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## **Collaboration Patterns and Product Innovation in the Basque Country.**

### **Does Foreign Ownership Matter?**

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#### **Abstract**

More and more, the ability to innovate can be considered as an explanatory factor for determining the long term potential of firms to be competitive. Therefore, it is of increasing importance to understand the critical success factors behind notably radical product innovations. The present paper explores the yields and results in terms of a series of competitiveness indicators that domestic-owned and foreign-owned firms in the Basque Country obtain from technological collaboration practices. In particular, the study seeks to assess differences in the way these two groups of firms organize their technological partnerships (in terms of the geographical spread of partners with whom they cooperate and the purposes for which they deploy collaboration: for commercial or science/knowledge generation), and the comparative differences that stem from their respective practices. The study uses firm level data from the Euskadi Innovation Survey, for firms located in the Basque Country. The paper finds that ( a) technological collaborations comprising different types of partners have the greatest positive impact on innovation novelty, and (b) when looking at the "nationality of ownership of firms" (domestic or foreign companies), collaboration strategies developed by foreign-owned firms have higher impact on achieving novel innovation. We posit that the superior innovation performance we observe among foreign-owned firms -as opposed to domestic firms in the Basque Country- relies on their ability to benefit from both inter-regional partnerships and commercial-based networks for the sake of innovation purposes.

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## **INTRODUCTION**

This research explores the yields and competitiveness that domestic-owned and foreign-owned firms located in the Basque Country obtain from collaboration practices. Specifically, this study seeks to assess differences in the way these two groups of firms organize their technological collaboration practices (in terms of the geographical spread of partners with whom they cooperate and the purposes for which they deploy technological collaboration: commercial or science/knowledge generation), and the results that stem from such differences. As such, this research tries to determine whether foreign-owned firms differ significantly from host country firms in terms of cooperative agreements and the impacts this has on their ability to bring about (successful) product innovations.

The rationale behind the research follows from an analysis of innovation and competitiveness indicators with regard to domestic-owned companies from the Basque country (CAPV). These companies can be considered highly competitive according to their levels of innovative performance in the national market. However, their position stays far behind the average when comparisons are made with foreign-owned companies located inside the Basque Country. For example, in 2010 the percentage of domestic-owned firms that introduced a novel product in the market was 8.8%, while the average was 20.89% for foreign-owned firms located inside CAPV. However, when we look at firms engaged in technological collaboration we find that the 45.71% of domestic-owned companies has developed technological cooperation; this figure is very similar to the 42.3% of foreign-owned firms (located inside CAPV) engaged in technological partnerships.

Literature has largely shown that collaboration is a good method of improving firms' innovation capabilities. When relevant resources are not available in the own organization, technological collaboration offers a good solution for product innovations. As long as innovation complexity increases, firms' ability to identify and absorb relevant knowledge will support the development

of new products. (Becker and Dietz, 2004; Belderbos, Carree, Diederer, Lokshin, and Veugelers, 2004; Nieto and Santamaria, 2007).

Therefore, previous figures suggest that domestic-owned firms in Basque Country, does not perform efficient innovation practices, and their under-performance can be consequence of wrong collaboration practices.

In order to build a competitive innovation strategy, this research will explore what would be suitable collaboration patterns for firms located in CAPV to achieve novel innovations.

Moreover, we assess whether domestic-owned firms as opposed to foreign-owned firms differ in their technological collaboration patterns and whether this has an impact on the kind or degree of product innovation that result from these different patterns. Degree of product innovation is related to newness in the innovation and will dictate firms' innovation sustainability over time.

We focus on product characteristics to determine whether an innovation can be considered radical or incremental. Radical innovations describes innovations with a higher degree of novelty, new or significantly improved products which suppose a novelty not only for the company, but also a novelty for the market in which the firm operates. On the other hand, incremental innovations describes incremental product innovations without modifications or lightly. Although novel innovations have a greatest impact on innovation performance, involve complex knowledge management. It would be necessary to analyze how different type of technological partnerships impact on innovation novelty to determine an efficient collaboration pattern.

The paper proceeds as follows. The next section discusses different collaboration patterns, and sets out the hypotheses. Section 3 discusses the methodology and data; Section 4 presents the results; and the final section presents the conclusions.

## **2. THEORIZING COLLABORATION PATTERNS**

Traditional literature has been largely concerned about external knowledge and innovation, devoting particular attention to performance issues. In today's knowledge based economy, the ability to innovate is more important than cost efficiency in determining firms' sustainable performance. In the current era of globalization, firms are involved in Schumpeterian competition and must adapt to rapidly evolving industries, where competitive capabilities are transitory and opportunities are quickly closed by competitors (Kim and Kogut, 1996). The ability of the firm to benefit from innovations in such environments quickly erodes and must obtain relevant knowledge in order to develop efficient innovations. Consequently firms must balance their capacity to develop know-how with their ability to introduce new products. Innovations occur as result of interactions between various actors rather than as a result of a solitary genius (Von Hippel, 1988), therefore we must explore how collaboration mediates on it. Traditional literature early examined how markets for technology would enact innovation performance (Caves, Crookell and Killing, 1983; Hennart, 1988; Williamson, 1989; Mitchell and Singh, 1992; Hagedoorn, 1993). However, more recent studies have been focused on the effect of different innovative cooperation strategies in technological evolution (Rosenkopf and Nerkar, 2001), and the implications of innovation search strategy on final product introduction (Ahuja, 2000, Chesbrough, 2003). In this line of research (Laursen and Salter, 2006) posit that radical innovators are likely to draw more deeply from external sources of innovation than firms that are not radical innovators, while incremental innovators are likely to draw more broadly than non-innovators. Another stream of research analyzes direct data about technological collaboration and innovation performance; Becker and Dietz (2004) obtain that joint R&D activities with other firms or institutions is a crucial instrument for firms to gain and implement external resources efficiently. Tsai and Wang (2009) investigate the effects of external technology sourcing strategies, on innovation performance; the authors posit that collaborating with different types of partners represents knowledge network diversity, raising the likelihood of achieving product

innovation due to the variety of knowledge shared. In this sense, literature has been largely focused on the motivation behind the type of collaboration and its impact on innovation performance (Miotti and Sachwald, 2003; Belderbos et al., 2004; Nieto and Santamaría, 2007). However, the willingness to engage in collaborative agreements is conditioned by internal organizational ability to explore the external environment. Thus, the latent nature of the company defined by ownership nationality will be crucial to understand firm's strategic behaviour and innovative performance in international markets. Prior literature is equivocal about the innovativeness efficiency of domestic versus foreign companies.

