledge locally or internally (Stuart and Podolny, 1996), while the others possibly explore outside in the pursuit of external knowledge (Chesbrough, 2003). Both internal and external knowledge can be thought of as an important input thrusting towards the firm’s innovative performance. However, the trade-off nevertheless exists between these two strategies since exploring outside for the new alternative usually reduces the acceleration of the internal search being implemented and vice versa. Firms therefore often have to make only choice worth allocating their effort for due to scarce resources (Radner and Rothschild, 1975).
Based on March (1991) and Katila and Ahuja (2002), it is argued in this study that both searching for knowledge internally and externally are of essence where neither of them can be neglected. Firms are indeed different in terms of their search strategies and this study is proposed to investigate in the questions of how and why. The study extends in many respects the recent work *inter alia* by Veugelers and Cassiman (1999) using the CIS1 data from Belgium to examine manufacturing firms’ innovation strategies to ‘make’ and ‘buy’ new knowledge/technology. My research is in a position that is able to use the more recent data, CIS3, from several sources to conduct a comparative cross-countries analysis. It in addition takes into consideration service firms that are in fact relatively more important contributors in the modern economy (Miles, 2005). In terms of methodology, this study will seek to exploit an advantage of structural equation modeling using LISREL (see, e.g., Kelloway, 1998; Joreskog, 2005) in the investigation of how firms search for knowledge and what determinants are crucial when making a decision on their innovation strategy. This analytical method is seen nicely suitable and interestingly viable for this part of my PhD research as it is one of the best techniques to precisely explore the relevance of indicators on each construct and, more importantly, the effects of exogenous ones on the dependent latent variable of concern (Bollen, 1989; Maruyama, 1998), i.e., it is a decent method that really lets empirical materials explain reality.

The following is a concise delineation of my prospective analysis. First, different indicators required for constructing important factors affecting a firm’s strategic decision on the search of knowledge will be taken from many relevant observed variables in the CIS3 dataset. For example, organizational factors can be considered to comprise indicators such as firm’s innovativeness, size and type of business activities (sector). Customer demand, market and financial condition are important measures of economic factors. Institutional factors may be composed of the variables representing public supports including R&D subsidies, partnership, appropriability and regulations. External factors at the country level may additionally be obtained and included such as differences in a variety of national policies and other factors related to the national system of innovation (Lundvall, 1992; Nelson, 1993). It is hypothesized that these factors have different impacts on a firm’s decision to search for new knowledge. Two distinguishable
strategies, internal and external search, are of interest here. The former can have indicators like in-house R&D expenditure/personnel and use of internal information sources, while purchase of either embodied or disembodied external knowledge, e.g., machinery and patents, acquisition of external R&D and use of external information sources such as from partners and competitors may be used to form a latent dependent variable for the external search. All these constructs and their indicators will be put in a structural equation model and scrutinized to explain how and why firms differ in the way they search for knowledge.

Question 2: How do different search strategies affect firm’s innovative performance?

There is no need for much effort to conceive that innovative firms in an ongoing knowledge-based economy have to consistently search for new knowledge necessary in an innovation process. The firm’s intention to search is important, but what is more crucial lies in a question of how to undertake it through the right path, owing to the inference that different search strategies may lead to vary outcomes. As outlined above, knowledge could be found both inside and outside the firm. To search internally might be better for innovative performance because some internal knowledge may be unique to the firm, seen as a key building block of a very distinguishable innovation in the market. Also, the firm is generally more familiar with internal knowledge (Katila and Ahuja, 2002). Embarking through this path is likely to result in the more predictable and reliable search and the less probability of false start and/or slip in the innovation process (Levinthal and March, 1981). On the contrary, some firms tend to get connected with and develop their new product and process by virtue of external knowledge banks—seen as the thrust of distinctive new variations—regarded to be worth more than internal ones (Sakkab, 2002). Chesbrough (2003) further asserts that the successful innovation rests more strongly on outer knowledge sources, the firm thus should not internally over-search, but be more open by exploring outside widely and deeply in order to achieve higher innovation performance (Laursen and Salter, 2005).
In line with Katila and Ahuja (2002) and Cassiman and Veugelers (2005), it is contended here that internal and external knowledge are complementary, i.e., to search both inside and outside the firm yields greater return. For instance, in-house R&D not only raises internal knowledge, but also strengthens the firm’s absorptive capacity; supporting the process of assimilating external knowledge and applying it to commercial ends (Cohen and Levinthal, 1989, 1990). On the other side, external knowledge enlarges the firm’s internal knowledge pool with new variations that may allow new combinations of knowledge towards very distinctive innovation and hence more profitability (Katila and Ahuja, 2002). This part will attempt to examine how two innovation strategies, internal and external search, differ in the extent to which they underpin innovative performance of the firm. Two methods will be used. The first will go with a basic econometrics to investigate how CIS measures (CIS3) of innovative performance are supported by these two strategies. Besides three standard technological innovation indicators which are product innovation, process innovation and turnover due to innovation, non-technological innovation measured by several changes in the organization (strategic, managerial, organizational, marketing and aesthetic innovation) will also be employed as dependent variables in the regression models. With regard to explanatory variables, the coherent indicators of innovation strategies (internal and external search) and of other factors that will have been resulted from the abovementioned structural equation modeling in the previous stage of research (in dealing with question 1) such as sources of information, intramural R&D, acquisition of external knowledge, firm size and sector will be taken into consideration.

