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ROSIS: A Regional Open Sectoral Innovation System

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ROSA, ROSAE, ROSIS: Modelización de un Sistema de Innovación Regional, Sectorial y Abierto
ROSA, ROSAE, ROSIS: Modelling a Regional Open Sectoral Innovation System

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ABSTRACT
The literature on territorial innovation modes has identified the development of a diverse set of innovation systems. However, despite the large variety of concepts that have emerged within this line of thought, there are still certain gaps that do not allow the adaptation of the various innovation systems proposed in the literature to the characteristics of certain territories. In this paper we introduce a conceptual framework based on a regional open and sectoral innovation system (ROSIS), which is qualitatively tested in the Duranguesado county in Spain.

Keywords: territorial innovation model, ROSIS, Basque Country.

Introduction

The literature about innovation studies has opened some research lines, which deal and study the competitiveness of a territory through collaborative innovation structures, known as Territorial Innovation Models (Moulaert & Sekia, 2003).

Among them, the most analyzed ones could be considered: the clusters of Porter (Capó-Vicedo et al., 2007), the innovative environments (Méndez, 2002), the industrial districts of Marshall (Goñi Mendizábal, 2010), the *milieux innovateur* (Vazquez Barquero, 1999), etc. But one of the most conceptually and empirically studied models is the innovation system (Lundvall, 1992). These systems analyzed the interaction and collaborative relationships between productive or manufacturing players, with those that contribute to the knowledge generation, as well as with those involved in sociopolitical or institutional framework (Cooke et al., 1997; Edquist, 1997).

First af all, this article analyzes the literature about existing innovation systems, in order to identify the gaps these models do not face.

Secondly, the article suggests a new framework to study a regional innovation system, focused on a sectoral strength and the need to be opened to external players. This model would lead to a Regional Open Sectorial Innovation System –ROSIS-. This model will be contrasted with the Durango county, a micro-region placed in the Basque Country (Spain). It is characterized by a broad knowledge of metal-mechanic transforming. The fact that it is a micro-territory specialized in a cross industry supplying multiple markets, highlights the need of a abroad inner and external opening so as to get new knowledge, acquire technology or to diffuse goods and services produced inside.

The article is organized as follows: The next section makes a review through the state of the art identifying and comparing the subtypes of innovation systems found in the literature. The succeeding point introduces the mentioned ROSIS model, which would answer the gaps identified in the literature.

After introducing the used methodology, the fifth section contrasts the ROSIS model with the Durango county, analyzing the main features and players that shape the case. The sixth chapter offers a discussion about the main results. Finally, the article presents some research lines.

State of the art: territorial models to encourage innovation

The regional level (OECD, 2007) has become a very important space to understand the global economic results. The economic policy changes from focusing on national level -with a *top down* strategy-, to scatter in regional and local levels, according to territorial characteristics. This is the result of an increasing competence transfer to sub-national levels, in order to articulate more effective and rapid policies from the territory (Fløysand et al., 2010). This means relying on local public and private stakeholders, so as to implement local development policies through for and from the territory, with a bottom-up point of view (Crescenzi & Rodríguez-Pose, 2011). Going deeper in the territorial analysis, makes difficult to consider the micro-territories, counties or cities as complete regions because they may lack of stakeholders, relationships or institutions, till the point that those territories might lose legitimacy (Navarro & Larrea, 2007). However, considering the local level allows a better understanding and characterization of the socio economic roles of the territory (Muscio, 2006). In addition, a high focus on a concrete space facilitates mutual knowledge and trust relationships which may evolve to potential business interactions (Nooteboom, 2010).

The need to promote the innovation capacity of the territories in order to improve their competitiveness has developed some analytical frameworks to study the relationships between the stakeholders inside an economic system, such as clusters, districts, poles, innovation systems, etc. Some of the distinguishing features of these models are: the existing players in the region, the sectorial specialization degree of industrial-technological agents, the relationships between them, the opening degree to outside stakeholders, the level from which policies are promoted, etc.

The literature employs different terms to analyze similar realities, making a mixture of confusing expressions. Therefore, some authors consider that a conceptual simplification should be undertook based on types and subtypes. In this way, the Innovation System type, would have different categories, from a technology, sectorial or territory point of view (Table 1), leading to a diverse of innovation system subtypes. Thus, even though the innovation system literature has achieved maturity, a map to analyze and clarify each typology has not been drawn.

The goal of this article is to sketch a innovation system subtype to satisfy the features of a located micro territory with a high level of sectorial specialization.

Table 1. - Innovation system tipology.

Main Type	**SUBTYPES**				
	Approach	**System type**	**Acronym**	**Governance**	**Source**
Innovation System	**Geographic**	National Innovation System	NIS	*Top-down*	Lundvall (1992)
		National Open Innovation System	NOIS	*Top-down*	Santonen (2009)
		Regional Innovation System	RIS	*Bottom-up*	Cooke et al. (1997)
		Local Innovation System	LIS	*Bottom-up*	Kolehmainen (2003)
		Regional Open Innovation System	ORIS ROSI	*Bottom-up*	Belussi, et al (2010) Savitskaya (2009)
	Sectorial	Sectoral Innovation System	SIS	Mixed	Malerba (2002)
		Regional Sectoral Innovation System	RSIS	*Bottom-up*	Cooke (2002)
	Technological	Technological Innovation System	TIS	Mixed	Carlsson & Stankiewicz (1991)
	Main Knowledge	DUI IS	DUI RUIS	*Bottom-up*	Pinto et al, (2013) **Cooke**

Source: own elaboration.

The state of art does not answer the cases with regional and/or local approach, having a high sectorial and technological specialization, which would require an important opening towards new knowledge, markets, skills and technologies. This is the contribution expected in this article, to be developed in the next section. Nevertheless it should be considered that the model introduced here is not a model in itself, but it would become a subtype of regional innovation system.

