Investigaciones Regionales

Innovation Processes of SMEs in Less Favoured Municipalities of Portugal

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ABSTRACT: This paper examines the innovation processes of Small and Medium Enterprises (SMEs) in peripheral areas, particularly in the municipality of Guarda and in the islands of Sao Miguel and Santa Maria in the Azores. For this purpose, a survey was conducted, and three models were estimated: a *Logit* model, to measure the difference between firms that innovate and those that do not; a *Tobit* model, to measure the intensity of innovation; and a *Probit* model to analyze the type of innovation. The results show a positive relationship between the introduction of innovations in the market sector and the age and activity of the companies, an inverse relationship in regards to the size of the company and in relation to the region.

JEL Classification: O31, P48.

Keywords: Innovation; SMEs, Peripheral Regions.

Procesos de innovación de las PYME en municipios desfavorecidos de Portugal

RESUMEN: Este artículo examina los procesos de innovación de las pequeñas y medianas empresas (PYME) en las zonas periféricas, en particular en el municipio de Guarda y en las islas de Sao Miguel y Santa María en las Azores. Para este fin se construyó una encuesta para ser aplicada en las áreas de negocio antes mencionadas y la metodología utilizada es la estimación de tres modelos: en primer lugar un modelo logit, para medir la diferencia entre las empresas que innovan y las que no innovan; en segundo lugar un modelo Tobit, para medir la intensidad de la innovación, y el tercero, un modelo Probit, para analizar el tipo de innovación. Las conclusiones apuntan a la existencia de una relación positiva entre la variable

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Acknowledgements: CEEAplA —Centre of Applied Economics Studies of the Atlantic UDI/IPG—Research Unit for Development of Inland.

Recibido: 25 de marzo de 2011 / Aceptado: 22 de octubre de 2011.

independiente: la introducción de innovaciones en el sector del mercado y las variables edad, y la actividad, una relación inversa en lo que respecta al tamaño de la empresa y en menor grado en relación con la variable región.

Clasificación JEL: O31, P48.

Palabras clave: Innovación, PYME, zonas periféricas.

1. Introduction

In an increasingly globalized world, innovation is an important factor for competitiveness but has received little attention. List (1842) questioned how to organize activities and how to deploy resources and examined the role of key players who design economic growth. Innovation is the crucial element of development, the way in which territory gains ground for economic, social and environmental progress.

In fact, the success of companies and of national economies increasingly depends on their effectiveness in obtaining and using advanced knowledge, on skills of production processes (Silva, 1998), and on innovation. Innovation is the driving force of economic development and a particular weapon in the competitive strategy of economic agents.

Tidd *et al.* (2001) define innovation as the process by which companies generate knowledge, experience, and technological capabilities in order to create new products, processes, or services. Innovation simultaneously allows a company to develop new products and provides greater ability to hold, anticipate, and carry out future developments. Therefore, along with innovation, there are certain methods of acquiring knowledge that allow a company to gain another level of benefits.

In the innovation process, small- and medium-sized enterprises (SMEs) play a vital role (Acs & Audrestch, 1990) both as mediators between research public infrastructure and large companies and as developers of new ideas. Small firms critically depend on greater production flexibility; innovations are usually associated with a search for *technological competitiveness*, based on high productivity rooted in quality advantages (Vaona & Pianta, 2006). Furthermore, companies located in small and medium-sized regions may have competitive performances different from those located in regions that are economically more developed and/or have larger populations. In this context, it is important to understand how companies located in peripheral regions promote innovation.

The success of business technological innovation largely depends on aspects such as workforce structure, strategy, alliances with other companies or universities and, above all, the internal organization of the company. Its development is strongly conditioned by the existence of an internal environment in which creative ideas can emerge and be effectively employed and by the gathering of both technological and administrative knowledge (Barañano, 2005). On the other hand, we can consider the lack of connection between companies, the little support for innovation activities, and the fact that the possibility of establishing ways of collective learning is strongly

conditioned by the insufficient number of public and private key players (and interaction between them) as obstacles to innovation. The latter exists in peripheral regions where there is not enough critical mass of business concentration. However, the success and growth of SMEs also depend on their location. Increased market competition has led certain territories to successfully adapt while others have diverged, becoming economic and social deserts.

The peripheral regions present severe structural weaknesses related to depopulation, weaknesses in urban systems, demographic aging, fragility of the economic and social fabric, and low innovative behavior. However, there is an increasing body of literature which emphasizes different types of national and regional innovation systems as well as innovation activities taking place in various industries and their impact on economic growth and performance of the region or country, excluding less-favored regions.

Thus, this study aims to evaluate the nature of the innovation process of SMEs in peripheral areas of Portugal, particularly in the municipality of Guarda and in the islands of Sao Miguel and Santa Maria in Azores, and to identify key factors for successful innovation. It seeks to determine if these regions and other central regions have similar behavior in terms of innovation. This research mainly concerns the study of innovation degree in a territorial context, identifying the conditions that lead to the formation of innovative behavior in SMEs in peripheral municipalities of Portugal.