The second approach is to examine the impact of search strategies on the firm’s innovative performance concerning the decision’s effect on the ‘innovation speed’. A recent empirical study defines the innovation speed as the time elapsed from the firm’s start-up to the moment at which the first product is launched onto the market (Heirman and Clarysse, 2004). This is a crucially important subject as many entrepreneurs/managers do not thoroughly understand the ‘black box’ of innovation and feel that innovation takes time with no guarantee of success; thus hindering the firm’s
decision to innovate. By applying event-history or survival analysis usually engaged in the study of firm’s survivability (see, e.g., Christensen et al., 1998; Cefis and Marsili, 2004), this part will seek to extend the concept to investigate what strategic decision on knowledge search leads to the least time to successful innovation, i.e., to find out the practical way to swiftly innovate. On this account, the innovation speed is defined as consistent with Stalk and Hout (1990) and Kessler and Chakrabarti (1996) as a period from the moment at which new knowledge is achieved by the firm to the event that innovation is obtained or in other words, it denotes how long it takes to turn invention into innovation. To analyze this, the CIS panel dataset spans from 1990 – 2004 will be exploited. The time that new knowledge was taken by the firm will be set as a starting point in the model. ‘Emergence of knowledge’ is a variable that has the value equal to one if the firm has obtained a new internal and/or external knowledge in such period, and zero otherwise. For the ending point, the variable ‘successful innovation’ measured by innovation indicators derived from the CIS questionnaire similar to the aforementioned will be used. This variable equals one in a period of concern if the value of at least one of innovation indicators is positive, and zero otherwise. Several factors that influence the firm’s innovation process (akin to those employed in the first approach) will then be included as independent/control variables in order to investigate what affects the speed from the ‘emergence of knowledge’ to ‘successful innovation’. Above all, it is hypothesized in this part that both internal and external search are the chief determinants; the innovative performance (measured in terms of relevant indicators in the two foregoing methods) is most superior if the firm combines both strategies—rather than pursuing only either of them—to search for new knowledge that is seen as part and parcel of successful innovation.


This study analyzes how firms go about organizational innovation and how they can best reap the fruits of it. The ground conjecture is that ‘organizational routines’ intrinsically exist as the fundamental ways of doing things in the firm (Nelson and Winter, 1982). As
time goes by, the prevailing routines that used to be best may be found no longer acceptable as becoming obsolete. A revolutionary period is thus crucial (Anderson and Tushman, 1990; Romanelli and Tushman, 1994), i.e., old routines need to be replaced by something new before the firm is driven out of business. Though an inclination and dynamic capability to carry out organizational innovation are of great importance to the firm’s survival and competitiveness, it is not implausible that, due to diverse characteristics, firms differ in the extent to which they are able to bring about and benefit from such innovative routine changes (Nelson and Winter, 1982). In particular, this study further argues that size does matter considerably when it comes to the degree to which the firm undertakes and benefits from organizational innovation.