Researchers conclude that the final impact of external knowledge on performance depends on many elements: theoretical assumptions; context; specifics of knowledge and its sources; type of innovation; and type of performance variable analyzed (Frenz and Ietto-Gillies, 2009).

On one hand, one literature stream defends that foreign firms face home country knowledge restrictions; therefore these companies suffer a pervasive dependency on internal knowledge sources as main driver of innovation. Research posits that foreign firms provide important vehicles for transferring research and knowledge within MNE units (Blanc and Sierra, 1999) while external collaboration can lead to depreciation of internal capabilities and coordination costs (Weigelt and Sarkar, 2009).

Another literature stream considers external collaboration as a means to foster innovation by getting access to specialized resources and learning opportunities from host country. Although internal knowledge flows are considered as the mechanisms for MNE-wide innovative outcomes, external knowledge flows have a positive impact on firm performance both through their direct effect on innovation by the subsidiary and, indirectly, through stimulating knowledge flows between the subsidiaries and other units within the MNE (Yasmin and Otto, 2004).

Research finds evidence that foreign firms use local knowledge (regional and country) at greater extent than similar domestic firms (Almeida, 1996). Almeida and Phene (2004) studied

that MNC develop slightly more foreign linkages, but the external linkages related to the host country are most likely to result on innovation. Later, Phene and Almeida (2008) revealed that host country knowledge is critical to scale and quality of innovation, while knowledge from other subsidiaries does not lead to increased innovation.

This debate on the development of efficient collaborative agreements and innovative performance indicators supports this paper to explore how foreign-domestic firms differ in product innovation through technological collaboration practices. Specifically this paper explores innovation patterns across firms located in the Basque Country. In particular, the main issues addressed in this paper are: the differentiation of technological collaboration strategies according to both knowledge-based dimension and geographical location; and the empirical assessment of such cooperation strategies on different degrees of product innovation (incremental and radical innovation) across domestic-owned and foreign-owned firms located in CAPV.

### **Hypotheses**

As pointed out before companies must create new knowledge and renew its technological competences in order to be innovative. Firm's innovation strategy involves a complex decision: whether rely on internal R&D sources, external R&D sources, or apply both of them.

On the one hand, reliance on internal R&D has time and cost advantages, but overreliance can lead to organizational rigidities and competency traps (Leonard-Barton, 1992).

On the other hand, external knowledge sourcing allows firms to explore new windows for opportunity, enlarge innovation scope and more flexibility to face markets uncertainty.

Companies which achieve this flexibility are able to cope better with speed, cost and complexity of technological development (Vanhaverbeke, Duysters, and Noordhoven, 2002; Tsai and Wang, 2009) and improve the organizational performance (Grant, 1996; Zahra and Nielson, 2002).

In the attempt to build a competitive innovation pattern, firms evaluate different partnership combinations, according to innovative purposes and firm's internal ability to profit from external linkages.

The goal of this study is to understand the rationale behind a competitive innovation pattern for companies located in CAPV. In order to fulfill this objective from a reliable perspective, the study accounts for different technological collaboration dimensions: the geographical spread of partners with whom they cooperate (geographical location), and the purposes for which they deploy technological collaboration (knowledge-based dimension).

As long as the geographical location of partners will shape the content, thus the scope of the cooperative agreement, external knowledge should be analyzed according to the geography of collaboration in order to understand its effectiveness in innovation output. Specifically this study distinguishes between different geographical levels, regional and inter-regional technological cooperations.

External sources involve linkages with different organizations such as: corporate group, customers, suppliers, competitors, consultants, technological centers, laboratories, universities and government agencies. Thus, this organizational heterogeneity must be analyzed carefully to understand its implications in the innovation output, thus it is essential to analyze the purpose for which they deploy technological collaboration. This study follows (Yasmin and Otto 2004) and distinguishes between business and non-business linkages. Specifically, this study differentiates between science-based and commercial-based technological cooperations. While commercial-based partners are located across the value chain and expected to be more directly related to problem-solving, science-based linkages may be more exploratory in nature. Thus, the impact of science system collaboration may help firms to redirect its efforts towards innovation sources. However, commercial-based agents would help firms to exploit its current knowledge patterns and searching for new product solutions.

In order to find out the best cooperation strategy to reach high innovation performance rates, this study will account for different types and diversity of partners according to both dimensions: geography of collaboration, and knowledge-based partnership. The internal firms' ability to take benefit from external partners' selection will dictate final innovation output.

### ***Foreign-domestic firms collaboration and product innovation***

In order to determine how domestic firms could increase its innovation competitiveness in the market, this study explores if nationality of ownership determines firm's ability to define the type of collaboration and its impact on product innovation.

As pointed out in literature, technological collaboration practices are an important source of competitive advantage. Access to external relevant sources allows organizations to obtain relevant knowledge which cannot be produced inside the organization. Collaboration networks would support the innovation activities of cooperation partners, increasing the ability to introduce new products (Nieto and Santamaria, 2007; Becker and Dietz, 2004). Firms will consider external partners as sources of valuable knowledge, which cannot be produced internally, maximizing firm value through partners' resources combination and complementarities exploitation (Kogut, 1988).

However, the success of cooperation is conditioned by internal organizational characteristics and the willingness to engage in different collaborative agreements. In this sense, latent nature of the company defined by ownership nationality will be crucial to understand firm's cooperation path and product innovation.

The starting point of this research analyze if innovation benefits from technological cooperations differ between firms according to ownership nationality. Thus, we study whether cooperation impact on product innovation differs between domestic-owned and foreign-owned firms located in the Basque Country.

