

Cermelli, Massimo; Asso, Pier Francesco; Pipitone, Vito

## Conference Paper

# Strategies to innovate in SMEs: analyzing the key factors of internationalization and interaction in Basque and Sicilian firms

53rd Congress of the European Regional Science Association: "Regional Integration: Europe, the Mediterranean and the World Economy", 27-31 August 2013, Palermo, Italy

## Provided in Cooperation with:

European Regional Science Association (ERSA)

*Suggested Citation:* Cermelli, Massimo; Asso, Pier Francesco; Pipitone, Vito (2013) : Strategies to innovate in SMEs: analyzing the key factors of internationalization and interaction in Basque and Sicilian firms, 53rd Congress of the European Regional Science Association: "Regional Integration: Europe, the Mediterranean and the World Economy", 27-31 August 2013, Palermo, Italy, European Regional Science Association (ERSA), Louvain-la-Neuve

This Version is available at:

<https://hdl.handle.net/10419/124005>

### Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

### Terms of use:

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

53th European Regional Science Association (ERSA) International Congress  
Regional Integration: Europe, the Mediterranean and the World Economy  
Palermo, Italy, 27-31 August 2013

## **STRATEGIES TO INNOVATE IN SMEs: ANALYZING THE KEY FACTORS OF INTERNATIONALIZATION AND INTERACTION IN BASQUE AND SICILIAN FIRMS**

Authors:

Cermelli Massimo \*: [massimo.cermelli@deusto.es](mailto:massimo.cermelli@deusto.es)  
Asso Pier Francesco †: [francesco.asso@unipa.it](mailto:francesco.asso@unipa.it)  
Pipitone Vito<sup>a</sup>: [vito.pipitone@cnr.it](mailto:vito.pipitone@cnr.it)

\*Universidad de Deusto - Deusto Business School - Avda. Universidades, 24. Bilbao (Spain)

†Università degli Studi di Palermo – Facoltà di S.Politiche - Via Maqueda, 324. Palermo (Italy)

<sup>a</sup>Consiglio Nazionale delle Ricerche - Via Ugo La Malfa, 153. Palermo (Italy)

---

### **Abstract**

The increasing openness of economies and the phenomenon of globalization has led to know-how and innovation becoming the key factors for business in terms of competitiveness. Thus, the fact that the activities and services are increasingly innovative means that the construction of innovation is channeled through the social sphere, attributing an increasingly importance and critical role to the field of local development. The exchange of knowledge and experiences between firms and within firms together with a high level of interaction among the agents, that constitute the social and economic environment of a region, becomes a source of competitive advantage and represents a key strategy for the generation of innovation at the firm levels. Internationalization and interaction for SMEs represent action strategies in an increasingly complex environment where territory plays a key role. The geographical areas with all their knowledge and experiences present in their context are the source of tacit knowledge that determines the competitive advantage of the new millennium. In this paper we study and analyze the predictors of innovation generation in SMEs, demonstrating the relevance of internationalization and cooperation strategies in Basque and Sicilian firms comparing the two experiences. SMEs constitute the majority productive Basque and Sicilian territorial reality and their impact on the local economy is crucial for the development of the two regions.

*Key words: Internationalization, Interaction, Innovation, SMEs, Sicily, Basque Country*

JEL: 031,032

## 1. INTRODUCTION

It was a hundred years ago that the Austrian economist Joseph A. Schumpeter showed how innovations were a crucial and complex activity which explained a major part of the growth and transformation of economic systems. After having lost momentum during the following decades dominated as they were by two world wars, a great depression and the Keynesian revolution, this powerful idea came to be rediscovered in the 1970s after the world economy was hit by stagnation and the general decline of the mixed economy and state owned enterprises.

In his treatise, Schumpeter offered a taxonomy of potential innovations (product, process, market, raw materials, organizational) which to a large extent has remained unmodified in the agenda of researchers and economic observers. What basically changed ever since his seminal contribution was a more thorough understanding of what really determines innovations. For the Austrian economist, the driving force behind innovations essentially resided in the potentialities of the entrepreneur, an idiosyncratic individual who managed to break routines and deep-rooted habits, in order to gain windfall profits from new products or methods of production. When in the 1970s Schumpeter's ideas began to reemerge, it was the amount of investments in large R&D departments on the part of big firms that came to be regarded as the main, most powerful engine of innovations. However, also this picture about how innovations come to be "uniquely" determined has changed significantly in the last three decades, when a growing amount of research has shown how innovations become possible and crucial also in low income countries, in small firms and in low technology sectors.

Here, we find a rather wide spectrum of determinants of innovation: besides financial capital and real investments, strong evidence has been found on the role that human capital and social capital play for the absorption but also for the production of innovations. Most particularly: the role of networks or of formal and informal relations among firms; the activities displayed by such intermediate institutions as professional associations or no profit organizations have all acquired a greater importance in explaining how and why firms innovate. Following this perspective, a higher level of interaction is a necessary condition for the generation of tacit knowledge, the exploitation of widespread economies of information and the experimental increments of "newness" which are so often relevant to innovation among small firms and in traditional sectors. Finally, greater interaction among firms also means a greater propensity toward internationalization, which is in itself both a source and a consequence of innovative capacities.