Mainly because of having a better financial status and more resources, larger firms in general may like to innovate more than their petite rivals do. However, it can be said that there commonly exists a higher resistance to organizational changes in large firms, that is, they are less prospective to be flourishing from conducting organizational innovation crucially owing to organizational rigidity or structural inertia (Downs, 1967). Larger firms have a complex structure and deep hierarchy that hinder a structural change. They may have also been living longer, instigating reluctance to unlearn past routines and could as a consequence have a higher probability to easily fall into a ‘competency trap’ (Levinthal and March, 1993). By contrast, being smaller would be more flexible and adaptive to organizational changes (Hannan and Freeman, 1984). Small firms typically have a less complex structure and shallower hierarchy; implying very little internal inertial force and less likelihood of facing path-dependency. So it could be expected that these small firms can benefit more from carrying out organizational innovation.

It is important to stress that organizational innovation in this sense does not refer broadly to adoptions of the whole range of novelties into the organization like that defined in, for instance, Damanpour (1991) and Sorensen and Stuart (2000). By ‘organizational innovation’, I mean an innovative change in the organization in a customary and institutional manner that is relatively non-technical and that is more related to the organizational nature, structure, arrangements, practices, beliefs, rules and norms
(Pettigrew and Fenton, 2000), rather than product and process trait. To quantitatively cast a brighter light on this facet of innovation studies, the novel information from the CIS4 dataset that embraces a noteworthy emphasis *vis-à-vis* that from preceding versions on the organizational innovation will be taken advantage of. The first main independent variable (CNTORG) used in the model depicts the extent to which the firm has attempted to carry out organizational innovation. The variable equals a count of the positive answers in connection with three organizational innovation activities (ranging from 0 – 3) in the firm which are: (i) new or significantly improved knowledge management systems; (ii) new or significant changes to organization of internal work; and (iii) new or significant changes in external relations. The second variable of chief concern is the firm size measured in two forms which are a log value of total number of employees (LogEmp) and size categorization (size1=10 – 19, size2=20 – 49, size 3=50 – 99 and size 4>=100). The dependent variable CNTorgEF (that is used to account for an effectiveness of the firm’s organizational innovation) illustrates the extent to which these organizational innovation activities enhance the firm’s performance, e.g., in terms of cost cutting, quality and satisfaction improvement, and increase in capacity and profitability.

In this analysis, since the dependent variable CNTorgEF is censored/limited, a Tobit regression is used in order to avoid a problem of specification bias commonly comes about when applying other estimation techniques such as Ordinary Least Squares (see, e.g., Laursen and Salter, 2006). In short, the study preliminarily finds that the introduction of new or significantly improved knowledge management systems, new or significant changes to organization of internal work and new or significant changes in external relations do enhance the firm’s performance in many respects (positive and statistically significant coefficients between CNTorgEF and several variables derived from the CIS4 questionnaire that are proxies for effects from organizational innovation). More importantly, results from the analysis show that: (i) the intensity of organizational innovation has, in general, a positive relationship with the firm’s performance, i.e., the more intense the firm innovates, the better the performance of the firm (a positive and statistically significant coefficient between CNTorgEF and CNTORG); (ii) however, firm size hinders the effective organizational innovation, i.e., bigger firms attempting
organizational changes are found to be less advantageous (a positive and statistically significant coefficient between CNTorgEF and the interaction variable of CNTORG and LogEmp).

Question 4: How do ICT and organizational changes foster service innovation in firms?

Following my prior attempt to marry ICT with services (Sapprasert, 2006), this research question is aimed at corroborating, subtly in a more coherent manner and on the basis of richer and newer empirical material. Briefly, my earlier work deals with a question of how ICT, regarded as the general purpose technology (Bresnahan and Trajenberg, 1995) and as the key input in the current techno-economic paradigm (Freeman and Louca, 2002), combined with organizational changes (Brynjolfsson and Hitt, 2000) jointly support service firms to grow higher vis-à-vis those in manufacturing. The work was built upon the relevant prior studies that acknowledge the importance of service innovation and/or appreciate the productive relationship between ICT and services which are, among others, Barras (1986), Licht et al. (1999), Evangelista (2000), Hempell et al. (2004) and Miles (2000, 2005). In particular, the main argument in this proposing study as in line with the earlier works is that the interactive and information-intensive characteristics of services make them greatly ‘ICT-friendly’ so that ICT, as regarded to be the most important new technology for innovation in these industries Licht et al. (1999), and organizational innovations shall be complementarily engaged in making service innovation most feasible.

