PAPER

(Preliminar Research)

Title: Analysis of the impact of the 2007-2013 Technology Fund and the 2014-2020 Smart Growth Programme on the innovation indicators of companies in Andalusia

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Abstract:

As a Convergence Objective Autonomous Community of the European Union, Andalusia was a beneficiary of the significant volume of European resources for regional innovation mobilized by the 2007-2013 Technology Fund and the 2014-2020 Smart Growth programme. For this reason, we evaluate the impact of these technology policies in Andalusia through the main business innovation indicators, differentiating companies´ size, participation in innovation and rol. The proposed analysis (through the study of projects, funds received, etc.) seeks to identify the impact of participation in this programme for Andalusian companies according to their characteristics based on the impact on the main business innovation indicators available (investment and expenditure on research and development). This impact is uneven depending on the characteristics of the companies.

Key Words: Innovation and companies´ size, innovation policies impact evaluation, business innovation in LE and SMEs, Technology Fund, regional development

JEL Classificarion: O38, R58, D21

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1- INTRODUCTION

The financial crisis suffered from 2008 onwards forced many Andalusian companies to close down, to close their financial years with losses or to reduce their investments. Within the group of companies, small and medium-sized enterprises are usually the most vulnerable. In this context, the austerity policies implemented together with the cut in bank financing partially restricted the possibility for the private business sector to carry out counter-cyclical measures with a view to the future through innovation (Sande, 2020).

Andalusia, like the rest of the Autonomous Communities with the Convergence Objective, was affected during the 2007-2013 programming period by a reduction in the Structural Funds (FFEE), resources necessary to try to combat the differences in development between the most and least advanced territories on the continent. Despite the progressive cuts in the ESF, Spain launched the so-called Technology Fund (TF), a business innovation policy aimed mainly at the Convergence Objective territories. Subsequently, in order to give continuity to the previous initiative, the so-called Smart Growth Operational Programme (Programa Operativo de Crecimiento Inteligente, PCI) was launched in the 2014-2020 period.

Precisely, and given the lack of strength of the industrial sector in peripheral territories, this paper aims to analyse the extent to which the planning, design and implementation of business R&D&I programmes financed by the FT and the PCI had a positive impact on the innovation indicators of Andalusian companies, depending on their characteristics. Specifically, as a fundamental part of the innovation policies implemented in the territory, the ERDF-Innterconecta programme has been selected for this study, the most important line of aid from the FT of the CIP specifically aimed at business projects in which support for innovative SMEs was included as a key objective.

While the body of literature on the impact of business innovation at the regional level in Spanish regions has started to grow in recent years (Segarra-Blasco, 2018; Sande & Vence, 2021; 2019; Sande, 2022a), the need to promote more research on the impact of the Structural Funds for business innovation in Andalusia has led to this original and

novel study that addresses the microeconomic impact of a European business innovation programme on companies in the Autonomous Community, using a systemic perspective and differentiating its results according to company characteristics such as size or their role in the projects. The results obtained will make it possible to discern the differences between some companies and others and to model policies that are better adapted to the needs of the business fabric (target policies).

From here, the article follows the following structure: the second section reviews the literature on the importance of innovation policies at regional level, also analysing the role of the TF and the CIP; the third section describes and justifies the SMP methodology used for the analysis carried out; the fourth section assesses the impact of the ERDF-Innterconecta TF and CIP programme on the main indicators of business innovation in Andalusia, differentiating companies according to the characteristics described; finally, the last section draws conclusions and recommendations for policies derived from the results observed.

2- EUROPEAN REGIONAL INNOVATION POLICIES IN COMPANIES IN PERIPHERAL TERRITORIES: THE ROLE OF THE FT AND THE PCI IN THE FEDER-INNTERCONECTA CALLS FOR PROPOSALS IN ANDALUSIA

As interest in the design, planning and implementation of R&D&I policies has increased, the European Commission, the Central Government and the Autonomous Community have been designing different policies aimed at promoting business R&D&I in recent years.