A survey was conducted among companies in three municipalities in order to assess whether companies innovate, what benefits come from innovation, and why companies have problems innovating. The chosen of those regions were: the first because it is a peripheral area as opposed to the Lisbon; the second because it concerns the islands that, by itself, determine the concept of periphery, and finally because these areas present law development and lack degree of innovation.

This paper is organized as follows. Section Two presents a brief literature review of the relevant theoretical and empirical studies that seek to identify key factors for successful innovation in order to help recognize those which are particularly associated with peripheral regions. The third section presents the hypotheses, and Section Four provides the methodology. Section Five presents the data processing and the main results. Finally, Section Six offers conclusions, implications, limitations, and future research directions.

2. Literature Review

The modern concept of innovation is due to Joseph Schumpeter (1934), who defined innovation by ascribing it to the five following cases: (1) the introduction of a new good —that consumers are not familiar with— or of a new feature within that good (2) the introduction of a new production method that has not been tested nor tried yet (3) the opening of a new market in a country where the company has not entered or this market does not exist (4) the achievement of a new source of supply of

raw materials or intermediate goods, regardless of its previous existence (5) the creation of a new organization of any industry, such as the creation of a monopoly or the rupture of a monopoly position (Schumpeter, 1934). Given this definition, not only are great radical inventions innovations, as are small steps like small improvements of a product or a process.

The simplifications limitations of the Schumpeterian approach have led researchers to include factors such as the types of innovations introduced; the influence of market structure, industry, and country specificities; and the variety of factors affecting innovative performances (Acs & Audretsch, 1990).

Innovation, performance, and innovative behavior are strongly influenced by a company's resources (Wernerfelt, 1984; Grant, 1996; Spender, 1996). However, more recently the theory of knowledge-based company (Barañano, 2005) focuses on the connection between knowledge, innovation and growth. The latter acknowledges the importance of social capital (Nahapiet & Ghoshal, 1998) and stresses the role of external connections as the main source of a company's innovation and growth, particularly SMEs (Cooke & Wills, 1999), giving rise to the emergence of new management and measurement models of a company's intellectual capital (Kaplan & Norton, 1996; Meritum, 2002; Sánchez *et al.*, 2000).

Sirilli (2003), Barañano (2003), Tidd *et al.* (2001), and Cobbenhagen (2000), among others, acknowledge the importance of a non-technological dimension, such as management and other factors, in the success of technological innovation processes, growth, and value creation. However, ever since the mid-twentieth century, many authors have tried to empirically identify management factors related to successful technological innovation (Carter & Williams, 1957; Myers & Marquis, 1969; Langrish *et al.,* 1972; Hayvaert, 1973; Rothwell *et al.,* 1974; Szakasits, 1974; Freeman, 1982; Utterback *et al.,* 1975; Rothwell, 1976; Barañano, 1994, 2003; Simões, 1997; Romijn & Albadalejo, 2002; Galende & de la Fuente, 2003), only to conclude that no single factor can determine technological success or failure.

Other factors, such as the intangible aspects of the technological process, namely, innovation management (Simões, 1997), limit a company's ability to innovate and to raise its productivity/competitiveness. A firm's ability to create new knowledge and innovation depends on its learning or absorptive capacity (Cohen & Levinthal, 1989, 1990). At the level of the firm, absorptive capacity is generated in a variety of ways (Cohen & Levinthal 1990). For Cohen & Levinthal (1990: 129), «absorptive capacity may be created as a by product of a firm's Research and Development (R&D) investment, when firms send personnel for advanced technical training». This absorptive capacity may also be developed as a product of a firm's manufacturing operations and depends on the firm's ability to reorganize or automate particular manufacturing processes and examine the cognitive structures that underlie learning.

A company's size also influences the ability to innovate. The relationship between the size of firm and the degree of innovation is unclear (Bessant & Tidd, 2007). In generally, SMEs do not possess many resources to make big plans for the future and cannot afford to make mistakes. However, it is the SMEs that are «born» the

most innovative projects. For Bessant and Tidd (2007), larger firms are more able to exploit economies of scale and scope innovation, including research development, production and sales, whereas small firm are less bureaucratic and are able to flourish in smaller marker niches which may be unattractive to larger firms. Motivation is typically much higher in such organizations.

Other important features of SMEs include the entrepreneurs' central position and local and regional orientation. The knowledge environment in which firms operate has also emerged as a factor influencing the relationship between firm size and innovation. Small firms appear to be better at exploiting external economies derived from a more innovative environment due to the proximity to R&D centers of large firms and to universities (Acs *et al.,* 1994, Audretsch & Vivarelli, 1994, Vaona & Pianta, 2006).