Basque country is an example of sustainable regional development (Orkestra, 2008; OECD, 2011) result of an effective cluster policy. Cluster emerges on the basis of technological complementarities (Porter 2003) claiming that specialization in clusters of related industries, is beneficial for regional development (Boschma, Minondo and Navarro, 2012). Policies encouraging cross-sectorial diversification support the development of related competences and assets in order to create a consistent knowledge portfolio (Boschma and Frenken, 2011). Clusters encourage firms to collaborate across related industries; this transference of knowledge between actors is supported by the dynamic flow of industry-related information, and the involvement of local culture with specific norms values and institutions (Malmeberg and Maskell, 2002). Spatial proximity would enhance interactive learning processes that allow knowledge exchange and innovation (Malmberg and Power, 2005). This particular specialization from regional clusters affects what is done within and among the firms and therefore what is learnt, how things are done and consequently how learning takes place (Lundvall and Maskell, 2000). Knowledge creation in cluster emerges from: inter-organizational collaboration interaction, increased competition and intensified rivalry, and informal interactions. According to previous assumptions, cluster industries would support an intensive cooperation among firms to benefit from specialized local synergies (Maskell, 2001), this restrictive cooperation will constrain the benefits from a broader cooperation strategy.

On the other hand, foreign firms according to its international ownership will benefit from network advantages through international market knowledge and access to larger and heterogeneous partners. From literature we can guess two main foreign subsidiaries characteristics: group membership (MNC); and environmental diversity (host and home-country). Being part of a group, supports learning from the environment in which it operates and transmits knowledge internally to the firm (Zanfei, 2000). Previous market knowledge will allow

organization to select the best partner for cooperation to achieve innovation goals. Thus each part of the MNC benefits from internal transfers as well as learning from environments.

The subsidiaries of the multinational corporations (MNC) have the potential to access resources from two distinct knowledge contexts. As Almeida and Phene (2004) posited: “First, subsidiaries are, a part of a MNC that has the capacity to share knowledge across its various units (Bartlett and Ghoshal, 1989). Second, subsidiaries are located in host country regions that often embody social, professional, and technological relationships among firms permitting interfirm knowledge flows (Porter, 1990)”. Ability to build networks through these two different contexts would have a positive effect in innovation achievement (Andersson and Forsgren, 2000).

From literature is well known that innovation opportunities exist because of information asymmetry, and that firms that have access to a larger variety of sources of information are in a better position to identify and develop innovation opportunities and introduce products with higher degree of novelty (Venkataraman, 1997; Amara and Landry, 2005). Due to foreign-owned firms benefit from subsidized and more diverse network; they would overcome over-specialization strategies supported by Basque region clusters. It seem reasonable to hypothesize that technological collaboration strategies developed by foreign-owned firms have higher impact on achieving novel innovation than collaboration of domestic-owned firms.

*H1: “Among firms competing in CAPV, collaboration of foreign-owned firms has a higher positive impact on novel product innovations than collaboration of domestic firms”*

### ***Foreign-domestic firms geographical collaboration and product innovation***

In this section, we explore the role of different types of geographical technological collaboration and the effect on innovation output. Specifically we want to answer:

- 1) Which type of geographical partnerships have positive impact on novel product innovation

- 2) In which type of geographical partnerships foreign-owned firms achieve superior innovation performance than domestic-owned companies.

To answer previous questions we would study different type of collaboration patterns according to geographical location.

In this sense, it would be interesting to analyze if the location of the network would have a positive impact on product introduction. Thus, if the geographical dimension of the network would dictate firms' innovation competitiveness. In this sense we distinguish between three different types of collaborations patterns: regional (within CAPV), inter-regional (outside CAPV) and diverse geographic networks (regional and inter-regional partnerships).

As long as geographical location of the partner just focus on the geographical location (does not distinguish between knowledge content of the partnership), we assume that different knowledge-based agents could be involved in regional and interregional networks. Thus, attending only to spatial distance between actors, we could posit the following arguments according to spatial collaboration typology and product innovation novelty.

First; firms located in CAPV are involved in a localized cluster, where regional networks involving short distances across collaborators benefit from knowledge externalities: bring people together, favor information contacts and facilitates exchange of tacit knowledge and innovation performance (Jaffe, Trajtenberg, Henderson, 1993; Audretsch and Feldman, 1996; Boschma, 2005). Although regional collaboration would allow firms to benefit from the cluster advantages, over-reliance on closer partners would lead to spatial lock-in. When regions become too much inward looking, the learning ability of local actors may be weakened to such an extent that they lose their innovation capacity and cannot respond to new environments (Boschma, 2005).

Interregional networks would imply the access to collaborators outside the CAPV. This collaboration would allow firms to avoid a spatial lock-in risk and encourage interactive learning. However, an exclusive reliance on inter-regional networks will make firms loose

cluster advantages from closer interactions and tacit knowledge. Firm's distance from knowledge sources would have a negative impact on innovation performance (Jaffe et al. 1993). Therefore, inter-regional collaboration would have a positive impact on product innovation if firms have the capabilities to absorb external knowledge and share same values and expectations with inter-regional partners.

Finally, firms located in CAPV which develop both regional and inter-regional networks will have a greatest positive impact on the degree of product innovations than collaboration with only one type. An exclusive regional competitive pattern leads to emphasize the potential advantages of close and familiar cooperative exchange and encourage an excessive knowledge specialization. Thus, supporting excessive national external sources will allow for the emergence of "lock-in" risk that deters firms' ability to develop product innovation. However, a combination between regional and inter-regional networks will allow firms to overcome experiential learning disadvantages from unfamiliar markets, and cultural barriers. This inter-regional cooperation suppose a great benefit for firms located in CAPV, supporting new diversification patterns and access to unfamiliar knowledge encouraging new product innovations. These foreign agreements would suppose the development of an inter-regional network allowing for a sustainable product innovation strategy. Thus, it seems obvious that diversity in geographical collaboration would have the highest positive impact on firm's novel product innovation.

Therefore, diversity in geographical collaboration would benefit foreign-owned firms to reinforce its innovation position (through both host country networks and inter-regional opportunities); and would allow domestic-owned firms to overcome lock-in risk, profiting from inter-regional partners.