My previous analysis defined services based on the NACE code. Service innovation was thus conceived as what indicated in the CIS3 questionnaire as innovative activities in firms, in the NACE’s service sectors. What has brought me a big concern is the synonymous use of the terms ‘service innovation’ and ‘innovation in services’ in many works mentioned above including mine (see a discussion of how the term ‘services’ may be analytically used in Gershuny and Miles, 1983). In such the contemporary ‘service economy’ (Fuchs 1968; Stanback, 1979), not only firms in the service sector can produce
and commercialize services to customers. A wide range of manufacturing firms in fact also involve service activities and components, e.g., after-sales services. Put another way, the boundaries between manufacturing and services are very blur. It is thus important, if one wants to thoroughly study ‘service innovation’ (see for instance, Drejer, 2004), to also take into consideration the service innovation possibly taken place outside the firms who define themselves as service. However, this has hitherto been very difficult due to the scarcity of detailed statistics (Castellacci et al., 2005).

Fortunately, the CIS4 data allows this research to contribute to the opening of the Pandora’s box as regard to this issue. The questionnaire for this latest wave of CIS includes a new significant question asking all firms in the sample set (both manufacturing and service) about the ‘service’ product innovation during the period 2002 – 2004. To scrutinize how ICT and organizational innovation foster this service innovation, the information on the share of ICT in R&D expenditure in 2001 and changes in an organization obtained from CIS3 will be employed as the main explanatory variables. In this respect, the second half of the CIS panel dataset embracing firms took part in CIS3 & 4 will be exploited. ICT R&D and organizational innovation as the variables of major concern combined with other relevant factors such as firm size and sector, past performance and other types of innovation activities derived from the CIS3 part will be used as independent variables in the regression models to examine their impact on service innovation (a dependent variable extracted from the CIS4 part) in not only service but also manufacturing and other firms.

References


Innovation Strategies and Performance of the European Firms

- Introduction
- Datasets
- Research Questions
- Theoretical Background
- Methodologies
- Preliminary Findings

Koson Sapprasert
Centre for technology, innovation and culture
Innovation Strategies and Performance of the European Firms

- Uses of novel empirical materials (European CIS3, Norwegian CIS4, Norwegian panel data - at the firm level)

- Schumpeterian approach, Evolutionary Economics (Nelson and Winter, 1982)
  1) Factors affecting search strategies
  2) Search strategies and innovative performance
  3) Size and organizational innovation
  4) ICT supporting service innovation

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Centre for technology, innovation and culture
Innovation Strategies and Performance of the European Firms - Data Issue

- CIS data -> non-R&D inputs to innovation & impacts not only radically new products and processes


- CIS micro-data across countries, CIS4 and CIS panel data (CIS1 - CIS4)

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Centre for technology, innovation and culture
Innovation Strategies and Performance of the European Firms - research questions

1) How and why do firms differ in the way they search for knowledge?
   ▪ Search as a behavioral pattern or routine (Cyert and March, 1963; Nelson and Winter, 1982)
   ▪ Knowledge search for the firm’s innovation (Grant, 1996)
   ▪ Internal Search (Stuart and Podolny, 1996) VS. External Search (Chesbrough, 2003; Laursen and Salter 2005)
   ▪ Tradeoff !!! (Radner and Rothschild, 1975)
Innovation Strategies and Performance of the European Firms - research questions

1) How and why do firms differ in the way they search for knowledge?

- Searching both inside and outside (Katila and Ahuja, 2002; Veugelers and Cassiman, 1999)
- Firm-level CIS3 from 5 European countries
- Factor analysis/Structural Equation Modeling
- Analyzing how factors (organizational, economic, sectoral, national) affect the firm’s decision on search
Innovation Strategies and Performance of the European Firms - research questions

2) How do different search strategies affect firm’s innovative performance?

- Different search strategies may lead to different outcomes
- Internal Search -> Uniqueness, Familiarity (Katila and Ahuja, 2002), Reliability (Levinthal and March, 1981)
- External Search -> New variations (Sakkab, 2002), Open innovation (Chesbrough, 2003; Laursen and Salter, 2005)
Innovation Strategies and Performance of the European Firms - research questions

2) How do different search strategies affect firm’s innovative performance?

