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## Innovation Activities in the Service Sector: Empirical Evidence from Portuguese Firms

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*This research aims to analyze the degree of importance of investment and expenditure on innovation activities for entrepreneurial innovative capability, in the scope of Portuguese services firms. The literature review considers three main approaches regarding service innovation: assimilation, demarcation and synthesis. A conceptual model was proposed and several research hypotheses were empirically tested using secondary data, belonging to the 4th CIS 4, supervised by EUROSTAT. The method used will be the logistic regression model. According to the results obtained, the greater the financial investment in acquisition of machinery, equipment and software, in internal research and development, in acquisition of external knowledge, in marketing activities and other procedures, the greater the propensity for firms to innovate in terms of services. This study highlights the contributions that innovation activities can provide in what regards the development of innovation process, giving special emphasis to their service innovation.*

**Keywords:** *Innovation, Services, Entrepreneurial Innovative Capability, CIS*

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## Introduction

In the last decades, we have seen an evolution of the service sector's role in the economy, its relevance increasing in innovation, competitiveness, employment and economic growth (Hauknes, 1998; de Jong, Bruins, Dolfsma and Meijaard, 2003; Howells and Tether, 2004; Tether, 2005). A study carried out in the European Union corroborates these facts, since in 2004, service sector, on average, accounted for 39,9% of total employment in the EU-25 and for 46,2% of added value (Arundel, Kanerva, Cruysen, Hollanders, 2007). From the growing importance of this sector, it becomes important to analyze the determinant factors of innovative capability in firms in general and service firms in particular.

This study aims to analyze the degree of importance of investment and expenditure on innovative activities for the innovative capability of service firms. Other studies (Author, 2003, 2009), analyzed some determinants that presented a significant impact on industrial firms' innovative capability, but for services the factors stimulating and restricting entrepreneurial innovative capability have yet to be identified and analyzed. The paper takes as reference the approaches to innovation in service. Considering this conceptual framework, this investigation intends to elaborate an empirical support to allow identification and analysis of the factors that affect innovative activity and performance in Portuguese service firms, more precisely in terms of innovative activities.

To test empirically the hypotheses formulated, use is made of secondary data supplied by the "Higher Education and Science Observatory" (OCES), belonging to the 4th Community Innovation Survey (CIS 4). This questionnaire was implemented under the supervision of EUROSTAT. To the data obtained, we apply the model of generalized linear regression, namely the logistic regression model.

The study is structured as follows: point two reviews the relevant literature on the subject of innovation in services and based on this, formulation of the hypotheses we intend to test empirically in the statistical model. Point three defines the sample and goes on to describe and characterize the variables used in the empirical study, with presentation of the logistic regression model. Point four analyzes the data. The final point

presents final considerations and suggests that future investigations are carried out.

## Literature Review

The importance of the innovation process in services is widely recognized, both theoretically and empirically, but the heterogeneity of the service sector and the lack of an innovation typology that allows integration of that diversity make theoretical teaching and empirical analyses difficult. The literature demonstrates a growing interest in the study of innovation in services. The service sector covers a wide range of different activities with greatly differentiating characteristics (Hauknes, 1998; Drejer, 2004; Hipp and Grupp, 2005; Miles, 2005; Vries, 2006; Más-Verdú, 2007; Mainardes, Silva and Domingues, 2010).

According to Miles (2005: 444), “despite services being defined differently by different authors, common characteristics are pointed out in the literature on innovation in services”. Many services are characterized by intangibility, inseparability, interactivity and variability, as well as weak protection of intellectual property.

Theoretical approaches to innovation in services have developed rapidly in recent decades (Sundbo, 1997; Grönroos, 2000; Miozzo and Soete, 2001; Miles, 2008) and can be grouped in the following approaches: negligence, assimilation, demarcation, and later, the synthesis approach (Haukens, 1998; Gallouj, 1998; Sundbo and Gallouj, 1998; Freeman and Louçã, 2001; Coombs and Miles, 2000; Gallouj, 2002; Howells and Tether, 2004; Drejer, 2004; Miles, 2005; Vries, 2006). Studies about innovation in services are relatively new and were categorized in four groups according to their respective approaches.

