HOW PUBLIC FUNDING AND FIRMS' INNOVATION STRATEGIES AFFECT THE INNOVATION OF THE SPANISH HOTEL INDUSTRY

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ABSTRACT

This article examines the way in which the Spanish hotel industry has responded to government aid and to the use of new technological strategies in order to improve its ability to innovate. Using the Survey on Technological Innovation (Encuesta sobre innovación tecnológica, 2000), carried out by the Spanish National Institute of Statistics under the guidelines of Eurostat and the Oslo Manual, hotel companies that have carried out innovative activities are investigated. Using the statistical technique of binary regression, we find that public funding has little effect on the innovative performances of these companies, whereas the effect of technological strategies varies depending on whether it is product innovation or process innovation.

Keywords: Public financing, innovation strategies, innovation performance, hospitality industry

Introduction

According to the Institute for Tourism Studies (IET, 2006), Spain is the second leading tourist destination in the world, preceded only by France and followed by the United States. In terms of tourist income, Spain also comes second, with the U.S. in first place and France in third. We can see from these statistics that Spain is a worldwide power in the tourism industry.

The real importance of the tourist sector becomes clear, however, when we consider its internal role in the Spanish economy; in 2007, tourism accounted for 10.8% of Spanish GDP (INE, 2009), a figure much larger than any other single component.

Within the tourism sector and its three main components—the hotel industry, travel agencies, and transportation—it is the hotel industry that generates the most income, comprising 65.4% of the total and contributing 7.1% to Spanish GDP (FEHR, 2008).

In light of these statistics, an analysis of the Spanish hotel industry is in order to give us an insight into the key factors that determine the competitive abilities of the Spanish tourism industry. The purpose of this article is thus to analyse statistically how public funding and certain technological strategies encourage the hotel industry to innovate in terms of both their products and their processes.

The relevance of the present study is clear. On one hand, innovation constitutes one of the keys to competition regardless of the field since a company's competitive capacity to reduce costs depends, to a great extent, on how innovative the process is, how competitive it makes the company compared with others, and on the degree of innovation found in the product. Consequently, the productivity and growth of firms depends crucially on their ability to innovate (Thatcher and Oliver, 2001; Baldwin and Sabourin, 2002; Freeman, 1994; Crafts, 1996).

On the other hand, it is important to understand the role of public support for technological development in a sector that is of such great importance to the Spanish economy. In this way, we can learn which strategies for innovation are the most important, thereby pinpointing the strengths and weaknesses of companies in the Spanish hotel industry concerning their plans for innovation.

This interest in evaluating the relevance of different innovation strategies on the innovative capacities of companies is a relatively new idea. Until very recently, researchers in favour of the theory of transaction costs (Coase, 1937; Williamson, 1975, 1985) have approached this issue from the assumption that the internal generation of technology (to produce) is at odds with external acquisition (to acquire) (Foray and Mowery, 1990). After the pivotal contribution made by Cohen and Levinthal (1989, 1990) in relation to the theory of absorptive capacity, it has generally been accepted that the coexistence of different innovative strategies within the same organisation can generate a synergistic effect on the results expected in innovation. Therefore, the combination of different strategies is not only possible but also desirable. As a result of this, companies these days lean toward using a simultaneous mixture of innovation strategies (Hartung and McPherson, 2000; Rigby and Zook, 2002). They combine the following alternatives ad hoc: internal knowledge generation, external acquisition strategies, and cooperation agreements on R&D with other agents. Every one of these strategy types can be looked at separately, which allows for a more detailed study of the kind we aim to achieve in this work.

The remainder of this article has the following structure. Section 2 reviews the literature on public funding for innovation and the relationships among different innovation strategies. Section 3 introduces the database used in our empirical analysis, the variables used, and the methodology and techniques used in the analysis itself. Section 4 presents the results and a discussion of the results. Section 5 contains the main conclusions attained and the foreseen implications.