*H2a: “Among firms competing in CAPV, diversity in geographical collaboration will have a more significant impact on the degree of novelty of product innovations than collaboration with only one type of geographical partner”*

According to the second question related to foreign-owned firm’s advantage in geographical collaboration, we posit the following reasoning.

If we look at the different geographical partnerships patterns, it seems reasonable that exclusive dependence on regional networks by foreign firm will be harmful for the MNC network. MNC advantages due to experiential learning advantage and knowledge specificity would be lost.

Exclusive reliance on regional partnerships would involve subsidiary autonomy which does not match with headquarter dependency dictated by MNC. Although diversity in geographical collaboration would benefit foreign-owned firms to reinforce its innovation position (through both host country networks and inter-regional opportunities); diversity in geographical collaboration would allow domestic-owned firms to overcome lock-in risk, profiting from inter-regional partners.

The advantage of foreign firms’ in product innovation according to geographical collaboration would emerge from exclusive inter-regional technological collaborations. Foreign-owned firms have easier access to international partnerships than domestic-owned firms. Foreign companies have higher abilities to profit from inter-regional agreements because already benefit from current international networks, and have more willingness to engage in new practices due to openness culture (Ebersberger and Herstad, 2011). Firstly, its international nature stresses the collaboration among affiliates located in different territorial contexts (Phene and Almeida, 2008). Thus, MNC provides international platforms for collaboration in the form of subsidiaries abroad. Second, subsidiaries benefit from learning advantages by identifying place-specific opportunities and partners with whom tight interaction is required (Lowe and Wrigley, 2010). While foreign-owned companies rely on a variety of territorial contexts due to its international nature, firms in

localized clusters stress informal networks and face-to-face contact to facilitate the exchange of specialized knowledge.

It can be concluded, that foreign-owned firms would benefit from easier access to international network and experiential learning advantages in exploiting inter-regional knowledge. However, domestic-owned firms rely on relationships based on closer contact, and find difficult to overcome experiential learning disadvantages in interregional contexts.

*H2b: “Among firms competing in CAPV, inter-regional collaboration of foreign-owned firms has a higher positive impact on novel product innovations than inter-regional collaboration of domestic-owned firms”*

### ***Foreign-domestic firms knowledge-based collaboration and product innovation***

In this section, we explore the role of different types of knowledge-based technological collaboration and the effect on innovation output. Specifically we want to answer:

- 1) Which type of knowledge-based partnerships have positive impact on novel product innovation
- 2) In which type of knowledge-based partnerships foreign-owned firms achieve superior innovation performance than domestic-owned companies.

In this hypothesis it is analyzed whether the knowledge orientation of the collaboration differs in novel product introduction. We distinguishes between three different types of collaborations: science-based, commercial-based and diverse knowledge-based partnerships (science-based and commercial-based collaborations)

Science-based partners involve research organizations that encourage cooperation based on first-stage of generic knowledge (Belderbos, Carree, Diederen, Lokshin, Veugelers, 2004). Science-based partnerships do not focus on supporting final product innovation of firms, but on providing them with new scientific and technological knowledge (Lundvall, 1992; Drejer and Jørgensen, 2005). This perspective mismatches company’s objectives focusing on exploiting innovation

investments in the short-term. An exclusive reliance on scientific cooperation would be contrary to the assumptions involved in cluster industries, which support specialized knowledge through inter-firm industrial collaboration (Malmberg and Maskell, 2002). Therefore, an over-reliance on scientific collaborations by firms involve in geographical clusters, would prevent firms to benefit from interactive learning from industrial partners. Innovation is result of an effective transfer of knowledge. Thus, innovative firms require an absorptive capacity to identify, interpret and exploit the new knowledge (Cohen and Levinthal, 1990). That is, successful product innovation requires people sharing the same knowledge base and expertise to learn from each other (Boschma, 2005). A unique reliance on scientific partnerships involves too much distance across collaborators knowledge bases leading to difficulties in knowledge absorption and interactive learning. Therefore, we can conclude that lack of complementarities in knowledge sources would be detrimental for development of novel product innovation.

Commercial partnerships involve collaboration among different collaborators in the industrial value chain. These technological cooperations will look for fast return of the investment in order to obtain product commercialization benefits. Commercial-based technological collaborations involve knowledge that often is tacit and context-specific. Thus, an exclusive technological collaboration with commercial partners would be detrimental for learning and innovation due to lock-in risk. Innovation requires complementary but dissimilar bodies of knowledge, thus homogeneous collaborations of specific knowledge would lead to competency traps, and lack of novel sources (Boschma, 2005). Therefore firms will suffer from myopia by restricting their innovation output to current technological combinations and deterring further innovation. According to previous argument, the unique reliance on commercial cooperation would make firms to focus on incremental rather than novel innovation.

However Maskell (2001) posits that firms in geographical clusters can fulfill requirements for effective product innovation in commercial collaborations. The key is to determine the extent of

dissimilar knowledge in these collaborations. As long as firm's commercial cooperation involves dissimilar and complementary knowledge, it would support development of product innovation. In this sense, cooperation between competitors with similar capabilities and inter-firm learning (customers and suppliers) encourage specialization. However, because of growing specialization, the knowledge bases of the firms diverge to such an extent that interactive learning is stimulated. Therefore, variety of knowledge across commercial collaborations would dictate the final impact on firm's innovation ability. Commercial collaborations involving a variety of knowledge will have a positive impact on novel product innovation. However, commercial partnership focused on specific and similar knowledge would be detrimental for innovation novelty. Thus, from this premises we cannot hypothesize neither positive nor negative sign between technological commercial cooperations and novel product introduction. Final effect would depend on firm's ability to encourage collaborations based on either dissimilar or traditional similar knowledge. On the other side, diverse cooperation suppose a great benefit for firms located in CAPV, supporting new innovation patterns and encouraging novel product innovations. Diversity in technological collaborations would allow firms benefit from generic knowledge useful to develop new diversification patterns and avoid lock-in risk. On the other hand, commercial collaboration would allow firms to exploit its current knowledge base with different actors in the commercial value chain and the advantages of cluster industrial network. The variety of partners will have the greatest positive impact on the degree of product innovation novelty than collaboration with only one type of partner (Nieto and Santamaría, 2007).