ROSIS: an territorial innovation model, open and sectoral

This research focuses on the regional innovation system literature (RIS). The RIS Concept (Cooke et al., 1997) appears shortly after the national innovation system concept (NIS) (Lundvall, 1992). According to Hommen & Doloreux (2004), two main trends influence of the appearance of the RIS subtype: the research line about national innovation systems and the studies about regional science, which lead to the appearance of socio-institutional innovative milieus (MacKinnon et al., 2002). Although there is no fully accepted RIS definition, this model could be defined as (Cooke et al., 2004, page 3): 'generation and knowledge exploitation subsystems which interact bounded with others regional, national and global systems, to commercialize new knowledge'.

As well as it happens with other territorial development models, externalities, culture and regional identity, as well as collective learning, play a key role in this concept (Cooke et al., 1997).
The reason for the growth of regional innovation policies lies in the potential of this model to improve skills, firm`s performance, as well as the competitive improvement of the environment through the collaboration of productive, knowledge and institutional stakeholders (Uyarra & Flanagan, 2009).
The ROSIS subtype presented in this section, complements the existing territorial structures, from a regional and sectorial approximation (Cooke, 2002; Rodríguez Barba, 2011) as well as from an open innovation approximation (Belussi et al., 2010; Savitskaya, 2009; Torkkeli, 2007).

The main features of this subtype are explained below:

Stakeholders:
The ROSIS subtype as the RIS, consists in three subsystems involved in territorial development:

- Knowledge exploitation subsystems or productive subsystem:
    - Formed by firms that manufacture their products and processes in the region. This subsystem is the core of any innovation systems.
    - It uses the internal knowledge as well as the knowledge coming from the generation subsystem, in order to employ the acquired knowledge in their production processes.
    - In this subsystem, not only manufacturing firms would be located, that would form an inner micro cluster, but also supporting services firms.

- Scientific and Technological Knowledge generation subsystem:
    - It includes research centers, mainly focused on R&D activities.
    - Vocational Training Centers, located in the region, actively collaborating with universities, research centers, etc.
    - Universities which not only train people, but also work in innovation projects with the firms and the stakeholders.
    - In this subsystem would also appear consulting and engineering firms that contribute to a particular knowledge application focused on specific needs.
- Socio-political and institutional Subsystem (Trippl & Tödtling, 2007):
    - Policy-making institutions, as well as, public regional development agencies working towards the territorial competitiveness, are included in this subsystem.
    - Associations and foundations that contribute to strengthen social capital, belong also to this subsystem. They promote a cooperation culture and inner territorial behaviors.
    - Facilitators or coach agents are also included in this subsystem (Eriksson, 2000)[1]. They promote a collaborative culture fostering innovation, regardless the existing knowledge players in the area or the potential of development agencies.
    - In this subsystem, public and private financial entities would also be included.

Geographical area located
Several authors analyze the presence of RIS, more or less in any kind of geographic area (Doloreux, 2004; Wolfe, 2003), regardless the technological level of the region.
Cases like the Garment district in New York (Rantisi, 2002), the Media industry of Montreal (Tremblay et al., 2002), the service industries in London (Keeble & Nachum, 2002) or the low urban agglomeration industrial districts(Asheim & Isaksen 2002), focus on micro regional environments without political autonomy. However, besides the geographical proximity of living in the same territorial space other kind of proximities should be considered in the ROSIS model:

[1] This author states explicitly in his the role of facilitators actors regardless of their belonging to generation and exploitation of knowledge subsystems.

- Cognitive proximity (Antonelli, 2000): it involves the easiness of knowledge creation, the access to new information sources, etc. This is, the presence in a geographical delimit space where knowledge contributors help in the establishment of learning relationship networks.
- Organizational Proximity (Gilly & Torre, 2000): it refers to the relationships between existing firms, institutions and organizations, according to their similarity – because of the performed activity-, or their belonging to same firm groups, business associations, etc.
- Institutional proximity (North, 1990) defined by the relationships between macro, meso, and micro institutional policy-makers and policy executers.
- Social proximity (Boschma, 2005): it refers to the embedded relationships in the micro level according to trust criteria, culture and common values. In this regard, the presence in a territorial delimit environment, allows personal knowledge of company, technological, socio-cultural agents, etc.

Sectoral strenght

The sectorial homogeneity does not involve the existence of a single market. Understanding the sector will promote different views of the industry. Thompson (1994) defines a sector as the group of companies whose products have similar attributes and compete for the same buyers. This view is not shared by Porter (1980) who considers that a sector is formed exclusively of substitute companies. On others behalf, the definition of Bueno (1987) would consider a sector prior to market-client identification, depending on the activities performed by the industrial group of firms.
For this author, a sector is defined by the set of companies that perform related or complementary activities. This latter definition is used in this research for the sectorial understanding of the ROSIS.
In recent years, the concept of relational variety has emerged (Frenken et al., 2007). From this research line, those regions having technologically different but related activities would benefit from the geographical, organizational and cognitive proximities (Audretsch & Feldman, 1999). Therefore, territories are more likely to diversify their economic activities towards related sectors near their initial processes, technologies or markets. Thus, a region having an high relation variety, would be nearer to new technological processes, markets or sectors, and diversification opportunities would be higher. This leads to search for a particular balance between relational and non-relational variety.