Relative to less developed regions or outskirts, the SME's behavior in terms of innovation it is essentially to promote innovation and competitiveness within the regions. However, they present low intensity of innovation as well as low levels of interaction, cooperation, and relationships between others firms or others local actors without a regional innovation system (Natário & Neto, 2006). Firms in small regions do not present a strategy choice from the innovation in terms of market orientation and business orientation (Skuras *et al.,* 2000; Fotopoulos & Louri, 2000; Littunen, 2000; Nicolas & Noronha, 2001; Niosi & Bas, 2001; Liedholm, 2002; Giner & Santa, 2002; Psaltopoulos *et al.,* 2005; Johnson, 2005; Hoogstra & Dijk, 2004; Vaz *et al.,* 2006). According to Naver and Slater (1990), market orientation is an organizational culture that promotes market supervision related values in order to provide the company's customers with greater value. In contrast, business orientation focuses on innovation opportunities, aversion to risk, and proactivity (Morris & Paul, 1987; Davis *et al.,* 1991; Slater & Narver, 2000). Market and business orientation therefore sustain business strategy and performance.

Several empirical approaches have tried to analyze the performance of companies in terms of innovation. García and Muñoz (2005) argue that organizational capabilities can promote innovation activities as part of a company's strategy and that these actions can influence performance, considering environmental variables that can have a positive or negative effect. The authors tried to measure performance in terms of four variables: profitability, sales growth, new product success, and the possibility of an updated portfolio. In this study [1], García and Muñoz showed that SME dynamics, survival, competitiveness, and growth in peripheral regions do not directly relate the strategy choice to the innovation and performance perspective. The authors developed a model that highlights the connection between organizational capabilities (market and business orientation) when one foresees the type of innovation activities implemented by SMEs in the accounted regions and the connection between specific

[1] The study focused on the directory of the 50,000 largest companies in Spain (DUNS) and used the regions of Castilla and Léon and Extremadura and companies with more than 20 and less than 250 employees in industry and services sector as samples. Data collection was carried out through qualitative surveys.

innovation and performance activities registered by companies considering competitive intensity and turbulence. Innovation activities were classified into processes, products and marketing.

Examining five Portuguese SMEs, Barañano (2005) identified organizational and business factors that contribute to the success of technological innovation processes. The results can also help to identify less adequate practices or gaps in terms of management as well as different factors that can work together to create and reinforce the environment that enables successful technological innovation [2]. For his study, Barañano (2005) selected a sample of companies from a population consisting of 474 Portuguese SMEs who reported innovative activities in the *Community Innovation Survey* —CIS II (89 micro, 155 small, and 230 medium-sized companies)—. In order to find a homogeneous set, three criteria for selecting the companies were applied:

— *Business sector*, it is not advisable to mix industrial and services companies. Furthermore, according to the methodology of Tidd *et al.* (2001), only specialized suppliers companies were selected;
— *Company size*, only micro and small companies were taken into account because of the different dynamics of medium-sized companies;
— *Geographical area*, for convenience purposes, only companies located in the Lisbon and Tagus Valley region were included in the sample.

Barañano found two major barriers to innovation: a great shortage of skilled manpower, aggravated by the lack of interest in continuously improving training, and a gap in external communication with knowledge generating agents (universities and research institutes). These two barriers also affect other aspects that should be improved, such as delegating management functions and decentralizing decision making along with a transition to more participatory and corporate cultures.

Examining the textile sector in Catalonia, Ribera *et al.* (2002) tested the effectiveness of management capabilities in development. Many of the companies had the same owners, managers, and family for several generations, so one could assume the great challenge of incorporating new tools for managing innovation [3]. The project was organized by various training sessions, and fieldwork was conducted in three steps: (1) process; (2) strategic direction; (3) project innovation. The ability to apply innovation is essential to a company's success. Large companies show a higher level of innovation compared to small companies. Ribera *et al.* (2002) shows the first encouraging results of an experimental project to develop innovation management capabilities. Similar experiments have been carried out in other sectors.

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[2] This exploratory study by Barañano (2005) visited select companies and sent surveys to their managers. Because this study considered a very small number of companies, there are significant limitations to generalization.

[3] The sponsor of this project was the Textile Companies Association in Sabadell, an industrial city near Barcelona. Five companies practically covered the entire value chain. The total group was chosen by the association. One company was the fiber manufacturer and the other two were manufacturers of textures based on raw materials from the first. Even the sample was conveniently chosen and did not show any specific feature.

3. Hypothesis

Based on the literature, this paper examines the innovation processes of SMEs in peripheral areas and how organizational capabilities can promote innovation activities as part of a company's strategy. A set of hypotheses will therefore be tested to relate dependent and independent variables, based on a sample of companies in the outlying areas of the national territory, specifically Guarda and Azores (São Miguel and Santa Maria Islands).

The ability of companies to innovate and to absorb innovation is related to the sectorial structure to which the company belongs (Pavitt, 1984; Dosi, 1988; OECD, 1997; Marques, 1999; Laranja, 1999; Castellacci, 2007). Different sectors can be distinguished according to their innovation behavior. Although each company or institution has a particular means of innovation, there are associated innovation patterns and ways of establishing connections that are common to several sectors. Thus, it is possible to find different sectorial innovation patterns, since each type is related to certain forms and flows of knowledge (Pavitt, 1984).