Theoretical framework of public funding and the relationships among innovation strategies

Innovation is considered to be the cornerstone indicator of productivity and corporate growth in the economics literature. These factors allow for an increase in per capita income and an improvement for ordinary citizens in the benefits received from the social welfare state and from progress in general (Keller, 2004).

Over the past few years, both developed and developing countries everywhere have implemented a series of technological programs aimed at stimulating and promoting R&D activities throughout the fabric of their economies. The goal has been to make productive units more competitive in order to improve the economic indicators of these countries.

Among the tools used in programs for innovation, the most widely used and efficient ones are so-called financial assistance for innovative companies. They may be provided directly (through subsidies, soft loans, and public funding) or indirectly,[1] mainly

[1] David, Hall, and Toole (2000) and Klette, Moen, and Griliches (2000) offer ample and enlightening reviews of the literature dealing with the problems caused by subsidies. Mohnen (1999) and Hall and Van Reenen (2000) do the same in relation to tax breaks.

through tax incentives. These types of financial assistance are generally given justification and receive social acceptance following so-called "market failure". This occurs when the market is incapable of allocating resources efficiently (Arrow, 1962), ultimately resulting in overinvestment or underinvestment by the private sector.[2] As a result of market inefficiency, the economic benefits generated by innovation may not end up in the hands of the corresponding investors but rather in those of other economic agents who did not contribute to the investment efforts (Klette, Moen, and Griliches, 2000). When this happens, appropriability problems appear, thereby diminishing the rate of return expected from innovation projects. The consequence is that overall profitability is lower than expected on many occasions, which discourages the implementation of subsequent innovative projects.

By means of subsidies and tax incentives, government intervention aims to promote private investment in innovative projects, so that the social benefits produced by such projects will increase rather than decrease. This financial assistance aims to reduce the cost of private investment, resulting in a higher rate of return for investors.

The literature on the subject of public funding for innovative companies has been ample and productive. The aim of these studies has been to determine to what extent various types of public funding complement or replace the costs of private R&D (Georghiou, 1994). In this regard, the studies by Carmichael (1981) Lichtenberg (1984, 1987, 1988), and Grileches (1986) have found evidence that such spending produces a crowding out effect on private investment. By contrast, research by Levy and Terlecky (1983), Busom (1991, 2000), Baily and Lawrence (1992), Hall (1993), Hines (1994), Mamuneas and Nadiri (1996), Dagenais, Mohnem, and Therrien (1997), Guellec and Van Pottelsbergue (2001), Lach (2002), Almus and Czarnitzki (2003), Duguet (2004), González, Jaumandreu, and Pazó (2005), and Marra (2004, 2008) have all concluded that public funding for innovation leads in fact to the success of private funding in great measure. Finally, studies such as Eisner, Albert, and Sullivan (1984), Bernstein (1986), Mansfield (1986), Wozny (1989), and Wallsten (2000) suggest that public funding has very little effect on R&D spending by private companies.

One of the key questions we examine in this study is the extent to which corporate innovation is related to the opportunity of receiving public funding. This is an important consideration given the fact that innovation increasingly demands a greater level of financial investment and a greater degree of uncertainty—both of which are intensified by the current situation of global competition. The pressure to innovate coexists with a situation in which products face increasingly shorter life cycles, in addition to which companies must confront serious problems with appropriability, while dealing with highly specialised technological and managerial difficulties (Cusumano, 1985; Okimoto, 1989; Stalk and Hout, 1990; Kay, 1994; Grupp, 1995; Ma and Lee, 2008). Given the collateral effects of innovation, in the end it is very difficult for companies to

[2] Even though the problems caused by appropriability reduce the return rate expected from innovation projects, such return rates may reach fairly high levels in certain legal situations connected with the market or with institutions. An example of this would be the competition to obtain a patent. Many companies invest heavily with the expectation of being granted a patent, but in the end only a single one of them benefits. Overinvestment may result in the fact that the extraordinary profits made by one company are outweighed in the end by the sum of the negative benefits obtained by the rest. The net result is an overall loss in terms of social welfare. In the context of innovation, many other situations result in a net effect of overinvestment. On this issue see, among others, Barzel (1968), Dasgupta and Stiglitz (1980a, 1980b), Dixit (1988), and Aghion and Howitt (1992).

take on all by themselves the burdens they must face. This is particularly true in terms of the high level of investment required and/or the increased risks that must be taken (Bower and Hout, 1988; Yip, 1992). Corporations therefore aim to reduce their expenses and exposure to risk by seeking public financing for their innovation planning.