Opening degree

RIS are not sufficient, *per se*, to keep their competitive level in a globalized economy. This leads to identify the need for establishing collaborative networks with institutions or external firms in the productive, technological, knowledge or institutional scopes (Bunnel & Coe, 2001).
This lack is even more important in micro-territorial environments, due to its scope and inner composition. Relevant technological knowledge for the local industry is not only endogenous but it is also generated in other regions that transgress geographical boundaries. Consequently, the territorial perspective should be flexible, considering local interactions as well as those having place globally (Bathelt et al., 2002). In this way, the ability to connect to new stakeholder's networks will provide the industry with new ways of obtaining knowledge and business opportunities (Cumbers et al., 2003).
Some authors consider this openness to external agents is implicit to the RIS model (Asheim & Gertler, 2005; Cooke, 2002; Navarro, 2009). On the other hand, other reseearchers highlight the need of making clear the need of a open minded RIS, in order to emphasize inner and external relationships (Belussi et al., 2010; Savitskaya, 2009; Torkkeli, et al., 2007). This research, focused on micro-territorial environments, is based on this second approach.
However, the opening should not be understood only from a geographical view, but also related to sectorial, technological, market, and institutional opening, etc, considering that related variety is closely linked to cognitive proximity, allowing the access to new knowledge niches.

Governance

Opposed to some researchers that consider a productive subsystem inside a institutional one, suggesting a top-down policy promoted by public authorities(Uyarra, 2008), the proposed model suggests a bottom-up perspective (Iammarino, 2005), where public private partnerships would promote cooperative work between firms, public stakeholders, knowledge players, facilitators, etc., without the unilateral direction of any stakeholder.

A bottom-up system would therefore be justified by (Patrucco 2008):

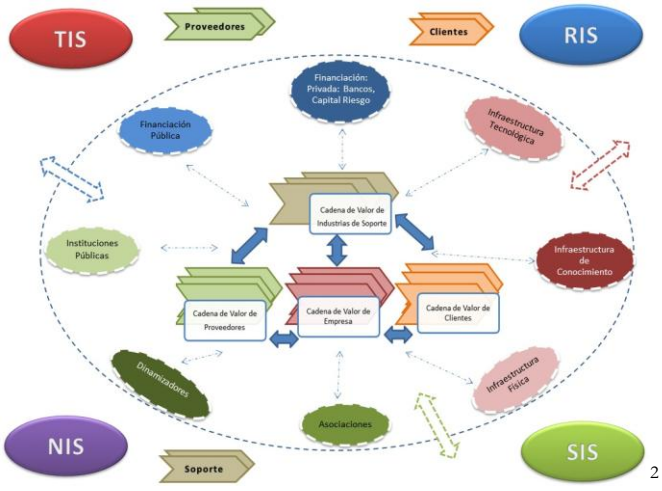
- Localized communication flow.
- Localized inventions and localized learning.
- Search for new procedures.
- Integration in localized networks.
- Historical relationships trajectory in innovation process.

ROSIS modeling

This research presents the ROSIS (Figure 1) as a RIS typology, valid in case of micro-geographical environments and sectorial specialization. The ROSIS would be characterized as:

- A specialized model: the model has a strong sectorial, productive or technological specialization that articulates the territorial competitiveness.
- A model geographically delimit: it is important that stakeholders identify the belonging to the environment. However, territorial limits are not critical to the system gestation, but cultural boundaries.
- A model with knowledge generators: the system would include explicit knowledge generators, but also productive or training players that somehow contribute to spread knowledge in the territory.
- A *bottom-up* governance model: the model is based on the participation of all available players in the territory, with special participation of the private initiative. The collaboration between public and private stakeholders articulates a joint strategy for the region.
- A cooperative model: it promotes cooperation among territorial stakeholders, including companies competing for the same market.
- A multilevel model: All relevant stakeholders implied in regional competitiveness are considered regardless their supra-regional responsibility ~~and available skills in the region~~.
- An open model: the model is not enclosed in the territory where it arises; it interacts with other supra-territorial systems. On this way, it would interact with other RIS, TIS, SIS and NIS.

Figure 1.- ROSIS: a regional open innovation system.



Source: own elaboration.

Methodology

In order to test the proposed model, qualitative interviews are used with stakeholders belonging to the analyzed territory, corresponding to the subsystems mentioned in the ROSIS, as well as external

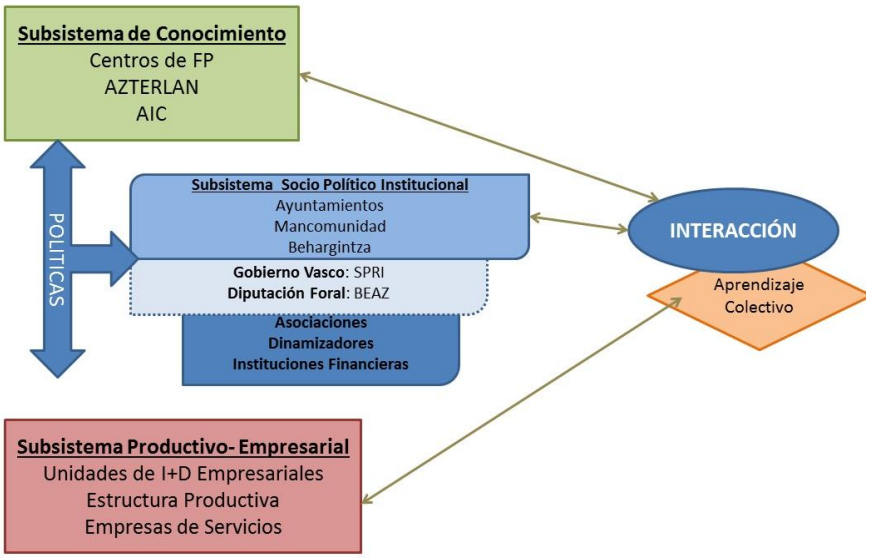
[2]ROSIS is characterized by open collaboration and open integration with heterogeneous systems related to the environment. This is displayed in the model by the interaction with technological systems, TIS, sectorial, SIS, or geographical, RIS, NIS, etc.