These approaches reveal that innovation in services differs from innovation in products. According to Sundbo (1997) and Tether and Hipp (2002), the very characteristics of services (intangibility, heterogeneity, perishability and simultaneity of production and consumption) which distinguish them from physical products, bring difficulties and restrictions to the importing of management programmes and models directed towards innovation in the industrial sector. Services have such particularities that

they require specific innovation models for the sector, something which is still scarce in the literature (Barras, 1986, 1990; Gallouj, 1998, 2002; Pires, Sarkar and Carvalho, 2008).

From a approach of services as a not very innovative sector that “absorbed” innovation from the manufacturing sector, various authors and organizations have considered services as possessing their own forms of innovation, and in some cases, with high levels of innovation (Evangelista, 2006; OECD, 2007; Brax, 2007). The increased interest in investigating the service sector has been obvious in recent decades, aiming to develop the necessary knowledge for increased productivity and innovation in this sector (Grönroos, 2000; Hertog, Broersma, Ark and Van, 2003).

The results of the innovation process are called entrepreneurial innovative capability. Therefore, this investigation adopted the term of entrepreneurial innovative capability to integrate the various components arising from the process of firm innovation, namely product innovation, process innovation, organizational innovation and marketing innovation (OCDE, 2005). This study is restricted to entrepreneurial innovative capability in terms of product or service. Therefore, the firm is considered innovative if in the period 2002-2004, it introduced any new or technologically improved product or service. Product or service innovation is defined as “the market introduction of a new good or a significantly improved good or service with respect to its capabilities, such as improved software, user friendliness, components or sub-systems” (CIS 4, 2005:9).

The literature review made in the area of firm innovation stresses that innovative capability varies from one firm to another, and is determined by a vast and complex number of factors, which both stimulate and limit the process of entrepreneurial innovation. Factors explaining innovation are not limited to the factors referred to here. However, intending to analyze the process of entrepreneurial innovation and considering the literature review carried out, this study highlights factors related to innovative activities. Other factors were taken into account, such as: firm size, sector of activity considering the various service sub-sectors. The innovative activities and expenditure to be studied in this investigation arise from those defined by the Innovation Survey CIS 4 (2004:5).

The importance of investment and expenditure on innovation activities in firms such as machinery, and equipment, software and external knowledge, is demonstrated in the studies by Mansfield (1988), Shields and Young (1994), Archibugi, Evangelista and Simonetti (1995), Weiss (2003), Camacho and Rodriguez (2005), Canepa and Stoneman (2008), Elche and González (2008) and Un, Romero-Martínez and Montoro-Sánchez (2010). According to these authors, firms that invest more in investigation and development and in improving structures and collaborators' competences acquire greater technological capacity, and consequently have the capability to produce more innovations. Therefore, they argue that firms that invest in better structures, technology and qualified staff show greater innovative capability. So the following relationship between investment and expenditure on innovation activities and entrepreneurial innovative capability is established:

*Hypothesis 1: investment and expenditure on innovation activities is positively related to service firms' propensity to innovate in terms of products/ services*

Based on the generic hypothesis related to investment and expenditure on innovation activities and to the typology presented in the Innovation Survey CIS 4, according to Table 2, the following seven specific hypotheses are formulated in this context:

- H11: Carrying out internal R&D activities is positively related to service firms' propensity to innovate in terms of products/services.*
- H12: Carrying out external activities of R&D is positively related to service firms' propensity to innovate in terms of products/services.*
- H13: Acquisition of machinery, equipment and software is positively related to service firms' propensity to innovate in terms of products/services.*
- H14: Acquisition of other external knowledge is positively related to service firms' propensity to innovate in terms of products/services.*
- H15: Carrying out training is positively related to service firms' propensity to innovate in terms of products/services.*
- H16: Carrying out marketing activities is positively related to service firms' propensity to innovate in terms of products/services.*