Several researchers have studied the opportunities and limitations created by different types of sectorial systems, the different trajectories of different industrial sectors, and the connections that each specific sector in the national innovation system allows (Archibugi, 2001; Laursen & Meliciani, 2002; Marsili & Verspagen, 2002; Malerba, 2002).

According to Diniz and Nogueira (2002), all development activities ensue from local conditions and depend on proposed goals and objectives in development activities, location factors, social infrastructure levels, institutional capacity, the region's social cohesion degree, and the diversity of existing sectors in the local economy.

Economic globalization, rapid technological development, and changes both in behavior and demand patterns imply significant adjustments in the production profile to promote and stimulate goals towards future activities. When applied to each business sector, these company intervention goals unfold into several specific goals. In this context, the more traditional sectors such as the primary sector, considered by many as a mature sector with little opportunities to captivate young farmers, lose their lead role in value creation. As for the secondary sector, thanks to transport cost reduction and to product preservation improvements, industries can be farther from their resource sources and closer to consumers and different production lines. It is therefore important to understand the connection that each sector has on value creation. Thus, the following hypothesis is formulated:

H1. The business sector influences the introduction of innovations in SMEs in peripheral municipalities.

Innovation is central to the regional competitive spirit. Knowledge, expertise, as well as other competitiveness dynamic factors in growth are also essential factors for innovation. In Portugal, family-based small and micro companies play a large part

in the production of peripheral regions. Passing from generation to generation, these companies also play a small part in external markets, especially those with higher value segments, causing an impact on local economies and on the national situation.

Some studies have analyzed the connection between knowledge and innovation in young companies as opposed to older companies (Koschatzky *et al.,* 2001; Meyer, 2002; Fort *et al*. 2004, among others). It has been suggested that maturity, experience and cumulative learning favor innovation. However, younger companies and start-ups show a higher tendency to innovate and to take part in innovation and can promote a region's structural change. These companies are especially important in the creation of industrial regions (Koschatzky *et al.*, 2001). Start-ups are important sources of new innovation ideas and may present advantages over large established firms in emerging areas where demand characteristics are not very clear and risks are high (OECD, 2000). In addition, young companies have innovation patterns that are different from older companies: the former develop more radical innovations, while the latter innovate through marketing and product improvement (incremental innovation) (Fort *et al.* 2004). Based on these assertions, it is possible to formulate the second hypothesis:

H2. In peripheral regions, younger SMEs are more likely to innovate.

According to Nicolas and Noronha (2001), small and large companies cannot have comparable results in terms of efficiency. SMEs are different from large companies, because their specific goals and their historical and spatial origins are different. They have more resource restrictions than larger companies, especially in terms of information. However, if they innovate, they will use a greater diversity of sources, rather than simply using Research and Development as larger companies do. Moreover, technological innovation is not limited to large companies. Acs and Audretsch (1987) found that small firms appear to have an advantage in innovative industries, while large firms have an advantage in capital-intensive industries.

In practice, neither large nor small firms are inherently more or less innovative (Bessant & Tidd, 2007). Therefore, because small and medium companies progressively show innovative initiatives, the idea that only large companies with their equipped laboratories can innovate and be connected to innovative processes has been refuted (*e. g.* Maillat, 1991; Julien, 1995; Acs and Audretsch, 1987, 1988, 1990), Nicolas and Noronha (2001), Vaz *et al*. (2004). SMEs show a greater ability to face new challenges without facing as many bureaucratic blockages (Vaz and Cesário, 2003); this corporate segment may be more related to other local role players and the local environment. Motivation is typically much higher in such organizations (Bessant & Tidd, 2007). Additionally, for Acs and Audretsch (1988), the returns to R&D inputs decrease with firm size, suggesting that industry specificities are key factors affecting innovative performances (Cohen, 1995).

Moreover, according to Julien (1995), there are four basic explanations that justify the economic importance of SMEs: the role of entrepreneurs in economic changes (especially its enterprising and innovative spirit); the existence of markets that are

particularly adequate to this type of company; the growing uncertainty in an increasingly global economy; and the need for greater flexibility from producers to adapt to technological advances. Thus, it is expected that company dimension positively influences innovation introduction in SMEs. The following hypothesis is therefore formulated:

H3. Company size positively influences the introduction of innovations in SMEs in less favored regions.

Innovation is a located process; proximity is vital to innovation dynamics (Maskell & Malmberg, 1999). Geographical proximity of economic activities can promote local forms of interactive learning and networking innovation. However, according to Doloreux (2003), the importance of proximity is not confirmed; companies, as knowledge sources, use a mix of local, regional, national, and international degrees. Their ability to sustain innovation networks at different scales is vital to SME innovation and competitiveness. Connections at different scales have more credibility (Bunnell & Coe, 2001) and favor competitive advantages in the accomplishment of innovation (Doloreux, 2003).