In more specific terms, the research conducted by de Molero and Buesa (1995a, 1995b), Reger and Kuhlmann (1995), and Heijs (2001, 2002) concludes that, generally speaking, public funding has had a positive effect on corporate innovation. In this regard, Herrera and Heijs (2007) showed that companies with a high level of technology transfer have a significant chance of obtaining government funding for their innovation projects. Similarly, Georghiou and Roessner (2000) as well as Luukkonen (1998, 2000) found in their studies of corporate collaboration among European companies participating in government funding projects that these companies receive positive benefits in their abilities to innovate. A positive and significant relation should therefore be expected between government spending on innovation and the innovative capacities of the companies involved. In this paper, we aim to determine whether this is in fact the case with the Spanish hotel industry, a question that to our knowledge has not been tackled so far in previous research.

As far as technological knowledge is concerned, empirical evidence indicates that different innovation strategies are not necessarily incompatible with each other. Most companies use simultaneously a variety of methods to generate and access technological knowledge. In this paper, we aim to assess the impact of each strategy on their innovative performances, at the level of both products and processes.

The coexistence of different innovation strategies has been analysed by different authors. Mowery (1983) stated that there is a clear interdependence between different strategies and suggested that the existence of a strategy to generate internal R&D enables firms to use the external sources of technology acquisition. Later, Mowery and Rosenberg (1989) showed that the existence of coexistence relationships between the development of internal R&D activities and the establishment of cooperative agreements. By contrast, Arora and Gambardella (1990) found that large biotech companies that generate extensive internal R&D tend to establish cooperation agreements with universities and small and medium-sized companies that are engaged in intensive R&D.

In addition, Arora and Gambardella (1994), for the pharmaceutical industry, and Colombo (1995), for the IT industry, found a significant correlation between internal R&D and the establishment of cooperative agreements. Likewise, Lowe and Taylor (1998) found a significant relationship between internal R&D and the establishment of licensing agreements, while Nakamura and Odagiri (2005) and Dhont-Peltrault and Pfister (2011) stated that there is a significant relationship between internal R&D and the outsourcing of R&D.

Some authors have tested reverse causality to the aforementioned. For example, Veugelers (1997), Harabi (2002), Kaiser (2002), and Becker and Dietz (2004) all provided evidence that pre-existing internal R&D influences the ability of firms to use external strategies of innovation, which, in turn, influences the further development of internal R&D projects.

Thus, there is ample research showing both the simultaneous use of different innovation strategies and an interrelationship among them. As stated earlier, we are interested in evaluating the influence these strategies have on the innovative capacities of Spanish hotel firms. In that regard, we should emphasise that the degree of innovation shown by this sector (12.3%) is lower than the overall service sector performance (26.3%) or the performance of the whole industry (41.8%).[3] These figures coincide with those found in previous studies (Ingram and Baum, 1997; Baum and Ingram, 1998) and corroborate the fact that 94.7% of Spanish tourism companies are microenterprises, while 4.6% of them are small enterprises (INE, 2006).