stakeholders, -policy-makers and researchers-, that will permit to confirm, from a theoretical-practical point of view, the proposed subtype.
In the first place, the interviews with productive firms in the region were performed, as the key agents of the model (Cooke et al., 1997), as well as the other stakeholders with a direct impact on the territory, such as public institutional players, knowledge generators, facilitators, etc. These interviews took place during the months of October 2012 to March 2013. In the productive subsystem firms of the metal-mechanics value chain were interviewed. In the knowledge generation subsystem, the R&D director of the transverse advanced knowledge center (AZTERLAN) and the innovation director of one of the training centers (Centro Marist FP) were interviewed. At least, in the socio political institutional subsystem different stakeholders that contribute to a cooperative culture to promote innovation are included. Specifically, and from a multilevel perspective, the three levels of territorial promotion were considered and their representative players were interviewed. It was considered for this reason, local government, as the micro-player, the closest to the territory, the basque administration as the institution with legislative competence in the field of industrial policy, as the meso one, and the state administration, as a macro administration. Considering the point of view of the associations, the Durango Business Association was considered as a transverse association that involves firms of the territory regardless the activity they develop. In turn, the director of the Tabira Foundry Institute was interviewed. Tabira promotes technological optimization in the casting industry and all the technologies related to it. [3]. Finally, a facilitator was interviewed, considering the dynamic role he performs in the region.
Secondly, academic experts and policy-makers were interviewed. From the perspective of university researchers and academic experts, people with different academic backgrounds and different knowledge of the industrial performance were interviewed. Specifically, a focus group was held with 7 economic researchers of Basque Institute of Competitiveness, ORKESTRA. Three university professors were complementary interviewed, two of them, engineers, located on the University of the Basque Country and the other one, economic researcher, was located in England (Manchester). This last one allows an outside vision, not directly involved in the country.
Afterwards, an expert in industrial geography was interviewed, being economic geography a research line closed to this theme.
Finally, an engineer, with a extensive knowledge of the local industry and the performance of the Basque Country innovation system was interviewed.
Regarding the policy-makers, 3 persons who are involved in the design of the Basque industrial policy were interviewed.
Lastly, a european level policy-maker was also interviewed

The ROSIS in the Durango county

The Durango county is a region located in the eastern region of Biscay next to Gipuzkoa and Araba. In the north, it borders the Biscay counties of Lea Artibai and Arratia, respectively. It has a strategic location in the Basque Country, interconnecting the whole country.
The county has a production structure characterized by a deep knowledge of metal-mechanic processing. This sectorial strength is confirmed by public stakeholders, such as the development agency of the region (Behargintza), and supra-territorial institutions: the Regional Development Agency of Biscay -BEAZ, or the Basque Agency for Firm Development-SPRI.
Knowledge dissemination and generation stakeholders are also available in the county. We would locate here, for example the vocational training centers, focused on metal mechanic processes, and advanced knowledge and research centers such as the Automotive Intelligence Center (AIC), or the metal technology research center AZTERLAN-IK4
.
Figure 2.- Subsystems of Duranguesado ROSIS.

It has to keep in mind that casting is the third industrial activity of the region and the third in employability terms (see section 5).



Source: own elaboration.

To facilitate the reading and comprehension of the ROSIS in the county, this section is structured in the same way as in section 3. Thus, the stakeholders (Graph 2) constituting the ROSIS in Durango, the characteristics of its geographical environment, its sectorial specialization and its openness would be discussed.

Stakeholderss
Firstly, the 3 subsystem of ROSIS model in the Duranguesado region are characterized.

a) Productive subsystem or Exploitation of knowledge:
This subsystem is formed by manufacturing firms developing products or processes in the county, as well as supporting firms. The region does not only have key industries in the metalworking transformation process, such as casting, stamping, forging or injection. It also involves supporting industries that complement the previous ones, such as treatment, machining or welding.
The county, as the Basque Country (Mera & Jiménez, 2005), presents a business network formed by small firms, mainly small SMEs. Specifically, 69% of companies in the territory have micro-SMEs character (with fewer than 10 employees), and 23% are small SMEs (between 10 and 50 employees).
Regarding to the activity performed by the firms, the primary sector of the county (4.77%) is similar to the primary sector in Biscay (3.12%) and the Basque Country (4.90%). The differences lie in the service and industrial activity. Specifically, the service activity in the county reaches the 60.27% compared with 78.34% in the case of Biscay and 84.58% from the Basque Country. On the other hand, the industrial level performed in the Durango County is the highest (17.31%), comparing it with the cases of Biscay (9.20%) and the Basque Country data (10.52%).[4]

Once analyzed the industrial character of the county, we go deeply in the kind of firms located in the area, considering the technologies they employ, their markets, their employment, etc.
To characterize the county as an industrial network dedicated to metal manufacturing, we compare the percentage of industrial firms according to the activity they perform and their employment ratio (Table 2). It might be concluded that the 80% of industrial employment in the county is focused on metal-mechanical processing.

[4]These data are endorsed by the gross domestic product (GPD), with it the industrial character of the area is shown, with data ranging between 77% and 86.74% in the towns of Mañaria, Mallabia or Izurtza.