The activity of companies at different territorial scales has been the target of different approaches. Some approaches emphasize the role of local environment in the development of learning and multilateral transactions that generate innovational specific externalities, for example, the innovative milieus approach (Aydalot, 1986; Maillat, 1998; Crevoisier, 2001). Regarding innovation dynamics, the region takes on dynamism, adaptability and learning skills through innovational regional systems (Cooke, 2003; Doloreux, 2003, 2004; Tödtlinng & Trippl, 2005; Asheim & Coenen, 2006; Cooke *et al.,* 2007). Other approaches stress the national and international level in national innovation systems (Lundvall, 1992; Edquist, 1997).Van Leeuwen and Nijkamp (2006) recognize other territorial scales of activity (villages, local, region, city, national and international), highlighting the importance of agro-industrial SMEs in the local economy and in creating jobs in rural areas. It is therefore very important to associate regional, national, and international scales with local innovation sources and with local partnerships to promote innovation territorial dynamics. Given the above, the following hypothesis is established:

H4. Scope of activity positively influences the introduction of innovations in SMEs.

The region is increasingly viewed as a means of generating specific resources and its own dynamics. Europe presently sees regions as the appropriate scale for implementing development policies and for promoting a knowledge-based economy. An example of this vision is the multiplication of regional innovation strategies and plans over the past years. According to *Innovating Regions in Europe Network's* data, 33 regional innovation strategies (RIS, 1994-2001), 70 regional innovation and technology transfer strategies (RITTS, 1994-2001), 16 regional innovation strategies in newly associated countries (RIS-NAC, 2001-2004) and 33 regional innovation strategies projects in the new member states and associated countries (2005) were

developed with the support of the European Union. Furthermore, 145 regions have developed Regional Programs of Innovative Actions under the ERDF, many as a follow-up to the implementation of its Regional Innovation Strategy. These strategies strongly focused on establishing and reinforcing Regional Innovation Systems. The Central Region of Guarda and the Azores were both involved in this process, presenting two projects to the Innovative Actions Program (2002-2003 and 2007-2008).

In this context, the regional level, as a unit for appropriate analysis to promote territorial innovation dynamics, has been highlighted in several studies on regional innovation systems (De la Moth & Paquet, 2000; Cooke, 2003, 2008; Doloreux, 2003, 2004; Tödtlinng & Trippl, 2005; Asheim & Coenen, 2006; Cooke *et al.,* 2007). The regional innovation system is a complex concept, characterized by the existence of territorial, intangible, institutional and relational resources (Guerreiro, 2005). It measures regional innovation, dynamism, adaptability and learning skills in order to use tangible and intangible, internal or external assets to strengthen innovative activities and therefore competitiveness. Actors and organizations (companies, governing system, universities and research centers) are committed to the region's innovation development and interactive learning (Doloreux & Bitard, 2005).

On the other hand, peripheral regions usually present two weaknesses: a fragile social capital associated with a reduced concentration of critical business mass and little ability to influence central government. The second derives from the first and strongly depends on it. Local rivalries often hamper the building of social capital, but cooperation can be a key element to strength regional social capital. The region as a variable plays an important role in creating innovation. In innovation processes, the importance of interactions between different actors and their environment and externalities affect territorial production. The region can therefore be seen as supporting the allotment of resources to activate innovation as an interactive process that results in collective forms of learning (Doloreux & Dionne, 2007).

The regional innovation builds up and finds itself outside and within a region through a complex navigation process of different social networks through various agents (Braczyk *et al.,* 1998; Lundvall, 1992). In peripheral regions, the success of pro-innovation (technological) politics depends more on this networking interaction of different locally rooted actors as well as on commitment and local characteristics rather than on technology itself. The question is whether SMEs in Guarda are more or less innovative than firms in Azores. In this context, the fifth hypothesis is formulated:

H5. The municipality location of SMEs affects the introduction of innovations.

4. Methodology

The regions chosen for this study were the municipality of Guarda and the Azores (São Miguel and Santa Maria islands). The first is a peripheral area as opposed to the great metropolis of Lisbon; the second is an island, both peripheral areas.

As part of this study, a survey was sent to companies in the above regions to understand whether companies innovate, their advantages in innovation, and their main problems. The survey was based on the hypotheses presented in the previous section and focused only on the most relevant indicators without burdening the companies. The survey was conducted over the last four months of 2008 via mail, email, and fax. A total of 2,273 surveys were sent to SMEs in the above regions: 1,434 to the district of Guarda and 839 to companies in São Miguel and Santa Maria. After an update, data were selected, resulting in a total of 111 answered surveys (55 by Guarda and 56 by São Miguel and Santa Maria), which defined the sample.

In order to test the hypothesis, we estimated three models: a Logit model to measure the difference between firms that innovate and those that do not; a Tobit model to measure the intensity of innovation; and a Probit model to analyze the type of innovation.