Innovation, a key factor for economic growth and increased competition, depends to a large extent on the local capacity to generate an appropriate ecosystem for innovation (Boyer, Ozor & Rondé, 2021). From a systemic conception of innovation, growth is not possible without a system that favours interactions between agents, linking technology to companies and institutions (Beaudry et al., 2021; Ke Rong et al. 2020; Figueredo Rocha et al., 2019; Vaz, De Noronha, Galindo & Nijkamp, 2014). As companies are a crucial element in innovation systems, it is necessary to evaluate what has happened in Andalusia's business fabric, bearing in mind that SMEs account for the vast majority of the private entities that make up its productive fabric.

2.1. The importance of European regional innovation policies for enterprises according to their size

The accumulation of experience and collaboration between different agents is a key factor in improving the technological capabilities of the business fabric (Gasgupta, Gupta & Sahay, 2011; Prajogo & Ahmed, 2006; Ahn, Minshall & Mortara, 2015). Not surprisingly, broader approaches such as clustering place a positive value on the processes of business rivalry, collective learning, collaboration and interaction between firms (Freeman, 1991; Singh, Chhetri & Padhye, 2022; Porac, Thomas, Wilson, Paton, & Kanfer, 1995; Benito, Berger, De la Forest & Shum, 2003), as well as analysing the role of large firms in shaping cooperative networks.

Notwithstanding the above, some authors (Cooke, 2009; Vence 1998) defend the need for R&D&I policies to promote the decentralisation of innovative activities in order to avoid an excessive concentration of activity and resources in these large companies. In this context, and for the case of Andalusia, we will focus on several key aspects from the point of view of business innovation in peripheral regions: a) The impact of European policies and the size of firms; b) The desirability of attracting innovative GE and multinationals; and c) The importance of direct subsidies to SMEs.

2.1.1. The impact of European regional innovation policies and the size of firms

The study of the impact of European innovation policies has been analysed over the last few years from different perspectives. While some studies (Becker, Egger & Von Ehrlich, 2013; Mohl, 2016; Gagliardi & Percoco, 2017; Ferrara, McCann, Pellegrini, Stelder & Terribile, 2016) find a positive effect of cohesion policy on growth or regional convergence, others (Mirwaldt, McMaster & Bachtler, 2009; Sande, 2022a) find it difficult to give a result when the allocation of funds occurs, and others (Molle, 2007; Bachtrögler, 2016; Pîrvu, Bădîrcea, Manta & Lupăncescu, 2018; Di Caro & Fratesi, 2022) claim negative effects in some circumstances and dispute the effectiveness of cohesion policy. In any case, it is worth noting the difficulty of measuring the effects of structural policies in times of economic crisis or recession (Sande, 2020; Camagni & Capello, 2017).

Using the PSM statistical technique, recent studies have found different effects of the FFEE. Thus, while some studies have found moderately positive effects of funds on indicators of innovation (Sande & Vence, 2021), employment and value added (Bachtrögler, Fratesi, & Perucca; 2019; Bernini & Pellegrini, 2014; Bondonio & Greenbaum, 2006 and 2014), or firm income (Maroshegyi & Nagy, 2010; Hartsenko and Sauga, 2012), other research has not found such a relationship (Fattorini, Ghodsi & Rungi, 2019), or has only found it in some of the territories analysed (Bachtrögler & Hammer, 2018), as the effects detected would not be uniform in all European regions, depending on the dynamicity of their entrepreneurial ecosystems (OECD, 2017).

The existing literature on the different effects of European resources on regional innovation depending on firm size is not very abundant. Despite this, there are some studies in recent years focusing on the differences produced between firms according to their size in other territories (Santamaría & Nieto, 2009; Silva & Carrizo, 2018; Blaschke, Demel & Kotorov, 2021; Sande, 2022b).

2.1.2. The desirability of attracting large innovative companies and multinationals to peripheral regions such as Andalusia

Generally speaking, financial support for R&D maximises benefits by reducing production costs and risks, which stimulates business participation in innovative activities. But for Rabellotti (2017), innovation policies should be aimed at trying to attract not large firms, but their innovative functions, by improving the socio-institutional system of regions to innovate. Thus, a desirable condition for multinational firms to decentralise their R&D activities and locate in a given region is that they have more attractive policy packages of direct funding (Rodriguez-Pose & Wilkie, 2016). However, according to other studies (Mattes, 2013) this would be a necessary but not sufficient condition. Other conditions from the supply side would influence such a decision, such as the productive capacity of HR specialised in R&D (Crescenzi, Pietrobelli, & Rabellotti, 2014; OECD, 2011a; 2011b;), or from the demand side the size of the market (Shimizutani & Todo, 2008).