Many empirical studies have focused on the analysis of particular innovation problems affecting the manufacturing industry, but studies of the tourism sector are scarce (Hjalager, 1997, 2002; Stamboulis and Skayannis, 2003; Jacob, Tintoré, Simonet, and Aguiló, 2004; Sundbo, Orfila-Sintes, and Sorensen, 2007), particularly in relation to hotel companies (Enz and Siguaw, 2003; Orfila-Sintes, Crespí-Cladera, and Martínez-Ros, 2005; Ottenbacher and Gnoth, 2005; Ottenbacher, Gnoth, and Jones, 2006; Jacob and Groizard, 2007; Orfila-Sintes and Mattsson, 2009; López-Fernández, Serrano-Bedia, and Gómez-López, 2009). It is also worth observing that there has been very little examination of the effect of particular innovation strategies on innovative performance in the manufacturing sector (e.g. Veugelers and Cassiman, 1999; Beneito, 2003; Cassiman and Veugelers, 2006; Vega-Jurado, Gutiérrez-Gracia, and Fernández de Lucio, 2008) and, to our knowledge, that such research in the hotel sector is non-existent. This paper aims to provide the first contribution, in the field of the Spain hospitality companies, on the influence that different innovation strategies have on product innovation and process innovation, thereby addressing a gap in the current research.

Data, variables, and methodology

In order to carry out this empirical study, we first looked at the database corresponding to the Survey on Technological Innovation (2000) for companies, with reference to the period between 1998 and 2000, carried out by the Spanish Institute of Statistics (INE) in accordance with the guidelines of Eurostat and the Oslo Manual (OECD 1997). This survey is part of the Community Innovation Survey (CIS3) of the European Union. In the end, 55 innovative hotel companies were selected for the present study based on their engagement in some type of activity related to the introduction—or improvement—of new products and processes during the period under consideration.

The decision to limit our analysis exclusively to innovative hotel companies is clearly necessary given the aim of this study is to examine the effect of public funding and various strategies of innovation on the innovative performances of these companies. It would be incoherent to study both innovative and non-innovative companies at the same time, since the latter display hardly any innovative strategies and their innovative performance is basically non-existent.

The following list of variables was used in the empirical component of this work. They include the statistical treatment of the data involved, in reference to the period from 1998 to 2000.

[3] Data collected from the 2000 Technology Innovation Survey for companies, carried out by the Spanish Institute of Statistics (INE).

PRODIN. When the company carries out an innovation at the product level, this variable takes the value 1, and 0 otherwise.

PROCIN. When the company carries out an innovation at the process level, this variable takes the value 1, and 0 otherwise.

FNDAUTON. This variable takes the value 0 if the company does not participate in any public funding for innovation from the Autonomous Communities of Spain, and 1 otherwise.

FNDEUROP.[4] This variable takes the value 0 if the company does not participate in any public funding for innovation by the European Union, and 1 otherwise.

INEXRD. Percentage of innovation expenditure dedicated to internal R&D.

EXEXRD. Percentage of innovation expenditure dedicated to external R&D.

EXEQUIP. Percentage of innovation expenditure dedicated to the acquisition of equipment.

EXTECH. Percentage of innovation expenditure dedicated to the acquisition of soft technology.

EXPREP. Percentage of innovation expenditure dedicated to technological preparations and the implementation of procedures necessary for innovative activities.

EXTRAIN. Percentage of innovation expenditure dedicated to necessary training activities in innovation.

EXMARKET. Percentage of innovation expenditure dedicated to the introduction of new products or services in the market.

COLLAB. If the company collaborates with other companies or institutions in R&D activities, this variable takes the value 1, and 0 otherwise.

SIZE. Four different categories are taken into account with regard to the number of employees: small companies, medium companies, large companies, and very large companies, designated respectively with the digits 0, 1, 2, and 3. Companies with fewer than 26 employees are designated "small." With 26–69 employees, they are designated "medium." From 69 to 229 employees constitute a "large" company. More than 229 employees constitute a "very large" company.