- Complementary Search (Katila and Ahuja, 2002; Cassiman and Veugelers, 2005)

- In-house R&D -> raising internal knowledge + absorptive capacity (Cohen and Levinthal, 1989, 1990)

- Acquisition of new knowledge -> gaining distinctive knowledge + increasing internal knowledge pool (Katila and Ahuja 2003)

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Innovation Strategies and Performance of the European Firms - research questions

2) How do different search strategies affect firm’s innovative performance?

2.1 Using European CIS3 on a basis of econometrics

- Explanatory variables -> Internal and external search
- Dependent variables -> product and process innovation, turnover due to innovation, non-technological innovations (strategic, managerial, organizational, marketing, aesthetic)
Innovation Strategies and Performance of the European Firms - research questions

2) How do different search strategies affect firm’s innovative performance?

2.2 Using the Norwegian CIS panel (1990 - 2004) to examine the innovation speed (Survival Analysis)

- From the moment at which new knowledge is obtained (invention) to the event that innovation is achieved by the firm
- Investigating factors (two search strategies in particular) affecting the innovation speed

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Innovation Strategies and Performance of the European Firms - research questions

2) How do different search strategies affect firm’s innovative performance?

- Both internal and external search are crucial determinants of the firm’s innovative performance

- The outcome is best if the firm combines both strategies rather than pursuing either of them
Innovation Strategies and Performance of the European Firms - research questions

3) How does firm size matter for organizational innovation?
   - Organizational routines are to be changed as time goes by (Nelson and Winter, 1982; Anderson and Tushman, 1990; Romanelli and Tushman, 1994)
   - Firms differ in how they can be effective in and benefit from organizational innovation
   - Size does matter
3) How does firm size matter for organizational innovation?

- Large firms -> more likely to innovate (Schumpeter, 1950) but somewhat having a higher resistance to change due to organizational rigidity and structural inertia (Downs, 1967)

- Small firms -> more flexible and adaptive to changes owing to less complex structure and shallower hierarchy (Hannan and Freeman, 1984)
Innovation Strategies and Performance of the European Firms - research questions

3) How does firm size matter for organizational innovation?
   ▪ Tobit regressions on CIS4 data that comes with the novel information on organizational innovation activities and their impacts on the firm’s performance.
   ▪ Main explanatory variables -> organizational innovation (CNTORG) & firm size (LogEmp / Size)
   ▪ Main dependent variable -> firm’s performance superiority (CNTorgEF)

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3) How does firm size matter for organizational innovation?

- Organizational innovations (1. New or significantly changes in knowledge management system; 2. New or significantly changes in organization of internal work; 3. New or significantly changes in external relations) enhance the firm’s performance in many respects such as cost cutting, quality and satisfaction improvement, and increase in capacity and profitability
3) How does firm size matter for organizational innovation?
   - Organizational intensity has a positive relationship with the firm’s performance ‘in general’ (CNTORG -> CNTorgEF = +++)
   - Larger firms undertaken organizational innovation are found to be less advantageous (CNTORG & LogEmp -> CNTorgEF = ---)
4) How do ICT and organizational changes foster service innovation in firms?

- As a follow-up effort on marrying ICT with services (Sapprasert, 2006)
- ICT -> general purpose technology (Bresnahan and Trajtenberg, 1995), the key input of the present techno-economic paradigm (Freeman and Louca, 2002)
- ICT combined with organizational changes (Brynjolfsson and Hitt, 2000) -> higher growth of services vis-à-vis manufacturing
Innovation Strategies and Performance of the European Firms - preliminary findings

4) How do ICT and organizational changes foster service innovation in firms?

- Prior works concerning service innovation/ productive relationship between ICT and services (Barras, 1986; Evangelista 2000; Hempell et al., 2004; Miles, 2000)
- Compatible characteristics -> Interactive, information-intensive -> service innovation is ICT-friendly

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4) How do ICT and organizational changes foster service innovation in firms?

- Classification based on NACE code
- Thus, service innovation = innovation in services = innovation in firms in the NACE service industries
- But manufacturing and other firms can produce and commercialize services
- A great degree of service activities and components in manufacturing firms, e.g., after-sale services
Innovation Strategies and Performance of the European Firms - preliminary findings

4) How do ICT and organizational changes foster service innovation in firms?
   - Information from CIS4 on ‘service’ product innovation -> analysis of service innovation not in only service sector
   - Unique Information from CIS3 R&D survey on ICT R&D
   - ICT -> service innovation in Norway

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Centre for technology, innovation and culture