In this context, SGs are an important source of knowledge generation and knowledge spillover effects. Moreover, recent research (Sande, 2022b; Benkovskis, Tkacevs & Yashiro, 2019) shows evidence of positive effects of FFEEs on larger firms and on

firms that were less productive before their participation in innovation policy. However, although authors such as Ferrero & Oddo (2016) defend the advantage of EGs in the creation of new products and processes, the truth is that the same study already recognises that SMEs have a greater advantage in terms of R&D effort in high-tech industrial sectors.

2.1.3. The importance of direct subsidies to SMEs

Although the conditions of regional innovation systems are relevant (Radziwon, Bogers & Bilberg, 2017; Herliana, 2015), and given that business innovation does not depend solely on these characteristics, authors such as Grillitsch & Nilsson (2015) include in recent studies other relevant factors such as the capabilities of the firms themselves or their access to external knowledge, giving less importance to aspects such as the size of the firms. Despite the difficulties, however, SMEs continue to be one of the most important endogenous factors in creating the conditions for structural change (Lewandowska, Stopa, & Humenny, 2014) in peripheral territories, so it would be useful to demonstrate the impact of policies on this type of firm (Lewandowska & Stopa, 2019).

However, the impact of R&D&I support for SMEs has also been controversial. Thus, some studies show positive effects of policies on SME innovation (Marseguerra, Bragoli, & Cortelezzi, 2016; Hvolkova, Klement, Klementova, & Kovalova, 2019; Soltanzadeh, Elyasi, Ghaderifar, Rezaei-Soufi, & Khoshsirat, 2019), including on aspects such as the number of employees or firms in innovation (Henriques, Viseu, Neves, Amaro, Gouveia, & Trigo, 2022), and sometimes on more financial than innovative outcomes (Zampa & Bojnec, 2017).

2.2. The role of the Technology Fund, the Smart Growth programme and the ERDF-Innterconecta calls for proposals in business innovation

The EU Strategy designed in Lisbon in 2000 had set the objective that its members should reach an investment in R&D of 3% of GDP, for which two other objectives were introduced through the 2005 Strategy: a) The development of research, education and innovation, and b) The promotion of innovation policy. In line with the new objectives, for the 2007-2013 multiannual programming period, the European Council approved an additional allocation of ERDF resources earmarked for a Fund for the development of

business R&D&I in the Convergence Objective regions, known as the TF, which was applied to Spain. In order to give continuity to the support for business innovation, in the 2014-2020 period Spain approved the Smart Growth Programme.

2.2.1. The Technology Fund and the Smart Growth Operational Programme

The European Council approved the birth of the TF as a programme dedicated to the promotion of business R&D&I (Ministry of Economy and Finance, 2007) and the strengthening of the Science-Technology-Enterprises System in Spain (Ministerio de Economía y Hacienda, 2007). This TF had a continuity framework for business innovation after the approval of the IGP (Ministry of Finance and Public Administrations, 2014). Table 1 below shows the main descriptive data on this funding, including territorial allocation, objectives and eligible actions.

Table 1: Descriptive data on the Technology Fund and the Smart Growth Programme

	TECHNOLÓGY FUND	INTELLIGENT GROWTH
Assignment to Spain	2.248,45 M€	3.939,18 M€
Assignment to Andalusia	976,80 M€	1.612 M€*
Territorial distribution Funds	-70% for Obj. Convergence regions (Andalucía, Galicia, Extremadura and Castilla La Mancha) -15% for Phasing-in regions (growth effect) -10% for Competitiveness Objective regions -5% for Phasing-out regions (statistical effect)	-Plurirregional
Objectives	-To articulate and integrate the Spanish R&D&I system with the regional innovation systems -Promote business innovation, especially in SMEs in Convergence Objective regions -To support the transfer of research results to companies -Widen the base of the S-C-T-E by attracting SMEs to R&D&I -Promote gender equality in R&D&I	-Promoting R&D and innovation -Improving the use, quality and access to Information and Communication Technologies (ICT). -Improve the communication and competitiveness of SMEs.
Subsided actions	-To vertebrate the innovation system, incorporating SMEs into innovative activity. -To create and consolidate Technology and Research Centres oriented towards relations with companies. -Promote the transfer of research from PRIs to companies. -Attract SMEs and other agents to innovation and research activity.	-Capacity building for the development of R&D&I activities supported by competitive scientific infrastructures at European and international level. -Stimulating and fostering capacities for the implementation of business R&D&I projects. -Promoting the incorporation of researchers and R&D&I personnel and fostering mobility between public sector personnel and the business fabric, as well as the creation of high added value employment.