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*H17: Investment and expenditure in other procedures is positively related to service firms' propensity to innovate in terms of products/services.*

The relationship between the factor of firm size and entrepreneurial innovative capability is widely discussed in the literature, and two perspectives are found. On one hand, Schumpeter (1942) and Vrande et al. (2009) found a positive association between firm size and entrepreneurial innovative capability. The results show that large firms have advantages in terms of innovation compared to small firms, in that they possess more knowledge and more qualified resources. On the other hand, studies made by Sengenberger and Pyke, (1992), Rothwell and Dodgson, (1994) and Tidd, Bessant and Pavitt, (1997) identified negative effects of firm size on entrepreneurial innovative capability. Kim et al. (2009) add to this, stating that small firms, due to greater proximity and contact with the market, have a greater propensity to develop innovative activities. It seems important, therefore, to clarify the relationship between firm size and innovative capability, and so the following hypothesis is formulated:

*H2: Larger service firms have a greater propensity to innovate in terms of services, than smaller firms*

The factor of sector of activity is a classic in studies of firm innovation. The sector of activity's influence on firms' innovative capability is highlighted in various studies (Fritsch and Lukas, 2001; Kaufmann and Tödtling, 2001; Bayona, García-Marco, Huerta, 2001; Tsai, 2001; Romijn and Albaladejo, 2002; Tether, 2002). It is expected that firms belonging to sectors of activity based on technology, such as electronics and computing, innovate more than firms belonging to other sectors of activity. In this investigation, the basis for analysis of sector of activity follows the classification proposed by NACE (Nomenclature of Economic Activities in the European Community). Based on the division made by Furrer and Sollberger (2007), considered as services with a technological basis are those such as communications, computing and related activities, research and development, architectural and engineering activities, and technical testing and analysis. The remaining services, such as hotel and catering, transport,

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banks and insurance are services where the main agent is the individual. This being so, the following hypothesis is presented:

*H3: Firms in service sub-sectors based on technology have a greater propensity to innovate in terms of services, than firms belonging to other sectors.*

The hypotheses formulated here were tested empirically bearing in mind the investigation design presented below.

## **Research Design**

### **Population, Sample and Data**

The data used in this research are secondary data, collected through a survey that consisted of a questionnaire named Community Innovation Survey IV – CIS 4 between June and November 2005. In Portugal, the survey was conducted by OCES – Observatório da Ciência e do Ensino Superior (Higher Education and Science Observatory), in collaboration with INE – Instituto Nacional de Estatística (National Institute of Statistics), according to EUROSTAT'S methodological specifications, and concerning innovative activities of Portuguese firms during the period 2002 to 2004.

The population contemplates all service firms according to the classification of economic activities CAE – Rev. 2.1. (CAE, 2003). The sample considered 4.815 firms replied to the questionnaire, giving a 74, 3% response rate (OCES, 2006). From the firms in the sample, only 1306 firms belonging to the services sector are considered.

Thus, service sector firms will be considered innovative in their services, if they introduce new or technologically improved services during the period 2002-2004.

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## Description and data characterization

### Dependent and Independent Variables

In this study, innovative capability is measured from the information collected in terms of service innovation, which is considered as the dependent variable. This dimension is presented as a dichotomic binary variable with the value of 0 if the firm did not innovate and 1 for those that innovated. Independent variables are internal R&D activities, external acquisition of R&D, acquisition of machinery, equipment and software, acquisition of other external knowledge and other procedures. Based on the data referring to the variable, the value of “1” is adopted when firms undertake any of the R&D activities specified and the value of “0” otherwise. It should be noted that these variables were also used in the studies by Kaufmann and Tödting (2001), Author (2003), Author et. al, (2008), Harris and Li (2009), Millot (2009).