Thus the emergence of a good mix between innovation, internationalization and cooperation can become a crucial asset in order to succeed in an increasingly complex environment, populated by a growing number of competitors coming from all over the world. As is well known, in building up competitive advantages, a strong link between international firms and innovative firms is often recorded.

In order to develop the latter perspective and enhance our understanding of the complex interactions between social and economic factors in spurring innovation and internationalization processes, economic analysis has profited by the development of a growing amount of econometric techniques that have been integrated by new approaches to sociological inquiry. In fact, a first-hand knowledge of the firms and their decisional process by means of surveys or interviews can integrate economic information coming from the analysis of firms' balance sheet or aggregate data on their performance in international or domestic markets.

The present paper intends to make a contribution to this field of research by making use of original data collected with direct surveys on firms behavior and performance at a regional level. Its foundations lay upon a comparison between two different surveys which have been recently

and autonomously conducted within two regional economic systems, namely in Sicily and the Basque Country respectively. There are several reasons which have led us to believe on the potential research interests of this comparison.

First. The two studies have followed a similar approach and have focused on a wide spectrum of variables (economic, social, relational, informational etc.) which aim to explain the key determinants of innovations among very small, small or medium sized enterprises.

Second. The two sets of data regard firms which are located in relatively backward regions of mature economies which are characterized by limited pro market activities. In other words, the focus is on firms which are innovative despite the general context in which they operate. A context which heavily constrains their daily life in terms of external diseconomies, low local demand, poor levels of agglomeration economies and district activities, and other factors which often coalesce perversely against innovation.

Third. The two surveys are focused on different sectors which obviously reflect the different structure of pro market activities which characterize the two regions. Since innovation processes and innovations strategies may tend to follow different paths according to the different nature of production processes then a comparative analysis of the determinants may confirm or reject the validity of the sectoral specificity hypothesis and may hopefully provide some suggestions in terms of policy design.

The paper is structured as follows. The second paragraph briefly offers a review of the literature which, for our purposes, has been classified in terms of the different kinds of relationship that have been found by the specialized literature between: i. size and innovation, ii. internationalization and innovation, iii. R&D expenditure and innovation, and finally iv. openness to cooperation and innovation. The third paragraph is devoted to explain our methodology with a rough description of the panel of firms, the main features of the survey, the different indicators of innovation, the two types of analysis that were conducted on the available data (contingency tables and a logical analysis model to provide correlations among the relevant variables). The fourth paragraph is devoted to describe the main results in terms of individual determinants, simultaneous effects and multiplier effects ignited by the main determinants. A final paragraph of conclusions follows.

## **2. REVIEW OF THE CONCERNED LITERATURE**

The variegated nature of innovation has inspired the production of a rich and diversified literature. Looking for the determinants of the innovation process, empirical studies have used different approaches (from individual case studies to large international samples) and have focused their attention on a large set of variables both internal and external to firms (Sternberg and Arndt, 2001).

For the purpose of this work, our attention has been put only on some causal relationships, highlighting the role of the internal variables linked to the structure and behavior of the firms. Among these variables, the size of firms has traditionally been regarded as one of the main determinants of innovation. There are several reasons to support this thesis, which follows directly from Schumpeter's seminal works. First, it has been recognized that larger firms have a greater cash flow and a greater ability to borrow from banks and on financial markets, thus acquiring the necessary financial resources needed to develop innovative projects. Secondly, in large firms fixed costs related to innovations can be spread across a larger volume of sales, with

a consequent reduction in average fixed costs (Cohen and Klepper, 1996). And third, larger firms can more easily intercept high skilled workers and become in this way more capable to generate innovations (Rogers, 2004).

All these arguments which stress the relevance of firm size have also drawn inspiration from the studies on the impact of R&D expenditure, which is considered by some authors as the single most influential variable in a firm's ability to innovate (Dosi, 1988; Freeman and Soete, 1997 Kafouros). Large firms are more likely to organize big research departments, where workers can not only find motivation for new research activities, but also the possibility of a more thorough interaction and division of scientific and technological labor. The organization of major research groups enhances the likelihood of recognizing more easily the importance of accidental discoveries and tends to create more opportunities to diversify the activities of R&D, reducing risk and increasing the returns of the resources used in research activities (Kamien and Schwartz, 1982 Kafouros, 2008). Moreover the organization of research departments increases the ability to accumulate large amounts of knowledge and technological capabilities, as well as to tolerate some failures in research (Damanpour, 1992).