In the first model, the dependent variable was the absence of innovation with an attributed value of «0» or the presence of innovation with a attributed value of «1». In the second model, the sample was reduced only for firms that had innovation activities, and the dependent variable was the measured by the percentage of new product sales. In the third model, the sample was reduced to firms that innovated, and the dependent variable identifying the principal area of innovation was measured on a three-point scale, where «0» is product innovation, «1» is process innovation, and «2» is marketing innovation.

Explanatory variables comprised R&D intensity (the number of employees involved in innovation activities); dimension (the number of employees); maturation stage (the number of years in activity); collaboration level (low, medium, or high); type of activity (primary sector, industry sector, commerce sector, construction and services activities); scope of activity (local, regional, national, or international); and region (Guarda or Azores).

5. Data Analysis and Results

The sample used in this study consists of 111 companies, 55 from the Guarda municipality and 56 from the Azores. The characteristics of the firms analyzed are presented in the Appendix. The most represented sectors are commerce and services, with 41% and 33% of the total, respectively (see Appendix, table A1). Most of the surveyed companies have been operating between 6 and 20 years or 20 to 50 years (41% and 24%, respectively of the total). These companies show local (54%) or regional (30%) activities. Most companies have 10 or fewer workers (58.2%), followed by companies with 10 to 20 employees (20%). In terms of innovative activity, 61% of the surveyed companies report some type of innovation introduced over the past three years (table A2).

The majority of these innovations were associated with the introduction of new products and product improvement (37% and 15%, respectively), followed by those

included in innovation systems and management reorganization (15% each, see table A3).

The majority of companies do not have more than three people directly involved in the innovation process (about 51%); in more than one third of all cases, no one was involved in the innovation process. When asked about sales increase resulting from introduced innovations, respondents mostly rate them between 4% and 10%, followed closely by 11% to 20%. From this data, we can conclude that the effects are significant and, in some cases, very significant. However, this analysis does not take cost/benefit into account, since it does not consider the investment effort inherent to the innovation process.

Regarding the information sources considered for the innovation processes, the customers are the main source of information. This shows that market orientation and dialogue with customers is a key element for improvements or innovation in products and processes (table A4).

The main difficulties for innovating were small market size, which would not return investments, high risks, and financing troubles (table A5).

A key aspect of innovation is the ability to congregate the necessary skills, whether internal or external. With that in mind, we asked about the partnerships established to achieve innovation in order to verify that companies collaborate mostly with their customers and/or suppliers to innovate (table A6). This shows the importance of companies networking with their clients and suppliers in order to develop solutions and processes that better meet the needs of the company or its clients.

Only 5.7% collaborate with universities and polytechnics, mainly for recruiting interns or providing services (table A7). This weak cooperation with universities is attributed to ignorance (25.5%), lack of need (19.6%), and the fact that universities do not attend business needs (14.7%). This reveals a large disconnection between companies and universities (table A8). Despite this gap, we can see that when innovation is associated with universities, it is 100% successful, unlike with any other kind of collaboration (table A9).

The results for the first model (table 1), which measures innovation presence, show that the Logit estimation is significant with a Log-Likelihood of 34,871 and a significance of 0.004. The significant variables distinguishing innovative and non-innovative firms are R&D intensity, dimension, and a higher maturation stage with a positive correlation.

The sector with more innovation was industry with a significantly higher presence than the reference category; other sectors did not show significant innovation differences. Innovative firms were more centered on local, regional or national levels than in international markets; the collaboration level is higher; and Guarda region had fewer innovative firms than the Azores region.

In the second model, which measured innovation intensity, the estimation results show that the model is significant with a Log-Likelihood of 45,546 and a significance of 0.001. The significant variables are R&D intensity and maturation stage.

Table 1. Estimation Results

Model			*Logit Innovation Presence*		*Tobit Innovation Intensity*		*Probit Innovation Type*
R&D Intensity	Employees in R&D	+	2,583 (0,000)	+	1,589 (0,000)	ns	0,657 (0,588)
Dimension	Number Employess	+	3,651 (0,000)	–	2,059 (0,000)	ns	2,574 (0,678)
Maturation Stage	Number Years	+	0,892 (0,000)	+	1,102 (0,000)	+	0,981 (0,000)
Type of Activity	Primary	ns	–1,571 (0,737)	ns	0,737 (0,511)	ns	1,532 (0,689)
	Industry	+	1,770 (0,077)	+	1,947 (0,000)	+	2,896 (0,000)
	Commerce	ns	0,855 (0,560)	ns	0,658 (0,684)	ns	0,501 (0,984)
	Construction	ns	–0,796 (0,453)	ns	–0,255 (0,865)	ns	–0,884 (0,765)
	Services	R	1,356 (Ref.)	R	1,254 (Ref.)	R	2,568 (Ref.)
Scope of activity	Local	+	18,665 (0,000)	+	17,532 (0,000)	ns	15,846 (0,453)
	Regional	+	19,326 (0,000)	+	13,235 (0,000)	+	20,687 (0,000)
	Nacional	+	18,786 (0,000)	+	20,782 (0,000)	ns	15,678 (0,885)
	Internacional	R	2,378 (Ref.)	R	1,897 (Ref.)	R	1,542 (Ref.)
Collaboration Level	Low	–	–3.598 (0,002)	–	–4,699 (0,000)	–	–2,865 (0,000)
	Medium	+	2,564 (0,005)	+	3,628 (0,000)	+	4,568 (0,000)
	High	R	5,834 (Ref.)	R	2,153 (Ref.)	R	4,238 (Ref.)
Region Location	Guarda	–	–0,340 (0,000)	–	–1,555 (0,000)	ns	0,853 (0,561)
	Açores	R	1,256 (Ref.)	R	1,982 (Ref.)	R	1,546 (Ref.)
Model Fit	Loglikelihood		34,871		45,546		26,321
	Sig.		0,004		0,001		0,006
	N		103		63		63