In terms of methodology, we used two equations: the first uses product innovation (PRODIN) as the dependent variable, whereas the second uses process innovation (PROCIN). The remaining variables function as regressors, using the variable of size as the control variable. Since the dependent variables are dichotomous, we used the binary logistic regression model as the regression technique. The generic structure of this model is as follows (McFadden, 1974):

[4] Since none of the 55 innovative hotel companies in this study made use of funding for innovation at the national level from the Spanish government, this model contains no variables for public financing of this kind.

$$\pi(x) = \frac{e^{\beta_0+\beta_1 x_1+\beta_2 x_2+\ldots+\beta_n x_n}}{1+e^{\beta_0+\beta_1 x_1+\beta_2 x_2+\ldots+\beta_n x_n}} = \frac{1}{1+e^{-\beta_0-\beta_1 x_1-\beta_2 x_2-\ldots-\beta_n x_n}}$$

Results and discussion

As shown in Table 1, most innovating hotel companies have not used public money to fund their innovation projects. Only six of them have used regional aid from the Autonomous Communities and two of them have used European funding. None of the 55 innovative companies has used national funding from the Spanish government. Most of the companies are large (14) or very large (24), constituting 69% of innovating hotel companies.

Table 1: Descriptive statistics for innovative hospitality companies

	0	1	2	3	Mean	Std. Dev.
FNDAUTON	49	6			0.1091	0.3146
FNDEUROP	53	2			0.0364	0.1889
SIZE	10	7	14	24	1.9455	1.1453

	PRODIN	PROCIN	INEXRD	EXEXRD	EXEQUIP
Min-Max	0-1	0-1	0-47	0-100	0-100
Mean	0.55	0.69	2.78	5.25	37.29
Std. Dev.	0.503	0.466	9.392	17.768	38.969

	EXTECH	EXPREP	EXTRAIN	EXMARKET	COLLAB
Min-Max	0-10	0-100	0-100	0-69	0-1
Mean	0.53	6.04	8.42	5.96	0.09
Std. Dev.	1.585	20.652	18.465	15.122	0.290

As shown in Table 1, 55% of innovating hotel companies are active agents of product innovation, whereas 69% are agents of process innovation. As for the costs of innovation, the highest average percentage in innovation expenditure corresponds to equipment acquisition (37.29%), followed by training and innovation (8.42%) and expenditure related to the implementation of innovation procedures (6.04%). In terms of cooperation in R&D, only 9% of innovating hotel companies implement agreements of this kind.

Finally, in order to observe the influence of public funding and of particular technological strategies on product and process innovation in the Spanish hotel companies, it is necessary to execute a binary logistic regression on the 55 innovating hotel companies referred to above. Before analysing the repercussions of the logistic regression coefficients, we need to assess the adjustment of the model to the corresponding distribution of data. In order to do that, we used the Hosmer–Lemeshow, Cox and Snell's R-squared, and Nagelkerke's R-squared tests as logistic models (Table 2).

Table 2: Model Fit Statistics

Dependent variable	Hosmer and Lemeshow test		Cox & Snell R-Square	Nagelkerke R-Square
	Chi-Square	Sig.		
PRODIN	5.659	0.580	0.224	0.300
PROCIN	2.747	0.907	0.355	0.500

For the two selected models, the Hosmer–Lemeshow test validates the hypothesis that both of them adjust the data with reasonable accuracy since there are no significant differences between the values observed and the ones that had been expected. Likewise, the values provided by Cox and Snell's as well as Nagelkerke's R-squared tests indicate a reasonable adjustment. These values are also in agreement with those obtained in other studies intended to determine the value and significance of the coefficients in these models; in such cases, the element of prediction clearly plays a secondary role.

Finally, Table 3 reflects the coefficients corresponding to the logistic regressions applied as well as their statistical significances. In the model where the dependent variable stands for product innovation, we can see that public funding coming from a regional source has a positive and relevant influence on innovation probability. European funding shows a negative influence, although not significant at the statistical level. Moreover, all innovation strategies—except for those related to soft technology acquisition and the implementation of marketing strategies to introduce new products or services in the market—have a negative influence on the probability of product innovation. The only innovation strategy showing a statistically significant influence on the probability to innovate products is the acquisition of equipment, although this influence is both negative and of little quantitative importance. The factor of size is also of little importance and not statistically significant in relation to the probability of product innovation.