Despite the reported positions may give the impression of a unanimous sharing of the Schumpeterian hypothesis, in reality this issue remains hotly debated. An issue that sometimes has taken an almost "theological" tone (Stock, Greis and Fischer, 2002). Several authors, in fact, have provided new evidence about the benefits of the small size of the firms in creating innovations, bringing back these benefits to the ability to avoid "bureaucratic inertia" (typical of large firms) and to adapt more quickly to market changes and needs (Gilder, 1988). Small firms can act quickly to achieve an optimal innovation effort and have staff more closely tied to business objectives. The R&D would also have a more visible impact on the overall performance of the company and this would lead to a higher overall level of motivation (Kamien and Schwartz, 1982).

Although in recent decades, researchers and scholars have had a greater access to empirical data, using a wider set of econometric methods and alternative measures of firm innovations, the results are still inconclusive. The relationship between firm size and innovation tends to be seen as a U relationship, characterized by a high innovative intensity which links small and large businesses (Bound et al., 1984). The smaller firms show a higher rate of innovation per employee, but at the same time, the average value of these innovations is lower than the one obtained by larger firms (Tether, 1998). More generally, the size of the company seems to have an effect on innovation only in relation to specific economic sectors (in particular, capital-intensive), and in specific technological and market conditions (Acs and Audretsch, 1987; Shefer and Frenkel, 2005).

Another aspect highlighted by the traditional literature is the close link between innovation and internationalization. This link has a double causation, which has been particularly discussed in the literature. While it is possible to assume that the most innovative firms are the firms with the highest probability of internationalization, on the other hand it can be observed that the firms' presence in the international markets and their openness to competition generates a flow of material and immaterial resources that are able to stimulate innovation (Lopez, 2005). In this perspective, a way to observe internationalization as a determinant of innovation is to focus on the change of innovative capacity (Kafouros et al., 2008).

The presence in international markets makes it possible to access to new resources not available in domestic markets (Kotabe, 1990; Cheng and Bolon, 1993) and the acquisition of new ideas from different cultural perspectives (Hitt et al., 1997). The interaction with a greater number of partners can also improve the internal capacity of learning and consequently the process of accumulation of knowledge (Santos et al., 2004). Then, the knowledge acquired on the

international market can allow an improvement in the overall quality of the products, getting closer to consumers' preferences and identifying new needs (Kafouros, 2006). However, the advantages of internationalization should not be limited to the acquisition of new resources, new capabilities or the reduction of the R&D costs, but they manifest themselves also in terms of higher returns to innovation. As it is well known in economics, innovation naturally produces positive externalities and therefore does not allow a complete capture of benefits by the firm that has made innovation. Working in different markets around the world is therefore a way to make the most of the benefits of innovative activity (Caves, 1982). Opening up to a larger number of buyers and suppliers can also compensate the shorter life cycles of products and the higher rates of depreciation of investments in innovation (Goto and Suzuki, 1989).

Some recent contributions, however, tend to remain careful about the real benefits of internationalization on innovation (Kafouros, 2008). Not all firms, in fact, are able to use their presence in international markets to increase the level of innovation, while the effect of innovation on business performance is sometimes insignificant.

An area of recent exploration is the role of networks in promoting firm innovation. This relationship is of multidisciplinary interest among economics, sociology, geography and management (Rogers, 2004). A network can be thought of as a web of relationships through which knowledge flows, either through formal or informal mechanisms. In this sense, it facilitates the exchange of intangible assets and becomes an important strategic tool to enable innovative processes (Kogut, 1988 Gulati, 1995; Miotti and Sachwald, 2003; Faems et al. 2005). In particular, the greater benefits produced by networks seem to affect small and medium-sized firms. In fact, in these firms innovation is less and less the outcome of an isolated individual effort (Fischer and Varga, 2002; Drejer and Jørgensen, 2005).

A study conducted in Italy on a regional basis showed that the regional level of university research primarily affects the output of patents in firms with fewer than 100 employees (Audretsch and Vivarelli, 1994). Similar results are found for the USA, where small semiconductor firms are more closely linked to regional knowledge networks than large firms (Almeida and Kogut, 1997).

However, there are significant differences among the various types of networks that can determine how the knowledge flows are managed and what kind of innovation can be achieved (Whitley, 2002). In Particular, vertical collaboration with clients and suppliers allows a firm to gain considerable knowledge (Whitley, 2002) and have a more significant impact on both product and process innovation (Miotti and Sachwald, 2003).

Collect market information directly from their customers or sometimes involve customers directly in the creation of new products increases the likelihood of innovation successful (Fritsch and Lukas, 2001), especially when products carry a higher degree of novelty (Meyers and Athaide, 1991; Amara and Landry, 2005; Nieto and Santamaria, 2007). Suppliers also represent valuable sources of information. They can help firms to reduce the risk of innovations, while enhancing flexibility, product quality and market adaptability (Chung and Kim, 2003). Structurally different are the horizontal collaborations with other firms. In these networks, partnerships will be more efficient and fruitful if companies are complementary to each other and if the information asymmetries are very low. Whilst collaborations with competitors seem to be limited only to the common problems outside the competitor's area of influence (Tether, 2002) or in pre-competitive research programs (Tidd and Trewhella, 1997; Dussauge and Garrette, 1998). Conversely, increasingly important has become the creation of networks with universities and other research institutions. While in the past the knowledge flowed in a unidirectional manner (from research organizations to firms), today knowledge is starting to flow

in a circular way and the research organizations are focusing more on filling out the innovation processes of firms (Bozeman, 2000; Vuola and Hameri, 2006).