(Ref.) Reference category.

The industry sector showed more intense innovation. Companies focused on local, regional and national markets have higher intensity of innovation than those focused on international markets. Moreover, the collaboration level is higher in more intense innovation firms, and firms in Guarda have less innovation intensity.

In the third model, which measured the type of innovation, the results show that the estimation is significant with a Log-Likelihood of 26,321 and a significance of 0.006. The R&D intensity, dimension, and maturation stage are not significant in distinguishing the innovation type. However, the type of industry, namely industry sector versus services activities, shows explanatory power. Firms in the industry sector are more focused on product and process innovation, while services firms have more marketing innovation.

The scope of activity was significant in distinguishing regional firm type of innovation versus international firm type of innovation. Regional firms are more focused on product innovation, while international firms are more focused on process innovation.

The collaboration level was also significant in distinguishing the type or innovation, with higher collaboration associated with innovation in products and processes. The type of region did not show any differences in determining the type of innovation.

6. Discussion and Conclusions

In this study, we identify factors influencing the introduction of innovation in Small- and Medium-Sized Enterprises in less favored municipalities, particularly in the regions of Guarda and the Azores. Innovative entrepreneurs and small business owners in these territories have similar factors for success. In terms of innovation type, firms in the peripheral regions innovated more in marketing or organizational aspects or in improvements (products) with investments were for tradable goods or their production.

These results are consistent with what was suggested by Sirilli (2003), Barañano (2003), Tidd *et al.* (2001), and Cobbenhagen (2000) regarding the importance of non-technological dimensions such as management and other factors in successful technological innovation processes, growth, and value creation.

This paper contributes to the knowledge on innovation theory by analyzing the factors that distinguish firms that innovate and by presenting the estimation of the Logit, Tobit, and Probit models. There is an increasing number of companies that innovate: 61% of the companies surveyed have effectively introduced an innovation in the past three years; however, this figure still falls short of the EU average.

The results show R&D intensity is an important variable in the first two models, namely in developing innovation and in increasing the innovation intensity. However, it does not help to understand differences in innovation type. Dimension was a sig-

nificant variable in explaining innovation developed. In accordance with the literature and with the resource-based view of the firm larger, firms are more likely to innovate. However, this variable does not explain innovation intensity or innovation type. This result is similar to the effect of dimension in activity, which contributes to initiate the activity but not the intensity.

The maturation stage was another significant variable in explaining innovation development, innovation intensity, and type of innovation. The more years of operation, the greater likelihood to innovate and the higher innovation intensity. In terms of innovation type, older firms showed more marketing innovation.

The type of activity was associated with innovating and the intensity of innovation. Industry firms are more involved and more product and process oriented than service firms, which are more marketing oriented. In terms of scope of activities, local, regional or national firms have more innovation than international firms. We attribute this result to the fact that international firms operating in this region are in part commercial operations but do not have a mandate to explore innovation activities, which are done in subsidiaries of the company in other regions or countries. The level of collaboration with other entities shows significance in developing innovation and in the intensity of innovation and in terms of type of innovation; that is, lower levels of collaboration correspond with less innovation.

The two regions also show differences in terms of innovation. Firms in the Azores show more innovation; Since Azores is an island archipelago, many local companies integrate all functions within the region. In Guarda, which is an interior region, companies can locate these activities in other regions or more easily benefit from innovation activities in frontier regions.

As implications of this study, we see the need to obtain experience and dimension in order to develop innovation. Innovation demands resources and commitment that smaller companies cannot obtain and therefore needs more incentives and collaboration.

Type of activity is closely associated with the existence, intensity, and type of innovation. Industry firms show higher levels of innovation and focus more on product and process innovation, while services companies show less innovation and are more focused on marketing innovation. This reveals the need for policymakers to develop incentives for other sector to innovate.

The scope of activity was a significant variable. Local, regional, and national firms showed more innovation activities then international ones. This may be due to the fact that international firms have other sources of innovation in other places, because foreign markets normally demand more innovation than local markets.