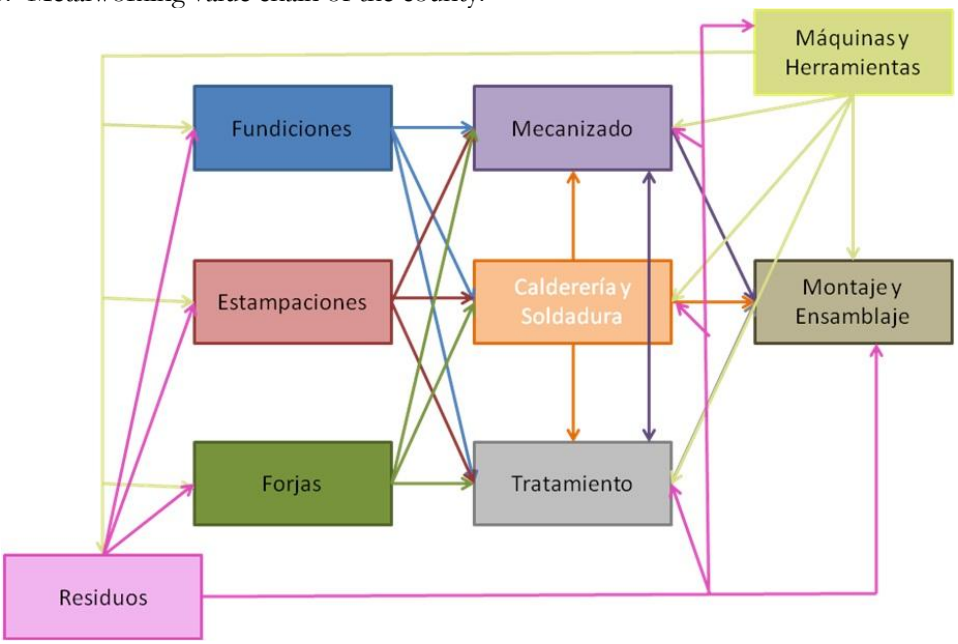
Table 2.- Relationship between activity areas and employment in Duranguesado.

Activity	%Firms	% Employment
Assembly	14.07%	24.02%
Tooling	14.95%	21.29%
Casting	12.75%	16.25%
Machining	23.08%	13.32%
Forging – Stamping	5.71%	8.17%
Welding	10.11%	4.90%
Treatments	7.91%	3.65%
Plastics	2.42%	3.04%
Tools	0.44%	2.89%
Others	8.56%	2.47%

Source: own elaboration (from Durango County Behargintza).

The manufacturing firms in the region are located through the metalworking value chain, being forging, stamping and casting the key technologies (Song, 2000; Trejo Tellez, 2011). The work of those manufacturing companies is complemented by the manufacturing services firms. They cooperate to provide the manufactured product with similar characteristics to what the intermediate client is expecting. Those manufacturing service firms would be companies performing machining, treatment, boiler and welding activities. Finally, the nearest firms to the intermediate client would be the assembly firms.
In addition to these, other supporting firms are identified: waste, energy, tool and machinery.

Figure 3.- Metalworking value chain of the county.



Source: own elaboration.

The principal client markets of the products, processes and services offered by the metal industry of county are automotion (51% of the sales), tool and machinery (10%), electrical appliances (4%), energy (4%), and the paper industry (3%).

Regarding to the innovation activities and developments of the productive subsystem, it is observed that 2011 is slightly less innovative than the previous years. This is contrasted by the amount of money invested in innovation projects and the employees with full dedication to innovation activities (Tables 3 and 4).

Table 3.- Investment in innovation projects in the period 2006-2011 (€ Million).

	2006	2007	2008	2009	2010	2011
Basque Country	1,829.70	2,030.00	2,193.90	2,219.90	2,159.50	2,214.00
Biscay	791.1	899.1	962.9	1,013.20	1,025.20	1,053.30
Durango county	78.1	90.1	108.8	114.4	107.9	95.2

Source: Eustat (2013).

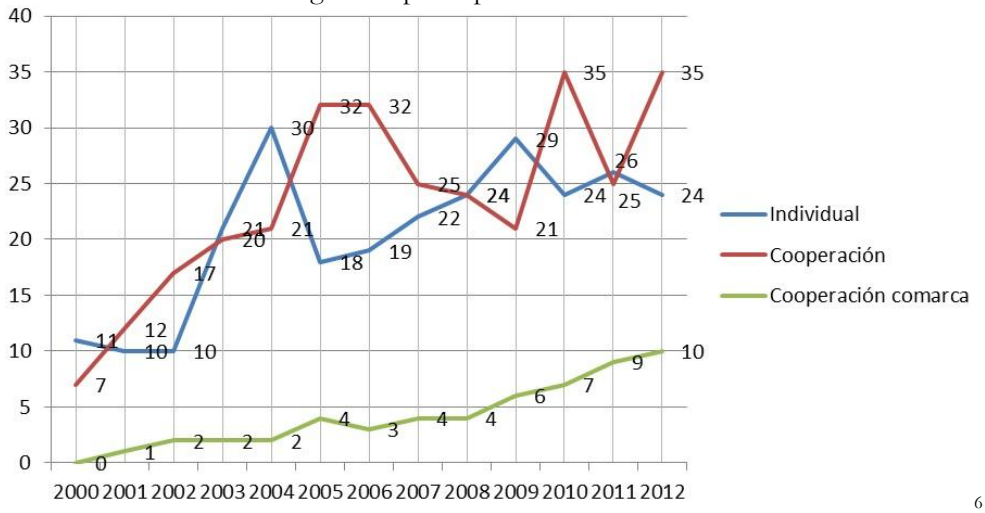
Table 4.- Employees with full time dedication to Innovative Activities 2008-2011.

	2008	2009	2010	2011
Basque Country	24,413	26,664	27,883	28,658
Biscay	11,610	13,044	13,816	13,734
Durango county	966	1,072	1,251	1,046

Source: Eustat (2013).

Finally, in order to analyze the evolutionary cooperative behavior in terms of R&D projects, the basque R&D public grants are compared to identify if the firms of the county access to innovation projects individually or in cooperation with stakeholders of their county or of the rest of the Basque Country (Figure 4). It should be considered that cooperative projects involve more funding from public administration, regardless the location of the company. This is, public funding is not an incentive to promote cooperation projects between companies in the same county. To make this comparison, the INTEK (2000-2005) and INTEKBERRI (2006-2012)[5] grant lines are matched, in order to differentiate between individual projects, cooperative projects with firms of the whole Basque Country, or cooperative projects between firms of the county.