While this review of the literature is rather partial, however, it provides many confirms on the complex nature of innovations and the multiplicity of variables that can foster and affect the persistence of innovative processes.

### 3. DATA SOURCES, VARIABLES AND METHODOLOGY

#### 3.1 Data sources and variables

Following some of the research strands that we have highlighted in the previous paragraph, our analysis was conducted in two different phases in the two different countries.

In the case of the Spanish SMEs according to Cermelli (2013) has been conducted an econometric analysis on **404 firms of the Basque Country** surveyed by SPRI - Society for the industrial reconversion – operating in four different sectors (according to the National Classification of Economic Activities – NCEA): NCEA 22 Graphics (40 firms), NCEA 28 Metal (159 firms), NCEA 29 Machinery (67 firms) and NCEA 72-7420 Informatics (138 firms).

The Basque SMEs analyzed, participated to the program Berrikuntza Agenda (Innovation Agenda) in 2008 answering a questionnaire with 34 questions, using four qualitative levels of evaluation (low – medium – acceptable – excellent).

The surveyed firms were also divided into three different groups according to their different level of innovation output:

- Not innovative firms (no innovation output);
- Innovative firms (incremental innovation, e.g. purchase machineries, software, etc.);
- Very innovative firms (patents, process or product innovations).

In the case of the Italian SMEs has been conducted an econometric analysis on **335 firms of Sicily** surveyed by the RES Foundation (Asso, Trigilia 2010) operating in nine different sectors: Agri Fisheries, Alimentary, Chemical/Pharmaceutical, Metal, Machinery, Transportation, Plastic/Wood/Rubber/Manufacturing, Construction and Tertiary.

The Sicilian SMEs surveyed in 2009 answered a questionnaire with 233 questions that we summarized in 24 macro areas of analysis similar to the questionnaire of the Basque firms.

The surveyed firms were so divided in five different groups according to their different level of innovation output:

- Innova (firm presents any kind of innovation)
- InnPrSe (firm presents product and / or service innovation)
- InnProc (firm presents process innovation)
- InnOrMk (firm presents organization and marketing innovation)
- InnRes (firm presents patent, brand or model)

The four firm's characteristics analyzed are:

- Size/Dimension of the firms
- Level of internationalization of the firms
- Level of R&D performed in the firms
- Level of cooperation/interaction with other firms

Although the study was carried out in two different moment, the same variables were considered to define the characteristics of the firms to cross them with the innovation outputs described above.

The variable **size/dimension** was built taking into account the number of employees. The distribution of the number of employees of the companies showed a marked asymmetry so we used a dichotomous classification dividing the firms in two categories: a) until 20 employees, b) up to 20 employees.

The variable **internationalization** took into account the existence of a proportion of the turnover's firms dedicated to the exports (up to 1% of the turnover).

The **R&D** performed in the firms has been calculated according to the evaluation of the questionnaire conducted in every firms using a dichotomous classification and dividing the firms in two categories: a) low-medium level in terms of resources directed to R&D projects, b) acceptable-excellent level in terms of resources directed to R&D projects.

Finally the level of **cooperation/interaction** took into account the collaboration with other firms, technological centres and universities to develop R&D programs, patents, research projects and requests for EU funding.

### 3.2 Methodology

The econometric analysis was also conducted in two phases in the two countries. In the first part **contingency tables** have been used to cross the four firm's characteristics introduced in the literature review (dimension, internationalization, R&D and interaction) with the innovation output, analyzing the independence test (Pearson  $\chi^2$ ), the degree freedom (DF) and the error probability in rejecting the hypothesis of independence (Probability  $> \chi^2$ ).

In the second part we studied the relationship between the innovation output and the four described factors simultaneously, to neutralize every form of influence between them. For this purpose, we used a **logistic analysis model** in which the innovation output has been measured as a dichotomous variable with value 0, when the firm is not innovating (it means that it does not present one of the innovation output described above), and with value 1 when the firms is innovating (it means that it presents a very innovative profile).

The log odds ratio that we used for the logistic analysis model was:

$$\log\left(\frac{\pi_i}{1-\pi_i}\right) = \alpha + \beta x_i + \gamma y_i$$

In which  $\pi_i$  is the probability the probability of presenting a high level of innovation in the firms "i", considering that the firms present values  $x_i$  and  $y_i$  in two factors. In the logistic model stated that the logarithm of the odds ratio (log odds ratio) is a linear function of the two factors.

According to Agresti (2007) and Stokes et al. (2009) we follow the methodological recommendations for the two phases of the analysis.