As limitations to this study, we consider the low number of answered surveys given the initial sample, limiting the ability to test certain aspects. Moreover, the study focused only on two particular regions, which limits generalization. As elements for future research, it would be interesting to study innovations in more regions and in contrasting regions, for instance, more and less economically developed regions and

central or peripheral regions. Another important factor is the human component in a possible innovation system. Specific training on innovation teaches employees how to organize and promote innovation efforts within the company, thus requiring higher levels of democratization.

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Table A1. General Characteristics of the Companies

Sectors	*%*	*Years of operation*	*%*	*Activity*	*%*	*Employess*	*%*
Agriculture	5	< 1 Year	7	Local	54	< 10	58.2
Industry	12	2-5 Years	17	Regional	30	10-20	20
Commerce	41	6-20 Years	41	National	14	21-50	13.6
Construction	8	21-50 Years	24	International	2	51-100	5.5
Services	33	> 50 Years	11			> 10	2.7

Table A2. Number of Innovations and Patents

	Innovations	*%*	*Patents*	*%*
Yes	63	61	7	6
No	40	39	101	94
Total	**103**	**100**	**108**	**100**

Table A3. Innovation Process in SME's: Type, People and Sales

Type of innovation	*%*	*People Involved*	*%*	*Sales Increase*	*%*
Product improvement	14.7	0	38.2	0	22.1
News Products	37.3	< 3	51	< 3%	13.5
Marketing innovation	9.8	4-10	7.8	4-10%	22.1
Innovation process	8.8	11-20	2	11-20%	21.2
Innovation Systems	14.7	> 20	1	> 20%	21.2
Management reorganization	14.73				

Table A4. Sources of Information for the Innovation Process

	Frequency	*Percent*	*Valid Percent*	*Cumulative Percent*
Clients	57	51.4	54.3	54.3
Suppliers	22	19.8	21.0	75.2
Partners	11	9.9	10.5	85.7
Consultants	4	3.6	3.8	89.5
Associations	7	6.3	6.7	96.2
Workers	4	3.6	3.8	100.0
Total	**105**	**94.6**	**100.0**	

Table A5. Main Difficulties for Innovating

	Frequency	*Percent*	*Valid Percent*	*Cumulative Percent*
High risk	18.0	16.2	17.6	17.6
Lack of information	10.0	9.0	9.8	27.5
Lack of trained human resources	12.0	10.8	11.8	39.2
Small size Market	42.0	37.8	41.2	80.4
Absence of Partnerships	6.0	5.4	5.9	86.3
Lack of Financial Means	14.0	12.6	13.7	100.0
Total	**102.0**	**91.9**	**100.0**	

Table A6. Main Cooperators to Innovate

	Frequency	*Percent*	*Valid Percent*	*Cumulative Percent*
Universities and Polytechnics	6.0	5.4	5.7	5.7
Business Associations	13.0	11.7	12.3	17.9
Consultants	7.0	6.3	6.6	24.5
Clients and Suppliers	57.0	51.4	53.8	78.3
Centers of Research	1.0	0.9	0.9	79.2
Others Companies	6.0	5.4	5.7	84.9
No Applicable	16.0	14.4	15.1	100.0
Total	**106.0**	**95.5**	**100.0**	

Table A7. Main forms of collaboration with Universities or Polytechnics

	Frequency	*Percent*	*Valid Percent*	*Cumulative Percent*
Provision of services	4.0	3.6	10.5	10.5
Studies and Research	3.0	2.7	7.9	18.4
Training to Employees	1.0	0.9	2.6	21.1
Use of Equipment	2.0	1.8	5.3	28.3
Recruitment of interns	5.0	4.5	13.2	39.5
Not Applicable	23.0	20.7	60.5	100.0
Total	**38.0**	**34.2**	**100.0**	

Table A8. Reasons for not collaborating with universities or polytechnics

	Frequency	*Percent*	*Valid Percent*	*Cumulative Percent*
Ignorance	26.0	23.4	25.5	25.5
Lack of Need	20.0	18.0	19.6	45.1
Not Adapted	15.0	13.5	14.7	59.8
High Cost	3.0	2.7	2.9	62.7
Deadline for reply	1.0	0.9	1.0	63.7
Complexity of process	4.0	3.6	3.9	67.6
No Applicable	33.0	29.7	32.4	100.0
Total	**102.0**	**91.9**	**100.0**	

Table A9. Innovation and Collaboration with Universities or Polytechnics

	Universities or Polytechnics	*Business Associations*	*Consultants*	*Clients of Suppliers*	*Others Companies*	*Not Applicable*	*Total*
Yes %	5.0 100.00	8.0 72.73	2 40.00	39 69.64	3 50.00	4 26.67	61 62.24
No %	0.0 0.00	3.0 27.27	3 60.00	17 30.36	3 50.00	11 73.33	37 37.76
Total %	**5.0 100.00**	**11.0 100.00**	**5 100.00**	**56 100.00**	**6 100.00**	**15 100.00**	**98 100.00**