*H3a: "Among firms competing in CAPV, diversity in knowledge-based technological collaboration will have a more significant impact on the degree of novelty of product innovations than technological collaboration with only one type of knowledge-based partner"*

According to the second question related to foreign-owned firm's advantage in knowledge-based collaboration, we posit the following reasoning.

As long as both domestic-owned and foreign-owned firms located in CAPV rely on specific and tacit knowledge, exclusive reliance on scientific knowledge would have a negative impact on novel product innovation. In the same manner, diversity in knowledge-based cooperation will benefit both domestic and foreign firms, allowing them to benefit from generic knowledge exploration and specific knowledge exploitation.

However, we can expect different impact of commercial-based collaboration in innovation output according to ownership nationality. Motivations for internationalization of MNC are related to home-based exploiting activity associated to firm's need to invest in R&D subsidiaries abroad to exploit their knowledge base in the home country (Ebersberger and Loof, 2004). In this sense, one important factor for foreign R&D activities is to generate products from foreign locations, ensuring that innovation output is partly returns on R&D investments in their home country (Dunning and Narula, 1995). As posited before, foreign-owned firms benefit from performing in two different contexts. Thus, foreign firms can benefit from commercial collaborations within the corporation but also from external partners. First, headquarters encourage the transference of knowledge across affiliates through asset exploiting strategy. Second, foreign affiliates can support an asset-seeking strategy, augmenting existing assets by absorbing and acquiring technological spillovers from specific collaborators in the host-country. Therefore, foreign firms would benefit from commercial technological collaboration achieving both complementary and dissimilar knowledge from affiliates and external collaborators. As posited before, pressure from headquarters to exploit R&D investments and firm's ability to access to complementary and dissimilar knowledge would encourage firms to develop novel product innovations.

*H3b: "Among firms competing in CAPV, commercial-based technological collaboration of foreign-owned firms has a higher positive impact on novel product innovations than commercial-based technological collaboration of domestic-owned firms"*

### **3. DATA AND METHODOLOGY**

#### *Eustat Innovation Survey*

The analysis uses firm level data from the Euskadi Innovation Survey, collected by Eustat (Basque Institute of Statistics) in 2010 and sampled to be representative at the regional level (Eurostat, 2006). The data is generated by a self administered survey questionnaire based on the homogenized and thoroughly tested European Community Innovation Survey (CIS). The data is thoroughly reviewed, and rigorous validation processes are carried out to avoid errors (Eurostat, 2010). CIS data is used for generating official innovation statistics of the EU and its member countries and has been used extensively for analysis in economics (Cassiman and Veugelers, 2002; Cefis and Marsili, 2006; Czarnitzki, 2005), in management studies (Laursen and Salter, 2004, 2006; Frenz and Ietto-Gillies, 2009; Schmiedeberg, 2008; Grimpe and Kaiser, 2010), and in economic geography (Simmie, 2003, 2004; Ebersberger and Herstad, 2011).

Participation in the Euskadi innovation survey (EIT) is compulsory for sampled firms, and non-respondents are fined. This results in a comparatively large data set, which is not plagued by a non-response bias. The data refers to activities conducted during the three-year reference period 2008-2010. Although it would be preferable a larger period, EIT changes in sampling procedures and questionnaires over time, do not allow for building sufficiently large panels.

The total data set contains 4,220 firms, 1,064 from Alava, 1,700 from Bizkaia and 1,456 from Gipuzkoa. The empirical analysis of the hypotheses is restricted to 1290 firms which report information about technological collaboration agreements. We include innovating and non-innovating to avoid biased results (Tether, 2002; Cassiman and Veugelers, 2002).

#### **3.1 Methodology**

##### Variables

\*Dependent variables: Radical and Incremental Product Innovations

The study tries to test previous hypotheses using regressions in which innovation output is explained by different cooperation sources. Innovation output is measured through:

- a) **Radical Innovations:** describes innovations with a higher degree of novelty. New or significantly improved products (goods or services) introduced in the period 2008-2010 which suppose a novelty not only for the company, but also a novelty for the market in which the firm operates. It takes the value 1 when the firm declares new product functions resulting from innovation; otherwise its value is 0.
- b) **Incremental Innovations:** describes incremental product innovations. Products (goods or services) without modifications or lightly modified (including products totally developed and produced by others) in the period 2008-2010. It takes the value 1 for innovations with a lower degree of novelty; otherwise its value is 0.

**\*Collaboration**

Firms indicated whether or not they had engaged in technological collaboration agreements, which allowed us to construct a dummy variable (COOPERATION).

**\*Ownership**

We create a dummy variable (FOREIGN) indicating if the firm has a foreign company as owner ( $\geq 50\%$  of the total stock). It takes the value of 1 if the company is owned by foreign firm; otherwise its value is 0.

**\*Type of technological collaborations: Geographical collaborations and knowledge-based collaborations**

We create six dichotomous variables to measure the effect of different types of technological partnerships. According to the localization of the cooperation we distinguish between:

- a) **Regional collaborations exclusively.** The firm only collaborates with local partners (REG).

- b) Inter-regional collaboration exclusively. The firm only collaborates with partners outside the region (INTERREG).
- c) Diverse-geographical collaboration. The firm collaborates with both regional and interregional partners (DIVERSEREG).

According to the knowledge-based character of the cooperation we distinguish between:

- d) Science collaborations exclusively. The firm only collaborates with science-based partners (SCIENCE). Science collaboration includes: universities, technological centers, R&D laboratories, and government organizations (Yamin and Otto, 2004)
- e) Commercial collaboration exclusively. The firm only collaborates with commercial-based partners (COMMERCIAL). Commercial collaboration includes: affiliates and subsidiaries, customers, suppliers, competitors, and consultancy firms.
- f) Multi-knowledge collaboration. The firm collaborates with both science and commercial partners (DIVERSEKNOW).