### Control Variables

Just as in other studies, (Nieto and Santamaria, 2007 and Author, 2009) this investigation used some control variables directly linked to business characteristics, such as firm size and sector of activity. Concerning the second variable, this investigation uses the Service activity sub-sector. For that variable, the typology of Furrer and Sollberger (2007) is used, creating two variables corresponding to levels of intensity: technologically based services and services centred on the individual. The value of one of the two categories is attributed to each firm, according to the service activity sub-sector it belongs to.

To measure Firm Size, four variables were created: (1) micro-firm: 5-9 collaborators; (2) small firm: 10-49 collaborators; (3) medium-sized firm: 50-249 collaborators and (4) large firm: with 250 or more collaborators.

### Method: Logistic Regression Model

From the theoretical literature review and the proposed conceptual model, it was found that a firm’s innovative capability is a complex

phenomenon influenced by a wide range of factors. Since it is necessary to explore the relationship between these factors and innovative capability, the intention is to study, more specifically, the statistical relationship of a dependent variable in relation to more than one explanatory variable; the Logistic Regression Model (Logit Model) was decided on. In the dimension of services' innovative capability, there is a correspondent regression model where the dependent variable is dichotomic, so according to Hair, Babin, Money and Samouel, (2003) the best application model is the Logit regression model. This has been the most widely used model in empirical studies carried out (Kaufmann and Tödting, 2001; Author, 2003), and is presented as an appropriate analytical technique for proposed conceptual models, since these include a dependent categorical variable (binary or dichotomic) and several independent variables. The estimation process is based on the maximum likelihood procedure and takes into consideration the following model specification

$$IS_i = \beta_0 + \beta_{11}Adi_1 + \beta_{12}Adi_2 + \beta_{13}Adi_3 + \beta_{14}Adi_4 + \beta_{15}Adi_5 + \beta_{16}Adi_6 + \beta_{17}Adi_7 + \beta_{21}Dim_1 + \beta_{22}Dim_2 + \beta_{23}Dim_3 + \beta_{62}Dim_4 + \beta_{31}S_1 + \beta_{32}S_2 + \varepsilon_i$$

Where: IS = Services Innovation;  $\varepsilon_i$  = Error term;  $\beta$  = Coefficients; Adii = Investment and expenditure on innovation activities; Dimi= Firm size; Si = sector de activity in services. What: Adi1= Intramural (in-house) R&D; Adi2= Extramural R&D; Adi3= Acquisition of machinery, equipment and software; Adi4= Acquisition of other external knowledge; Adi5= Training; Adi6= Marketing activities; Adi7= Other procedures.

## Results and Discussion

At this stage of the research, logistic regression models were applied to the Community Innovation Survey, to test the proposed model. The Wald statistic was used as the testing statistic to analyze the behavior of variables and the adjustment quality of the proposed model.

Logistic regression results show that not all regression parameter estimates are statistically significant at a level of 5%. Regarding adjustment quality of the model, the results show that the predictive capacity of the model is 84,9%, which results from comparison of the values of the variable response values predicted by the model and those observed. The  $\chi^2$  statistic test has a value of 531,35 with proof value less than the significance level of 0,05. The log-likelihood statistics, with a value of 703,24, corroborate the global significance of the model.

Concerning the generic hypothesis H<sub>1</sub>, which aimed to test the effects of investment in innovation on innovative propensity in terms of services, a positive relationship with significance under 0,05 was found when a service firm makes investment in internal investigation and development activities (variable *Adi1*), acquisition of machinery, equipment and software (*Adi3*), acquisition of external knowledge (*Adi4*), in marketing activities (*Adi6*), and other procedures (*Adi7*), it presents a greater propensity to innovate in terms of services. The other factors (external acquisition of R&D and training) are not seen to be significant at 0,05 level. Considering the results obtained and those presented in column *Exp(B)*, it is observed that by investing in the acquisition of machinery, equipment and software (6,425), and internal investment in innovation (4,985), as well as implementing marketing activities (2,563), and other procedures for developing new products (2,113) and also acquiring external knowledge (1,752), service firms are seen to be more likely to innovate in terms of services. From the significance of the values obtained, the results show that investments in acquisition of machinery, equipment and software and internal investment in innovation are those which stimulate the propensity for service firms to innovate most.