Both, in the first part of the analysis as in the second one, in presence of a positive effect of the characteristics presented by the firms we also measured a **multiplier effect** on the generation of



relevant innovation output. This value basically shows how many times the likelihood of developing innovation in presence of the characteristics increases.

According to the relevance of the innovation output (high level or very innovative profile), we focused our attention particularly on the generation of patents, process or product innovations in the Basque firms and on the generation of patents, brand or model in the Sicilian ones.

According to the significance of the analysis we identified three different levels considering not significant a  $Prob > \chi^2$  higher than 5%:

- \*\*\* Very high significance ( $Prob > \chi^2$  less than 0,01%)
- \*\* High significance ( $Prob > \chi^2$  between 0,01% and 1%)
- \* Significant ( $Prob > \chi^2$  between 1% and 5%)

## 4. RESULTS OF THE ANALYSIS

### 4.1 Analysis of the Spanish SMEs (Basque Country)

Summarizing the first part of the analysis of the Spanish firms (see table 1), according to the effect on the generation of the high level of innovation, we found a very high significant effect of the internationalization and interaction respectively in the Informatics sector (0,01%) and in the Metal one (0,02%).

**Table 1**

**Summary of individual contrast effect of the characteristics on the high level of innovation output**

	<b>Graphics</b>	<b>Metal</b>	<b>Machinery</b>	<b>Informatics</b>
<b>Internationalization</b>	- No sign.	+ Signific. 1,78% **	+ No sign.	+ Signific. 0,01% ***
<b>Dimension</b>	- No sign.	+ No sign.	+ No sign.	- No sign.
<b>R&amp;D</b>	+ No sign.	+ Signific. 1,26% **	+ No sign.	+ Signific. 2,76% **
<b>Cooperation/Interaction</b>	+ Signific. 1,98% **	+ Signific. 0,02% ***	+ No sign.	+ No sign.

Source: Own elaboration on SPRI data

Furthermore, in order to the dimension, in the firms analyzed, it does not exist a significant relationship in all the four sectors. However, the other characteristics (R&D, internationalization and interaction) show a positive and significant relationships in some sectors.

Also when we analyzed the relationship between the innovation output and the four described factors simultaneously, to neutralize every form of influence between them, we found that the dimension of the firms does not matter as well as the R&D performed in the firms analyzed and that the more relevant factors are the internationalization in the Informatics sector and cooperation/interaction in the Metal one (see table 2).

**Table 2**

**Summary of the join test effect of the characteristics on the high level of innovation output**

	<b>Graphics</b>	<b>Metal</b>	<b>Machinery</b>	<b>Informatics</b>
<b>Internationalization</b>	– No sign.	+ Signific. 3,54% **	+ No sign.	+ Signific. 0,07% ***
<b>Dimension</b>	– No sign.	– No sign.	– No sign.	– No sign.
<b>R&amp;D</b>	+ No sign.	+ No sign.	+ No sign.	+ No sign.
<b>Cooperation/Interaction</b>	+ Signific. 2,36% **	+ Signific. 0,24% ***	+ No sign.	+ No sign.

Source: Own elaboration on SPRI data

As we mentioned before we measure a “multiplier effect” that basically shows how many times the likelihood of developing a high level of innovation in presence of a very high significance relationship in the four sectors increases (see table 3).

**Table 3**

**Multiplier effect in the Basque (Spain) firms analyzed**

<b>Multiplier effect Sectors</b>	<b>NoEXTMARK</b>	<b>SiEXTMARK</b>	<b>NoEXTMARK</b>	<b>SiEXTMARK</b>
	<b>NoCOOPER</b>	<b>NoCOOPER</b>	<b>SiCOOPER</b>	<b>SiCOOPER</b>
<b>Graphics</b>	1	0,19	13,13	4,40
<b>Metal</b>	1	2,23	4,43	6,89
<b>Machinery</b>	1	2,44	2,38	4,77
<b>Informatics</b>	1	4,79	2,18	7,40

Source: Own elaboration on SPRI data

Notes: No EXTMARK: No existence of a proportion of the turnover’s firms dedicated to the exports  
 Si EXTMARK: Existence of a proportion of the turnover’s firms dedicated to the exports  
 No COOPER: No collaboration with other firms, technological centres and universities  
 Si COOPER: Collaboration with other firms, technological centres and universities

In the Basque firms analyzed, through the last table on the multiplier effect, we can argue the relevance of the two characteristics and, above all, the importance to focus the attention on the internationalization process to be more innovative in the sectors of Machinery and Informatics.

In the case of the Graphics sector in which seems to prevail the effect of cooperation it should be noted that due to the low number of firms in the analysis group we found, during the analysis, different statistical validity problems, due to the appearance of cells with expected values below 5.

#### 4.2 Analysis of the Italian SMEs (Sicily)

Summarizing the two parts of the analysis of the Italian firms (see table 4 and table 5), according to the effect on the generation of the high level of innovation, we found a very high significant effect of the internationalization and interaction respectively in all the sectors analyzed and also in the case of the Sicilian SMEs for the different kinds of innovation.