These mutually exclusive variables avoid potential problems of multicollinearity and to capture the impact of each partner more clearly by separating it from the effects attributable to other partner types in heterogeneous networks (Nieto and Santamaría, 2007).

#### \* Control Variables

We include different control variables for firm specific and industry characteristics.

According to firm specific characteristics we control for the size of the company, export intensity, group affiliation, R&D internal intensity, knowledge protection. Size of the firm is measured by the logarithm of company turnover (NETSALES). EXPSHARE measures the international orientation of the firm by its export share. Company group, irrespective of the location of company subsidiaries, is positively associated with innovation performance, we use a binary variable (GROUP) coded 1 if an enterprise is part of a company, and coded 0 if it is a single-unit firm. We include an indicator for internal R&D intensity, measured as the ratio of

internal R&D expenses to total firm's turnover (R&DEXP.). An indicator for formal IPR protection is introduced because protection enables the firm to protect proprietary knowledge during collaborative work and R&D contracting (PROPAT) (Ebersberger and Herstad, 2011). We control for industry characteristics by the introduction of 43 industry dummy variables, albeit their coefficients are omitted from our tables (INDUSTRYDUMMIES).

### The Model

As both dependent variables (Radical and Incremental) are dichotomous, estimation models such as logit or probit (Aldrich and Nelson, 1984; Greene, 2000) would normally be appropriate. However, as the error terms of the two models are likely to be correlated, an extension of probit known as bivariate probit (Greene, 2000) is usually a more appropriate estimator. The bivariate probit model has the following specification (Breen, 1996):

$$\begin{aligned}
 Z_{i1} &= \beta'_1 X_{i1} + \varepsilon_{i1} ; \text{ if } \gamma_{i1} = 1 \text{ if } Z_{i1} > 0, \quad \gamma_{i1} = 0 \text{ if } Z_{i1} \leq 0, \\
 Z_{i2} &= \beta'_2 X_{i2} + \varepsilon_{i2} ; \text{ if } \gamma_{i2} = 1 \text{ if } Z_{i2} > 0, \quad \gamma_{i2} = 0 \text{ if } Z_{i2} \leq 0, \\
 (\varepsilon_{i1}, \varepsilon_{i2}) &\approx N(0, 0, 1, 1, \rho)
 \end{aligned}$$

The bivariate probit model was estimated using the Stata 11 routine, based on the method of simulated maximum likelihood. The difference between the specifications of each model lies in the explanatory variables (collaboration, and type of network).

## **4. RESULTS**

Table 1 below gives descriptive statistics, collinearity statistics, and correlations of all variables.

**Table 1. Descriptive statistics**

Variable	Std.													
	Mean	Dev.	RADICAL	INCREMENTAL	SCIENCE	COMMERCIAL	DIVERSEKNOW	REG	INTER-REG	DIVERSEREG	FOREIGN	GROUP	R&DEXP	PROPAT
RADICAL	0.095	0.294	1											
INCREMENTAL	0.962	0.192	-0.303	1										
SCIENCE	0.050	0.219	0.074	-0.034	1									
COMMERCIAL	0.052	0.222	0.038	-0.031	-0.054	1								
DIVERSEKNOW	0.203	0.402	0.264	-0.072	0.456	-0.118	1							
REG	0.103	0.304	0.011	-0.029	0.202	0.277	0.190	1						
INTER-REG	0.023	0.151	0.126	-0.012	-0.012	0.358	0.037	-0.052	1					
DIVERSEREG	0.180	0.384	0.214	-0.064	0.261	0.063	0.747	-0.159	-0.072	1				
FOREIGN	0.055	0.228	0.093	-0.002	0.089	0.045	0.072	-0.014	0.259	-0.003	1			
GROUP	0.712	0.453	-0.142	0.056	-0.058	-0.145	-0.198	-0.083	-0.132	-0.189	-0.347	1		
R&DEXP	0.183	3.795	0.010	-0.029	0.010	-0.016	0.029	-0.007	-0.012	0.039	-0.011	0.020	1	
PROPAT	0.062	0.241	0.406	-0.155	0.074	-0.045	0.211	-0.037	0.017	0.226	0.028	-0.084	0.026	1
EXPSHARE	0.064	0.180	0.162	-0.091	0.112	0.042	0.072	0.063	0.030	0.062	0.166	-0.190	-0.008	0.213
NETSALES	14.110	2.242	0.197	-0.069	0.081	0.135	0.246	0.070	0.134	0.258	0.218	-0.432	-0.057	0.162

Table 2 presents the regression results testing our first hypotheses. The  $\rho$  parameter is highly significant, this support the choice of biprobit instead of probit model. The Wald test also points out high significance of both variables for the models.

**Table 2. Collaboration impact in product innovation**

	Model 1a		Model 1b	
	RADICAL	INCREMENTAL	RADICAL	INCREMENTAL
COOPERATION	0.613***	-0.225*	0.534***	-0.247*
FOREIGN	0.516**	-0.008	0.186	-0.134
COOPERATION*FOREIGN			0.802**	0.321
GROUP	-0.147	-0.019	-0.164	-0.024
R&DEXP	-0.056	0.009	-0.056	0.009
PROPAT	0.755***	-0.194	0.762***	-0.199
EXPSHARE	0.379*	-0.613*	0.418*	-0.599**
NETSALES	0.013	0.074*	0.013	0.073**
INDUSTRY DUMMIES	significant			
LR rho=0		39.974		40.448
Wald test of full Model		303.98		305.35
Log pseudolikelihood		-913.985		-910.21
Number of observations		1290		1290
One-tailed <i>t</i> -test applied.	***p > .01	**p > .05	*p > .10	