Figure 4.- Evolution of the R&D granted participations.



[6]

Source: own elaboration from Basque Government resolutions.

b) Knowledge Generation Subsystem

[5] INTEK and INTEKBERRI grant lines corresponding to the Basque Government promote individual and cooperation R&D projects for the development of new processes or products.

[6] A continuous increasing in cooperation R&D projects between enterprises of the county is identified.

Two types of knowledge are identified in the region. On the one hand, vocational training centers which not only work in human capital education and teaching, but also in technological optimization of the firms of the county through innovation projects. In this sense, these centers maintain a proactive and proximity attitude to the manufacturing firms, collaborating to promote technology optimization, scheduling dissemination workshops, etc. Another remarkable fact is the willingness of the teachers of these centers to directly collaborate with the firms of the county. Even though they are not university professors, they are open to participate in useful and practical projects to optimize production processes.[7]

On the other hand, two research centers are identified. These centers focus on advanced knowledge promoting technological researches through radical and/or incremental innovations. One of them has a transverse character dedicated to the whole metal-mechanical industry (AZTERLAN-IK4), while the other is oriented to the automotive market (*Automotive Intelligence Center*, AIC). AZTERLAN is a private technological center belonging to the corporation IK4, member of the Basque Science, Technology and Innovation network. It was born from one of the vocational training centers and it has over 30 years of proven experience as a metallurgy research center.

At the beginning, the researchers of AZTERLAN were teachers of the training center, that work together with firms so as to analyze and test the manufactured products and proposing new possible developments. This somehow evidences the relationship of the vocational schools with firms. The main customers of AZTERLAN are located in automotive, energy and aeronautic markets. Within its portfolio, it might be indicated that 25% of its customers belong to the county.

On the other hand AIC is an advanced knowledge center focused on high-performance design developments in the automotive market. AIC was born through collaboration between the public and private sector to promote the competitiveness of automotive market suppliers in Biscay and the Basque Country, seeking a better positioning of basque firms as leaders in that market.

The AIC hosts and moves into the county 22 firms using intensive knowledge in automotion. These organizations have moved to AIC their R&D, training or industrial development units.

c) Institutional Socio-Political Subsystem

This subsystem has the participation of a multilevel public network with the direct presence of local administration and the collaboration of supra-territorial entities, in particular, the regional development agency of Biscay (BEAZ), and the business development agency of the Basque Country (SPRI).

The associative institutions have a strong presence in the county. They help to strengthen social capital, and values of the county, through different entities that promote each other knowing. Those institutions have different points of view and action: technological, market oriented, whole transverse firms association or socio cultural one[8].

In this subsystem appear also public and private financial institutions, considering that the specificity of the Basque Country in fiscal and tax matters permits an autonomous capacity to design own collection policies. In this sense, proactive policies with public R&D funding for innovation activities and tax incentives for innovative firms are implemented (Fernandez Ribas, 2009).

Facilitators are also active members of this subsystem. In the analyzed case they are former university professors, or ex managers, already retired of county firms. In both cases, they have a strong knowledge of the type of industry of the county.

Geographical located area

The case presented here focuses on a county of the historic territory of Biscay, formed by towns with low levels of population, but with a high indicator of industrial activity. Durango County is a unit homogeneous territory, geographically delimited. The case therefore belongs to a micro-

[7] Example of this availability is the participation of vocational training as certified stakeholders in CHEQUE+ INNOVA 2012 and 2013 calls, in order to develop technological optimization projects in enterprises. Another sample are EKOSCAN projects focused on environmental improvement of enterprises for technical optimization of their developed processes.

[8] Specifically, the enterprises association of Duranguesado, the ACICAE association (Automotive Cluster Association), the casting institute Tabira, HETEL or Gerediaga can be identified in the territory.

territorial environment. It has the advantage of having a decentralized policy adopted in the basque level. This means that, specifically, industrial policy is adopted at the regional level (Basque Country), while fiscal and tax policies are taken at provincial level (Biscay). However, Spanish and European policies are ultimately binding. It might be considered that the absence of end customers in the region can be a disadvantage for the system. The state of the art, in the opposite sense, shows that geographic and proximity relationships are not essential to generate an innovative system (Weterings & Boschma, 2009).

Besides geographical proximity in ROSIS model, the other types of proximities are also identified:

- Cognitive: this proximity is justified by the productive relationship between the existing firms across the metal value chain. Working around the metal industry allows a shared tacit knowledge base and similar industrial experiences which can also be shared in order to solve common problems (Boschma & Lambooy, 1999).
- Organizational: this proximity is displayed through the product-market-technology relationships matrix, according to the firm's activity. These relationships are not only in the production arena, but they extend to training centers, which adapt their training offer in terms of demand, and technology centers - mainly AZTERLAN- whose main client core is located in the county.
- Institutional: this proximity is shown by the presence and participation of the local development agency in the county (*Behargintza Duranguesado*), and the active collaboration with the provincial and autonomic economic departments, through their development agencies, BEAZ and SPRI. In addition, the rising of public funding grants, through R&D innovation projects, involves active relationships between firms.
- Social: A sample of this proximity lays in the revitalizing stakeholders, also called in the case, trust builders (Referencia). This kind of facilitators individually analyze firm's situation in order to make a program of project, process, product or market optimization so as to improve competitiveness. It's because of social trust and common shared values that this analysis can be realized. Associations would also be an example of the social proximity. Not only the diverse kind of associations promoting competitiveness, but also the existence of the 1º firms association, AED, and the existence of an association to promote the values of the county, are significant facts of the importance of social proximity.