Also in the Italian analysis the dimension characteristic does not matter on the generation of the firm's innovations.

**Table 4**  
**Summary of individual contrast effect of the characteristics**  
**on any kind of innovation output**

	<b>INNOVA</b>	<b>INNPrSe</b>	<b>INNProc</b>	<b>INNOOrMk</b>	<b>INNRES</b>
<b>Internationalization</b>	** (0,22%)	*** (<0,01%)	*** (0,03%)	*** (0,05%)	*** (<0,01%)
<b>Dimension</b>	No	No	No	No	No
<b>R&amp;D</b>	*** (<0,01%)	*** (<0,01%)	*** (<0,01%)	*** (<0,01%)	*** (<0,01%)
<b>Cooperation/Interaction</b>	*** (<0,01%)	*** (<0,01%)	*** (<0,01%)	*** (<0,01%)	*** (<0,01%)

Source: Own elaboration on RES data

As table 5 shows when we study the relationship between the innovation output and the four described factors simultaneously, through a logistic analysis model the effect of R&D as in the Basque firms it disappears so we focused our attention on the internationalization characteristic (MEREXT), that reports that we are in presence of the existence of a proportion of the turnover's firms dedicated to the exports, and on the cooperation/interaction (COOPER), that reports that Sicilian firms are collaborating with other firms, technological centres and universities to develop R&D programs, patents, research projects and requests for EU funding.

In the case of the Italian SMEs we cross data with the variable InnRes that states that firms present a patent, a brand or a model and that we identified as in the Basque firms like an high level of innovation output.

As we can observe the relevance of the cooperation/interaction in the Sicilian firms surveyed by the RES Foundation is more relevant than the internationalization although the two characteristics are very relevant on the innovation output in the majority of the sectors.

**Table 5**  
**Summary of the join test effect of the characteristics**  
**on the high level (InnRes) of innovation output**

Characteristics/ Sectors	Est	Stand. error	DF	L-R Chi2	Prob>Chi2	Sign.
<b>MEREXT</b>	0,7724724	0,3722387	1	4,372	3,65%	*
<b>COOPER</b>	1,4697413	0,3397184	1	19,943	<0,01%	***
<b>Agri-Fisheries</b>	-1,77138641	0,5970157	1	9,668	0,19%	**
<b>Alimentary</b>	-1,65782518	0,4689857	1	14,214	0,02%	**
<b>Chemical/Pharmaceutical</b>	-1,16922645	0,8441946	1	1,963	16,12%	
<b>Metal</b>	-4,69275118	1,0612731	1	63,883	<0,01%	***
<b>Machinery</b>	-2,62187042	0,6132793	1	23,928	<0,01%	***
<b>Transportation</b>	-1,09336695	0,7624987	1	1,967	16,07%	
<b>Plastic/Wood/Rubber/Manuf.</b>	-1,94114603	0,4442506	1	22,541	<0,01%	***
<b>Construction</b>	-3,62335136	0,5439801	1	115,391	<0,01%	***
<b>Tertiary</b>	-3,18958826	0,5320463	1	60,489	<0,01%	***

Source: Own elaboration on RES data

As we do with the Basque SMEs we measure a “multiplier effect” for the Sicilian ones that basically shows how many times the likelihood of developing an high level of innovation in presence of a very high significance relationship in the four sectors increases (see table 6).

In the Sicilian firms analyzed we can underline the relevance of the two characteristics and, above all the importance to focus the attention on the cooperation/interaction process to be more innovative in the sectors of Metal, Construction and Tertiary.

The presence of the two characteristics (internationalization and cooperation/interaction) in the Metal sector, for example, increases almost nine times the probability to present an high level of innovation output that means to achieve a patent, a brand or a model.

**Table 6**  
**Multiplier effect in the Sicilian (Italy) firms analyzed**

<b>Multiplier effect Sectors</b>	<b>NoEXTMARK</b>	<b>SiEXTMARK</b>	<b>NoEXTMARK</b>	<b>SiEXTMARK</b>
	<b>NoCOOPER</b>	<b>NoCOOPER</b>	<b>SiCOOPER</b>	<b>SiCOOPER</b>
<b>Agri-Fisheries</b>	1	1,85	2,92	4,23
<b>Alimentary</b>	1	1,82	2,83	4,01
<b>Chemical/Pharmaceutical</b>	1	1,70	2,42	3,14
<b>Metal</b>	1	2,14	4,22	8,75
<b>Machinery</b>	1	2,01	3,54	6,00
<b>Transportation</b>	1	1,68	2,36	3,03
<b>Plastic/Wood/Rubber/Manufact.</b>	1	1,89	3,06	4,58
<b>Construction</b>	1	2,10	4,00	7,72
<b>Tertiary</b>	1	2,07	3,84	7,06

Source: Own elaboration on RES data

## 5. CONCLUSIONS

The aim of this work was to analyze the predictors of innovation generation in SMEs, demonstrating the relevance of internationalization and cooperation/interaction strategies in Basque and Sicilian firms. The three authors had already devoted some research efforts in collecting original data and providing new analysis on the innovative dynamics of these two Mediterranean regions. The paper is intended as an extension of these previous workd, by means of a comparison of the two different data sets and the possible identification of the different drivers of innovation in the two different contexts.