In Model 1a we test the impact of collaboration on development of novel products. As expected the collaboration effect is positive and significant in firms' ability to develop radical product innovations, however cooperation has a negative and significant impact in incremental innovations. The effect of foreign is highly significant in radical innovations, however foreign ownership takes a negative but insignificant effect on development of incremental innovations. In Model 1b we test Hypotheses 1 to analyze if the effect of collaboration in product innovation would be higher in foreign rather than domestic companies. We find support for our Hypothesis 1 as long as the coefficient of the interaction term between the variables COOPERATION\*FOREIGN is positive and statistically significant in radical innovations. The impact of collaboration remains positive and significant, but the effect of foreign ownership of

the company becomes insignificant in the development of novel products. This makes us believe that foreign firm's superiority in radical innovation relies mainly on its superior ability to benefit from cooperation, rather than its international nature itself. According to incremental innovations, cooperation is negative and significant, while foreign ownership has not a significant effect. Consequently, collaboration of foreign-owned firms does not have a higher positive impact on incremental product innovations than collaboration of domestic firms, due to COOPERATION\*FOREIGN is not significant in achieving less novel innovations. The effect of the control variable PROPAT on the likelihood of achieving innovations is positive and significant in the case of radical innovations. The variable for EXPSHARE has a positive and significant effect in the development of radical innovations, while it takes a negative and significant value in incremental innovations. Size of the firm controlled by NETSALES is a positive and significant factor for the achievement of less novel innovations.

Table 3 presents the estimated results for the impact of different types of geographical technological collaborations on the degree of novel product innovation; and the significance of ownership nationality in determining geographical collaboration impact on product innovation. The  $\rho$  parameter is highly significant, this support the choice of biprobit instead of probit model. The Wald test also points out high significance of both variables for the models.

**Table 3. Geographical collaboration impact in product innovation**

	Model 2a		Model 2b	
	RADICAL	INCREMENTAL	RADICAL	INCREMENTAL
REG	0.369**	-0.280	0.324**	-0.226
INTER-REG	0.968***	-0.320	0.507	-0.578
DIVERSEREG	0.709***	-0.181	0.672***	-0.227
FOREIGN	0.174**	0.009	0.181	-0.152
REG*FOREIGN			0.455	-0.569
INTER-REG*FOREIGN			1.401**	1.029
DIVERSEREG*FOREIGN			0.548	5.385
GROUP	-0.150	-0.024	-0.165	-0.023

R&DEXP	-0.054	0.009	-0.055	0.009
PROPAT	0.730***	-0.205	0.732***	-0.231
EXPSHARE	0.422*	-0.620**	0.475**	-0.508**
NETSALES	0.005	0.072**	0.006	0.074**
INDUSTRY DUMMIES	significant			
LR rho=0		39.810		41.561
Wald test of full Model		309.690		308.600
Log pseudolikelihood		-910.318		-902.871
Number of observations		1290		1290
One-tailed <i>t</i> -test applied.	***p > .01	**p > .05	*p > .10	

Model 2a estimates, the impact of different types of partnerships according to geographical location in firms located in CAPV. Results suggest that the effect of collaboration depends on the type of partner.

While exclusive regional cooperation (REG) has a positive and significant effect on the development of radical product innovation; exclusive interregional cooperation (INTERREG) does not have a significant impact in the achievement of novel products. As expected, diversity in geographical collaboration (DIVERSEREG) has the largest positive and significant in the achievement of radical innovations. Therefore we can confirm our Hypothesis 2a related to the highest significant impact of heterogeneous geographical networks in the development of new products.

Model 2b estimates the impact of different geographical technological networks in product innovation according to foreign ownership. In order to analyze this issue, we create three interactions capturing the effect of different geographical networks in foreign-owned firms: REG\*FOREIGN, INTERREG\*FOREIGN, DIVERSEREG\*FOREIGN. The introduction of these interactions allows us to isolate the effect of collaboration performed by foreign firms in product innovation. Through the application of these interactions we can confirm our Hypotheses 2b. Foreign-owned firm's advantage on geographical collaboration relies on interregional collaboration, INTERREG\*FOREIGN is positive and significant in the achievement of novel

products. However, foreign firms do not take a higher advantage from exclusive regional or diverse geographical networks than domestic firms, as long as REG\*FOREIGN, DIVERSEREG\*FOREIGN does not have a significant effect.

According to the development of incremental innovations, neither type of geographical collaboration, nor foreign-collaboration interactions have a significant impact.

The effect of control variables is similar to previous model.

Table 4 presents the estimated results for the impact of different types of knowledge-based networks on the degree of novel product innovation; and the significance of ownership nationality in determining knowledge-based collaboration impact on product innovation. The  $\rho$  parameter is highly significant, this support the choice of biprobit instead of probit model. The Wald test also points out high significance of both variables for the models.

**Table 4. Knowledge-based collaboration impact in product innovation**

	Model 3a		Model 3b	
	RADICAL	INCREMENTAL	RADICAL	INCREMENTAL
SCIENCE	-0.408**	0.106	-0.523**	0.046
COMMERCIAL	0.389**	-0.441**	0.220	-0.478**
DIVERSEKNOW	0.949***	-0.136	0.923***	-0.189
FOREIGN	0.526**	0.006	0.261	-0.245
SCIENCE*FOREIGN			0.650	4.575
COMMERCIAL*FOREIGN			1.540**	0.384
DIVERSEKNOW*FOREIGN			0.252	0.785
GROUP	-0.131	-0.020	-0.143	-0.032
R&DEXP	-0.044	0.009	-0.046	0.009
PROPAT	0.696***	-0.230	0.695***	-0.250*
EXPSHARE	0.472**	-0.648**	0.524**	-0.605**
NETSALES	0.004	0.076**	0.002	0.074**
INDUSTRY DUMMIES	significant			
LR rho=0	42.350		44.354	
Wald test of full Model	321.850		324.440	
Log pseudolikelihood	-901.416		-894.226	
Number of observations	1290		1290	
One-tailed <i>t</i> -test applied.	***p > .01	**p > .05	*p > .10	

Model 3a assess the impact of different types of knowledge-based technological partnerships in firms located in CPAV. Results suggest that the effect of collaboration on novel innovation depends on the type of partner.

As posited in the theory, exclusive science cooperation (SCIENCE) has a negative and significant effect on the development of radical product innovation; while commercial cooperation (COMMERCIAL) has a positive but insignificant impact in the achievement of novel products. The largest positive effect of knowledge-based networks is found in diverse partnerships (DIVERSEKNOW) has the largest positive and significant in the achievement of radical innovations. Therefore we can confirm our Hypothesis 3a related to the highest significant impact of diversity in knowledge-based networks in the development of new products.