Sectoral strength

Based on the type of industry of the county, due to the homogeneity of the industrial network, the sector could be defined as metalworking processing (FADE, 2004), regardless the final market.
As it has been presented in the previous section, the industry of the county is characterized by a broad knowledge of metal processing. The production subsystem is dedicated to the metal-mechanical industry -80%- (Table 2), with a dedication of the 51% to the automobile market. The relationships between suppliers, production companies and manufacturing service firms, are linked through the territorial value chain (Figure 3). It has also be noted the importance of the sector in the employment ratio (Table 2).

Opening degree

The production subsystem includes exporting companies, cooperatives organizations or multinational organizations, so through each firm's internal networks a small openness is achieved.[9] Nevertheless, the openness is not only geographical. It also means a great flow between companies performing the same activity, in order to share knowledge and disseminate spread achieved innovations (Russell, 2014). In this sense, 3 coopetitive projects are being developed in the county,

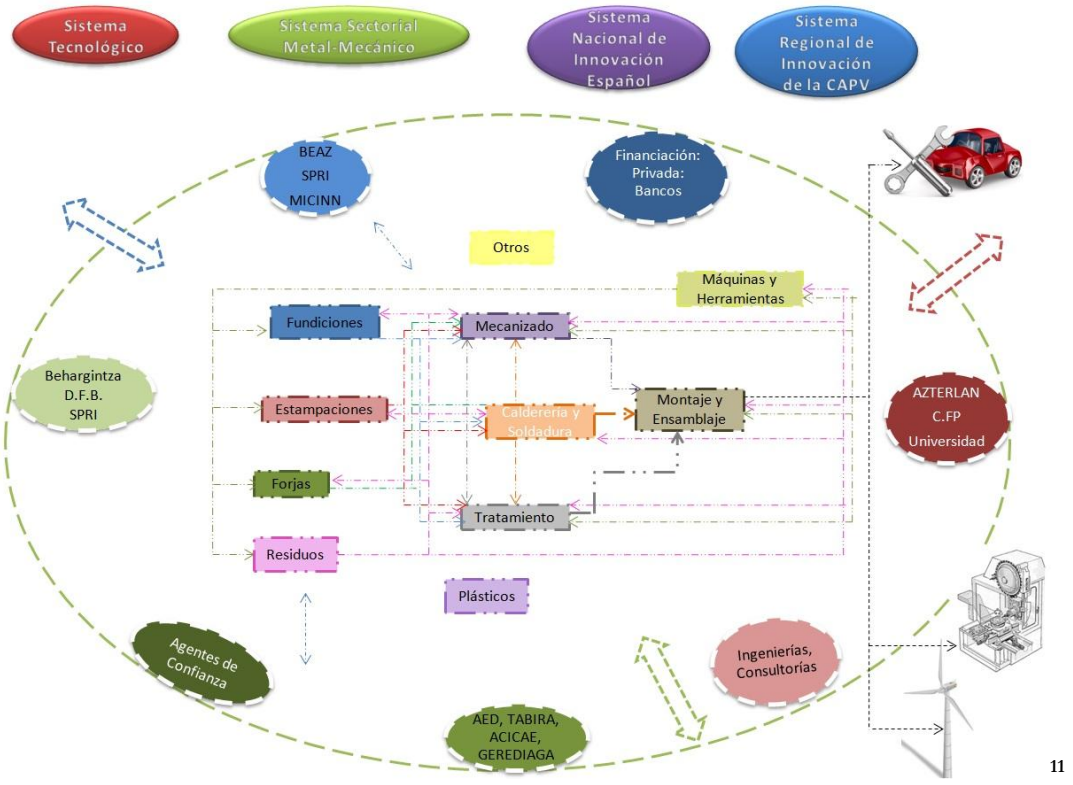
[9] Algunas de las empresas que cumplen con estas características serían por ejemplo CIE Automotive, Smufit Kappa, Grupo Arruti, Industrias LAIP, Layde Steel (perteneciente al grupo TATA), Rothenberger, Wallair Engine Components (perteneciente al grupo Velatia), Eroski S. Coop. (perteneciente al grupo Cooperativo Mondragón), DOIKI S. Coop. (perteneciente al grupo Danobat), ULMA Conveyors (perteneciente al grupo ULMA), Ekin S. Coop., y Orbea S. Coop.

in the casting, stamping and machining industries. In relation to the ROSIS model, the defended opening would be justified by the following facts:

- Internal opening: between existing agents of the county.
  - Trust Builders: revitalizing stakeholders, facilitators of collaborative dynamics of the territory.
  - Technological diffusion conferences and workshops to identify new opportunities of competitiveness performance: proposed working seminars to establish relationships between technological stakeholders located in the county, with productive or knowledge players, in order to diffuse possible new product, market, or process chances.
  - The increasing of the R&D cooperative projects.
- External Opening: towards the outside stakeholders of the county.
  - Participation in supra-county institutions to promote technological management dynamics: AIC, IK4, marGUNE CIC.[10]
  - Relationships between universities and external advanced technology centers: KIMURA, World Foundry Organization, European Cast Iron Group, SIFE which is the Basque Association for Stamping, etc.
  - Relationships within business groups in the case of multinationals companies or cooperative ones.
  - Relationships inside the value chain and with end customers: In the automotive market, relationships with the end vehicle manufacturers are identified - *Renault, Seat, Tata, Land Rover* -. In the wind energy market, the main customer is *Gamesa*, company also located in the Basque Country.

The figure below shows in summary form the ROSIS modeling which is suggested in the previous section, for the characteristics of the existing stakeholders in the region of Duranguesado (Figure 5).

Figure 5.- ROSIS of Duranguesado.



[10] CIC Margune is the Cooperative Research Centre for Advanced Manufacturing, opened in 2002.

Source: own elaboration.

Contrast of ROSIS of Duranguesado

In order to validate the previous conceptual model and its application to the specific case of the Durango county, interviews with internal and external experts were carried out. The opinions will be presented, depending on the location of the expert and the role played for the territory.