The analysis was conducted in two different phases: in 2008 in the Basque country and in the Spring of 2009 in Sicily. However a very similar methodology was employed in the two surveys as well as in the general research objectives which tried to investigate how four different determinants of innovation were positively correlated to the innovation output.

Thus, drawing inspiration from the review of the innovation literature on the determinants of firms innovations we analyzed the influence of internationalization, dimension, R&D and cooperation/interaction on the innovation output measured through the production of patents, process or product innovations, brands or models.

The main results of our analysis are the following: first, both the capacity to stay in international markets and the construction of network and other forms of cooperation are particularly relevant for Spanish and Italian firms. The presence in the firms of these two characteristics has a significant relationship with the innovative output. This can be interpreted as if, *ceteris paribus*, the innovation output was affected positively in firms that sell their products to foreign markets and cooperate and interact with other firms, research centres or university departments. Our estimates show that internationalization is particularly relevant in Spanish firms while cooperation/interaction in Italians ones.

Second, the effect of R&D on the innovation output is positive although quite ambiguous for our group of Spanish and Italian firms which is characterized by the presence of small and medium sized enterprises.

Third, size does not matter on the innovation generation in Spain as well as in Italy.

This can be interpreted as if, *ceteris paribus*, the innovation output were affected positively by the percentage of firms that carry out R&D activities in the country.

A final remark regards the exploratory nature of this analysis underlining some limitations of the analysis. First of all the Spanish firms analyzed belong to 4 sectors while the Italian ones to 9 sectors. Secondly, the sample of the 404 Basque SMEs analyzed belonged to a program to boost innovation while the 335 Sicilian ones did not. Thirdly, the Basque SMEs were surveyed in 2008 while the Sicilian ones in 2009. In this regard it would be interesting to achieve in the next years an intertemporal analysis to provide a further comparisons with the results obtained in this analysis.

## REFERENCES

- Acs Z.J. and Audretsch D.B. (1987), *Innovation, market structure and firm size*, Review of Economics and Statistics, vol. 69, pp. 567-575.
- Agresti A. (2007), *An introduction to categorical data analysis*, II edition, Jhon Wiley & Son, New York
- Almeida P. and Kogut B. (1997), *The exploration of technological diversity and the geographical localization of innovation*, Small Business Economics, vol. 9, pp. 21-31
- Amara N. and Landry R. (2005), Sources of information as determinants of novelty of innovation in manufacturing firms: evidence from the 1999 statistics Canada innovation survey, *Technovation*, vol. 25, 245-259.
- Asso P.F. and Trigilia C. (eds.) (2010), *Remare controcorrente. Imprese e territori dell'innovazione in Sicilia*, Roma, Donzelli Editore.
- Audretsch D. and Vivarelli M. (1994), Small firms and R&D spillovers: evidence from Italy, CEPR Discussion Paper 927.
- Bound J. Cummins C., Griliches Z., Hall B.H. and Jaffe A, (1984), *Who does R&D and who patents?* in Griliches Z. (ed.), *R&D, Patents and Productivity*, University of Chicago Press.
- Bozeman B. (2000), *Technology transfer and public policy: a review of research and theory*, Research Policy, vol. 29 (4-5), pp. 627-655.
- Caves R.E. (1982), *Multinational enterprise and economic analysis*, Cambridge University Press, Cambridge.
- Cermelli M. (2013), *Internacionalización e interacción: estrategias para innovar en las Pymes vascas*, Boletín de Estudios Económicos, Vol. LXVIII – N.º 208, pp.147-163
- Cheng J.L.C. and Bolon D.S. (1993), *The management of multinational R&D: a neglected topic in international business research*, Journal of International Business Studies, vol. 14, pp. 1-18.