Model 3b estimates the impact of different knowledge-based networks in product innovation according to foreign ownership. In order to analyze this issue, we create three interactions capturing the effect of different knowledge-based networks in foreign-owned firms: SCIENCE\*FOREIGN, COMMERCIAL\*FOREIGN, DIVERSEKNOW\*FOREIGN. The introduction of these interactions allows us to isolate the effect of collaboration performed by foreign-owned firms in product innovation. Through the application of these interactions we can confirm our Hypotheses 3b. Foreign firms obtain greater performance than domestic firms on commercial collaboration, COMMERCIAL\*FOREIGN is positive and significant in the achievement of novel products. This result confirms previous literature about firm's commercial collaboration in spatial clusters. Malmberg (2003) pointed out the disappointing results of commercial collaborations within clusters, and the increased attention to more informal unintended interactions.

According to the development of incremental innovations, only exclusive commercial cooperation is significant, taking a negative sign. Exclusive science collaboration takes a positive but insignificant effect, and diverse knowledge-based networks have a negative but significant effect. Looking at foreign-owned firm's advantage from knowledge-based networks, any foreign-collaboration interaction has a significant impact in the achievement of incremental innovations. Once again, the effect of control variables is similar to previous model.

## **5. DISCUSSION AND CONCLUSIONS**

Economic development is connected with the generation of innovation. Collaboration has been largely considered as an important enactor of firm's innovation ability. However, literature is equivocal about the impact of different type of networks on innovation output.

In this sense, firm's particular context will dictate the best collaboration pattern to achieve higher rate of innovation novelty. This research focuses on the development of an effective collaboration pattern for firms located in Basque Country. Traditionally Basque Country has been considered an example of geographical cluster. The aim of this paper is to understand why domestic-owned firms achieve lower innovation performance than foreign-owned firms located in the CAPV. Therefore, we assess differences in the way these two groups of firms organize their technological collaboration practices and the comparative differences that stem from their respective practices.

This study confirms that show collaboration strategies developed by foreign-owned firms have higher impact on achieving novel innovation (Frenz and Ietto-Gillies, 2004). In order to explore the source of this foreign advantage, we analyze how foreign-owned firms benefit from different networks (according to geographical and knowledge-based dimensions). This distinction between technological networks makes us exploring traditional cluster advantages focused on geographical proximity and specialized industry collaborations.

Firstly, when we focus on technological geographical collaboration we find that diversity in the make-up of geographical networks, favors innovation novelty more than collaboration with a single type of geographical partner does. This is in line with recent cluster literature focused on spatial collaboration diversity (Boschma, 2005). By considering the individual impact of each type of geographical partner, results confirm that regional partners are the single partners who most impact on the achievement of novel product innovation. This is consistent with the argument that short distances across collaborators benefit from knowledge externalities (Jaffe et al. 1993; Audretsch and Feldman, 1996; Boschma, 2005).

Looking at foreign-owned firm's superiority in innovation performance, we obtain that inter-regional collaborations seem to be the key source of advantage. Being part of a MNC allows affiliates to be involved in a multinational network and develop an open-vision of spatial collaboration. Thus, foreign-owned firms benefit from inter-regional collaborations due to its international learning ability (Phene and Almeida, 2008; Lowe and Wrigley, 2010; Ebersberger and Herstad, 2011).

Second, knowledge-based technological collaborations may be a make-or-break decision for the success of novel innovations across firms located in CAPV. Our results show that diversity in knowledge networks has the greatest positive effect over radical innovations. Being integrated in a diverse knowledge-based network allows firms to benefit from generic knowledge from scientific partners in order to explore new knowledge, but also from commercial collaborators exploiting current specialized knowledge.

Looking at foreign-owned firm's superiority in innovation performance, we confirm commercial collaborators as source of innovation advantage. Foreign-owned firms have a greater chance to combine dissimilar and complementary knowledge in commercial-based collaborations.

Therefore, these commercial partnerships developed by foreign firms enable them to profit from

a variety of specific knowledge (across MNC, and host country) with a positive impact on novel innovations creation.

We contribute to literature exploring new global dynamics of cooperation in firms located in geographical clusters. In this sense we challenge traditional cluster assumptions, by estimating the impact of different on innovation novelty. Traditional cluster literature has stressed the rigid “local” focus; however we take a contemporary vision by integrating ownership nationality in geographical cluster research. Introduction of foreign companies in regional systems research have been neglected due to the particular attention to locally owned medium-sized firms, while MNC are seen as alien the idea of a dynamic spatial cluster (Malmberg, 2003). We provide a global pattern of effective collaborations and determine the foreign firm’s collaboration advantage. In this sense, firms located in the Basque country should encourage diversity in geographical and knowledge-based networks.

This study is a novel empirical study in the cluster theory, traditionally focused on the development of case-studies. Malmberg (2003) already suggested the importance of assessing the implications of global and local circuits in an empirical way.

Our findings provide useful managerial implications. Managers should be aware of the importance of parent choice and diversity of collaboration strategy in order to achieve sustainable innovation. Besides, managers should look at gaining advantage from inter-regional and commercial partnerships in order to gain competitiveness from foreign firms. As pointed out before, radical innovation is essential for organizational competitiveness.

From the point of view of policy-makers, its mission is essential in promoting efficient practices. As long as Basque country is result of an efficient regional policy, regional policy-makers should encourage sustainable innovation strategy. In this sense, they should encourage science organizations to develop generic knowledge closer to domestic firm’s background to motivate innovation development. In the same way, regional government should explore the rationale

behind informal commercial transactions in order to promote a commercial collaboration efficient pattern. According to geographical collaboration, interregional partnerships should be supported allowing firms to develop an open geographical perspective.

Finally, this work is not free of limitations. It would be interesting to enlarge empirical analysis through a larger sample from different periods. The results warrant further study of geographical and knowledge-based networks at different levels and analyze its implications in innovation performance. Related to empirical validation of the model, our findings could be supported by the development of an in-depth case study.

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