Local active experts in the territory

The interviewed firms consider ROSIS can be a feasible model due to co-location in the region of the necessary stakeholders considered in the model. They perceive that it is essential to establish relationships with external stakeholders in order to obtain competitive improvements and new development chances. They emphasize the need of keeping an open work culture. They focus on the importance of keeping not only external cooperation relationships but also inner ones, on order to improve collective competitive advantages, through individual improvements.

Interviewed public stakeholders belong to different location scales, impacting all of them in the region. They emphasize in the need to keep virtual and flexible geographical boundaries. Even though the ROSIS is born in Durango County, the competitiveness improvement can arrive from relationships with outside systems. That vision confirms the chance of getting strong links with the Basque Country University, located outside the county, but currently involved in specific technological projects.

The experts from knowledge centers consider the model would be a reality in the case of those companies that have identified in the industrial network of the county a chance of improving the micro economic situation, though technological optimization projects. However, they think this reality will spread to the county when the results of the working projects would be achieved. The results will be translated into new processes opportunities, new markets or new products for existing markets. Nevertheless, they consider just coopetitive projects and coopetitive stakeholders would be keeping a ROSIS way of interacting with the rest of the players inside and outside the county.

Business associations consider that the stakeholders mentioned in the ROSIS subsystems are located inside the county. They consider that in most cases, it is just necessary to emphasize the relationships between those stakeholders, highlighting the achieved results for the productive firms, attending to common indicators of performance.

Finally, the facilitators try to promote a cooperative culture in the territory, through the identification of technological projects where common developments between several firms can be translated into products, processes or markets advantages. Nevertheless, they confirm the players considered in the ROSIS subtype, would be included in the county. They underline the importance of having in the county an advanced knowledge research center, focused on the technological needs of the firms and the tacit knowledge of the county. They also emphasize the role of the vocational training centers and the manufacturing firms. In the end, AZTERLAN research center was born from the relationships between firms and vocational training centers. Thus, somehow confirm the opinion of public stakeholders, who consider that new players should not be needed in the county, but new relationships should be established with external players, such as university, new research centers, new countries, markets, etc.

External researchers and policy-makers to the territory

Academic experts consider the model is not valid due to the lack of public policy-makers adopting industrial policies specifically for the county.

However, they consider that there are several stakeholders with technical skills who could sustain a sectorial system. They consider the sector should be underlined, not as the customer market for which products or processes are manufactured, but from the technical skills needed in those markets. Therefore they agree in the consideration of metal mechanic the sector of the county,

11 DFB corresponds to the Provincial Council of Bizkaia and CAPV to the Basque. The acronym C.FP is a shortened way of referring to vocational training centers. MICINN is the current Spanish Ministry of Economy and Competitiveness of Economy and Competitiveness.

instead of automobile, energy or machinery industry. Besides, they consider extremely important the informal relationships having place in the county. They think formal relationships could arise from informal relationships, due to social patterns: school, cultural, sport, etc.

On the other hand, interviews with policy-makers and public stakeholders showed different positions in the validation of the subtype. While researchers thought the model would not be really a system because of the lack of local policies, public stakeholders think an innovation system can arise despite not having an institution with policy capacity in the area, and being policies adopted in a supralocal level. Considering the specificities of the Basque Country in policy making, they point out policies are adopted considering local indicators, and after bottom-up conversations where the vision of the local stakeholders concerns. They admit that the county has the stakeholders the theoretical model considers, but they emphasize in the need of keeping virtual boundaries so as to keep a open relationship not only with the world, but also with geographically close players.
In this way, they appreciate positively the underlying of the "opening" culture of the proposed model. They detail that openness could become through relational variety: commercial, technological, sectorial, and geographical related variety. They focus on the need to procedure in the establishment of those inner and extra opening mechanisms.
Finally, for them, it is necessary to strengthen trust relationships, while they highlight the important work of trust builders, with the manufacturing network, through a common identity and cultural patterns.

Conclusions and future lines

This paper contributes to the literature about innovation territorial models with a conceptual framework that joints the characteristics of a located territory in a small geographical area and strong sectoral specialization, a gap in the literature.
In this case, the article presents a model of regional open sectoral innovation system (ROSIS), which has been tested in the Durango County, located in the Basque Country (Spain). One of the conclusions that can be obtained from this research is that a model of territorial innovation cannot be forced exclusively from public administrations; it should be promoted in direct cooperation with productive and knowledge subsystems. However, the promoted model might be directly linked to the culture and the social values of the territory, considering the activities performed by the private sector. That is why industrial specificity and homogeneity should be taken into account when designing a territorial development process. In the same way, it should not be expected the same answer in those firms consuming intensive knowledge, or those performing manufacturing services. Therefore, it is essential, first, to understand the productive network to work with. Consequently, the trust builders for those firms should be identified in order to plan jointly activities so as to stimulate the network and bring up challenges to optimize individual and common competitiveness.

It is important to note that lowering down in the territorial scale, would require a more open minded attitude towards external stakeholders, in order to cooperate with need players to promote collaborative working and innovative projects. This fact can be observed also in the public administration. Even though a territory has not a public institution with policy making legitimacy, a multilevel system could be designed in order to cooperate with supraentities that count on those policy makers.
This research has a strong qualitative character, since the main contribution is theoretical and the followed methodology is based primarily on the use of interviews with key stakeholders inside and outside the territory. The research, therefore, does not include how the model arises. For this reason, the research does not explain the temporal evolution of a given system. A future research line would have to analyze how these models evolve depending on the behavior of the stakeholders located in the system and their historical relationships. On the other hand, it should be noted that the validation of the theoretical framework ROSIS proposed, has only be compared with the micro-region of the Durango County, making necessary to compare it with other territories with similar characteristics.

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