Hypothesis H<sub>2</sub>, established an association between firm size and the propensity for firms to innovate in terms of services. Four classifications were considered for the sample firms, namely: micro, small, medium-sized and large. Firms considered as large (*Dim4*) were excluded from the analysis, as there were too few cases carry out logistic regression interactions. Testing the micro, small and medium-sized firms showed that the first (*Dim1*) did not present statistically significant results. However, small firms (*Dim2*) and medium-sized firms (*Dim3*) were positively related to the propensity for firms to innovate in terms of services (lower significance, respectively 0,1 and 0,05). Therefore, observing the values of *Exp(B)*, it seems we can state that the bigger the firm, the greater the propensity to innovate in terms of services.

Hypothesis H<sub>3</sub> related innovation in terms of services to service activity sectors, differentiating service firms based on high technology from low technology firms. This hypothesis was seen to be significant at a level under 0,1 and with a positive effect. Therefore, according to the division made by Fuller and Sollberger (2007), service firms in communications,

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computing, investigation and development, architectural and engineering activities, and technical testing and analysis have a greater propensity to innovate in terms of services than firms connected to other sectors.

## Final considerations

The aim of this study was to investigate the degree of importance of factors determining entrepreneurial innovative capability, in the context of Portuguese service firms. With the purpose of improving comprehension of innovation in services and identifying the main determinants of innovation in the service sector in the area of innovation activities, various hypotheses for investigation were formulated based on the literature review carried out of innovation in services. The literature review identified three fundamental approaches in the sphere of service innovation: assimilation, demarcation and synthesis.

This investigation highlights seven factors stimulating and limiting innovative capability in firm: investment in innovation activities, firm size and sub-sector of service sector activity. It was in relation to these factors that the various hypotheses tested empirically were formulated.

The results of the model indicate that service firms based on technology are more likely to innovate in products/services than firms providing other types of services. According to the results obtained, some investments in innovation present positive and significant effects in service innovation; therefore, the greater the financial investment in acquisition of machinery, equipment and software, in internal research and development, in acquisition of external knowledge, in marketing activities and other procedures, the greater the propensity for firms to innovate in terms of services. The results of the model show that size has a positive and increasing effect on service innovation, despite large firms not being included in the interaction process of the *logit* Model. According to the results, we can say that medium-sized firms have a greater propensity to innovate in services than small firms do.

The principle contribution of this research lies in inclusion in the study of factors determining the innovative capability of service firms, seeking to increase comprehension of innovation in services and identify the main factors stimulating innovation in this sector. The investigation

proposed an empirical study based on a *logit* model, for joint analysis that provided measurement of the direct and indirect effects of a selected set of explanatory variables of the innovative capability of Portuguese service firms.

The main limitations of this study arise from the limited data obtained, through lack of access to all the results of CIS 4, for example, the number of employees per firm. Nor was it possible to draw up a comparison of results, with previous CIS, so as to assess evolutionary tendencies in the area of innovation activities and expenditure.

To continue this investigation, in future work it is proposed to repeat the empirical study with data from other European countries where the fourth Community Innovation Survey – CIS 4 was carried out. In addition, a new study will be developed with the proposed conceptual model, with the aim of contrasting empirically data from the Community Innovation Survey 2006 – CIS 2006. From this perspective, it is considered that repetition of the investigation in Europe, more precisely in countries that responded to the same questionnaires, could also enrich study of the phenomenon of entrepreneurial innovation, and specifically the approach to service sector innovation.

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