Table 3: Influence of public support and innovation strategies

Independent variables	Dependent variable PRODIN		Dependent variable PROCIN	
	B	Sig.	B	Sig.
(Constant)	1.086	0.206	-0.866	0.336
FNDAUTON	2.464	0.068	-1.606	0.212
FNDEUROP	-1.854	0.443	22.563	0.999
INEXRD	-0.006	0.850	0.079	0.563
EXEXRD	-0.020	0.286	1.868	0.996
EXEQUIP	-0.021	0.022	0.020	0.043
EXTECH	0.200	0.484	0.785	0.081
EXPREP	-0.009	0.599	0.038	0.196
EXTRAIN	-0.012	0.492	0.044	0.295
EXMARKET	0.004	0.859	0.008	0.772
COLLAB	-1.316	0.354	-4.545	0.216
MEDIUM	0.702	0.556	-0.983	0.464
LARGE	-0.878	0.368	0.960	0.374
EXTRA LARGE	0.337	0.718	0.038	0.972

In relation to process innovation, the coefficients in Table 3 show negative repercussions for regional public funding, whereas European funding has a positive influence. Nevertheless, this information is not statistically significant. Moreover, contrary to what happens in the case of product innovation, innovation strategies show a positive influence on the probability of process innovation—with the exception of cooperation strategies, which show a negative influence. However, we need to emphasise that, from the point of view of statistical significance, only equipment and soft technology acquisition strategies affect the probability of process innovation. Likewise, in this case, company size is irrelevant in determining the probability of process innovation.

Conclusions

Of the 55 hotel companies that are active in product and/or process innovation, only six of them have used public funding from the regional governments of the Autonomous Communities; two of them have used European funding and none of them has used national funding from the Spanish government. Aid from regional governments has a clear influence on the probability of *product* innovation for hotel companies. This influence is statistically significant at a confidence level of 90%. Where *process* innovation is concerned, regional aid has a negative effect, although the results are not statistically significant. European funding is not statistically significant either for product or for process innovation. In contrast to regional funding, however, European funding has a *negative* influence on the probability of product innovation and a strong *positive* influence on process innovation.

As for different innovation strategies, the acquisition of equipment is by far the most commonly used option by innovative hotel companies. Expenditure on training related to innovation is the second most used option. This seems logical since investment in training workers involved in handling the newly acquired equipment is a must. By contrast, the average percentage of expenditure on the innovation of soft technology is virtually irrelevant.

Regarding the type and degree of influence displayed by particular innovation strategies, different alternatives exert a different degree of influence depending on whether we consider their effect on product innovation or process innovation. Of the eight different strategies evaluated, six have a negative influence on the probability of *product* innovation and seven have a positive influence on the probability of *process* innovation. Cooperation in the field of R&D, marketing efforts to introduce new products and services, and the acquisition of soft technology are the only three types of innovation strategies that show the same influence on the probability of product and process innovation. However, only soft technology acquisition is statistically significant in indicating the probability of *process* innovation. In regard to *product* innovation, generally speaking only equipment acquisition shows a statistically significant influence, and the effect is negative. At the level of *process* innovation, the acquisition of machinery and soft technology (licenses, franchising, etc.) show a positive and statistically significant influence.

In light of the results obtained, the implications for the implementation of different innovation strategies are clear. In general, strategies promoting the development of process innovation have a negative effect on the development of product innovation. Only marketing efforts aimed at the introduction of new products and services, together

with the acquisition of soft technology, positively stimulate the joint development of both product and process innovation. At first glance, a reasonable proposal would be to make greater efforts toward the development of these two strategies. Equipment acquisition, by contrast, while being a statistically significant technological strategy, presents some problems. Although it promotes *process* innovation, it is nonetheless negative for the development of *product* innovation. As for the implementation of R&D agreements in the context of innovating hotel companies, their influence is strongly negative both on product and on process innovation, although it is not statistically significant in either case. The results prove that R&D cooperation does not seem to constitute a strategy that can actively contribute to product and process innovation.

Finally, company size plays a different influence depending on whether we are talking about *product* innovation or *process* innovation. Only very large companies show no difference in this respect. In any case, none of the coefficients related to the size of the company can be considered to be statistically significant.

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