- Chung S. and Kim G.M. (2003), *Performance effects of partnership between manufactures and suppliers for new product development: the supplier's standpoint*, Research Policy, vol. 32, pp. 587-603.
- Cohen W.M. and Klepper S. (1996), *Firm size and the nature of innovation within industries: the case of process and product R&D*, The Review of Economics and Statistics, vol. 78 (2), pp. 232-243.
- Damanpour F. (1992), *Organizational size and innovation*, Organization Studies, vol. 13, pp. 375-402.
- Dosi G. (1988), *Sources, procedures and microeconomic effects of innovation*, Journal of Economic Literature, vol. 26 (3), pp. 1120-1171.
- Drejer I. and Jørgensen B.H. (2005), *The dynamic creation of knowledge: analysis public-private collaborations*, Technovation, vol. 25, pp. 83-94.
- Dussauge P. and Garrette B. (1998), *Anticipating the evolutions and outcomes of strategic alliances between rivals*, International Studies of Management and Organization, vol. 27 (4), pp. 104-126.
- Faems D., Van Looy B. and Debackere K. (2005), *Interorganizational collaboration and innovation: toward a portfolio approach*, Journal of Product Innovation Management, vol. 22, pp. 238-250.
- Fischer M. and Varga A. (2002), *Technological innovation and interfirm cooperation: an exploratory analysis using survey data from manufacturing firms in the metropolitan region of Vienna*, International Journal of Technology Management, vol. 24, pp. 724-742.
- Freeman C. and Soete L. (1997), *The economics of industrial innovation*, The MIT Press, Cambridge.
- Fritsch M. and Lukas R. (2001), *Who co-operates on R&D?*, Research Policy, vol. 30, pp. 297-312.
- Gilder G. (1988), *The revitalization of everything: the law of the microcosm*, Harvard Business Review, vol. 66 (2), pp. 49-61
- Goto A. and Suzuki K. (1989), *R&D capital, rate of return on R&D investment and spillover of R&D on Japanese manufacturing industries*, Review of Economics and Statistics, vol. 71 (4), pp. 555-564.
- Gulati R. (1995), *Social structure and alliance formation patterns: a longitudinal analysis*, Administrative Science Quarterly, vol. 40, pp. 619-652.
- Hitt M., Hoskisson R. and Kim H. (1997), *International diversification: effects on innovation and firm performance in product-diversified firm*, Academy of Management Journal, vol. 40 (4), pp. 767-798.
- Kafouros M.I. (2006), *The impact of the internet on R&D-efficiency: theory and evidence*, Technovation, vol. 26 (7), pp. 827-835.
- Kafouros M.I. (2008), *Industrial innovation and firm performance: the impact of scientific knowledge on multinational corporations*, Edward Elgar.
- Kafouros M.I., Buckley P.J., Sharp J.A. and Wang C. (2008), *The role of internationalization in explaining innovation performance*, Technovation, vol. 28, pp. 63-74.
- Kamien M.I. and Schwartz N.L. (1982), *Market structure and innovation*, Cambridge University Press, Cambridge.

- Kogut B. (1988), *Joint ventures: theoretical and empirical perspectives*, Strategic Management Journal, vol. 9, pp. 312-332.
- Kotabe M. (1990), *The relationship between offshore sourcing and innovativeness of US multinational firms: an empirical investigation*, Journal of International Business Studies, vol. 21 (4), pp. 623-638.
- Lopez R.A. (2005), *Trade and growth: reconciling the macroeconomic and microeconomic evidence*, Journal of Economic Surveys, vol. 19 (4), pp. 623-648.
- Meyers P.W. and Athaide G.A. (1991), *Strategic mutual learning between producing and buying firms during product innovation*, Journal of Product Innovation Management, vol. 8 (3), pp. 155-169.
- Miotti L. and Sachwald F. (2003), *Co-operative R&D: why and with whom? An integrated framework of analysis*, Research Policy, vol. 32, pp. 1481-1499.
- Nieto M.J. and Santamaria L. (2007), *The importance of diverse collaborative networks for the novelty of product innovation*, Technovation, vol. 27, pp. 367-377.
- Rogers M. (2004), *Networks, firm size and innovation*, Small Business Economics, vol. 22, pp. 141-153.
- Santos J., Doz Y., Williamson P. (2004), *Is your innovation process global?*, Sloan Management Review, vol. 45 (4), pp. 31-37.
- Shefer D. and Frenkel A. (2005), *R&D, firm size and innovation: an empirical analysis*, Technovation, vol. 25, pp. 25-32.
- Sternberg R. and Arndt O. (2001), *The firm or the region: what determines the innovation behavior of European firms?*, Economic Geography, vol. 77 (4), pp. 364-382.
- Stock G.N., Greis N.P. and Fischer W.A. (2002), *Firm size and dynamic technological innovation*, Technovation, vol. 22, pp. 537-549.
- Stokes M.E., Davis C.S. and Cook G.G. (2009), *Catagorical Data Analysis using the SAS system*, II edition, SAS Institute Inc, Cary NC.
- Tether B.S. (1998), *Small and large firms: sources of unequal innovations?*, Research Policy, vol. 27, pp. 725-745.
- Tether B.S. (2002), *Who co-operates for innovation and why? An empirical analysis*, Research Policy, vol. 31, pp. 947-967.
- Tidd J. and Trehwella M. (1997), *Organisational and technological antecedents for knowledge acquisition and learning*, R&D Management, vol. 27, pp. 359-375.
- Vuola O. and Hameri A.P. (2006), *Mutually benefiting joint innovation process between industry and big-science*, Technovation, vol. 26, pp. 3-12.
- Whitley R. (2002), *Developing innovative competences: the role of institutional frameworks*, Industrial and Corporate Change, vol. 11, pp. 497-528.