Source: Own elaboration

*Note: Total forecast expenditure (Boscá, Escribá, Feri & Murgui, 2016)

2.2.2. The ERDF-Innterconecta programme

The ERDF-Innterconecta call was created as a line of aid in competitive concurrence for integrated strategic projects of experimental development and industrial research, with a

large dimension and which develop novel technologies in areas with international economic projection (CDTI, 2013). The basic data of the programme are included (table 2).

Table 2: ERDF-Innterconecta Programme descriptive data

	TECHNOLÓGY FUND	INTELLIGENT GROWTH
Assignment to Spain	262 M€	210 M€
Territorial distribution Funds	-Andalusia 150 M€ -Andalucía: 105 M€ -Extremadura: 7 M€ -Castilla La Mancha: Don´t participate	-Plurirregional
Subsided areas	-All, as long as they stimulate employment and increase added value (Ministry of Economy and Competitiveness, 2013)	Health, demographic change and well-being, food safety and quality; safe, efficient and clean energy, smart, sustainable and integrated transport; action on climate change; social change and innovations, digital economy and society; security, safety and defence
Dimension and Amounts subsidised in the projects (Andalusia)	Up to 5 M€	Between 1-4 M€
Project requirements	Formation of an Economic Interest Grouping (EIG) or Consortium	
`royects duration	Two- and three-year projects (Ministry of Science and Innovation, 2012).	
Objectives	Support for large R&D projects Increasing business R&D expenditure Use of existing infrastructures Mobilisation of SMEs Greater involvement of stakeholders and promotion of innovative culture Internationalisation of innovation Experimental development and cooperation between companies	

Source: Own elaboration

3- METHODOLOGY AND DATA USED FOR THE STUDY

The present work has an empirical character as it takes as its starting point the cross-referencing of quantitative data obtained from a multiplicity of sources: R&D statistics that contextualise the situation in the territory obtained from official bodies such as the Spanish Statistics Institute (INE), Eurostat, the Andalusian Regional Government's Department of Finance, the Spanish Ministry of Finance and the European Administration; data on participating companies provided by the Centre for Technological and Industrial Development (CDTI) and constructed with information obtained during the research process; and, finally, data provided by the ARDÁN business information service of the Vigo Free Trade Zone Consortium on economic and financial performance indicators of the companies participating in Innterconecta. The analysis of data interrelation in the period under study, the qualitative analysis, the work of obtaining and interpreting quantitative data from Large Enterprises (GE) and SMEs,

the statistical analysis using the Propensity Score Matching (PSM) technique and the synthesis efforts will serve as a means to achieve the objective of the study.

This research will start with the analysis of the main economic indicators of innovation of a sample of 337 Andalusian companies participating in the calls of the ERDF-Innterconecta programme for Andalusia. For these, we analyse the evolution of the following indicators over the period 2007-2020, compared with a sample from the ARDÁN database of 355 Andalusian companies not participating in the programme: revenue, GVA, employment, economic profitability, profit for the year and investment in research (R) and development (D). For the last two indicators specifically related to innovation, the PSM technique will be applied, which allows estimating the effect of a policy by accounting for and analysing the covariances of the observed values.

4- EVALUATION OF THE IMPACT OF THE ERDF-INNTERCONECTA PROGRAMME OF THE TECHNOLOGY FUND IN ANDALUSIA ACCORDING TO THE CHARACTERISTICS OF COMPANIES

This section breaks down the information into two parts: the first is a general study of the Innterconecta programme data, analysing aspects such as the size and characteristics of the projects approved and the networks formed; the second part analyses in comparative terms the main innovation indicators of the companies participating in the policy evaluated according to their size, participation in innovation and role in the projects.

4.1. General study of data on ERDF-Innterconecta calls for proposals in Andalusia

The most relevant data extracted from the projects approved in the calls of the Innterconecta programme in Andalusia are analysed. A study is made of the project database, structuring the most relevant information on each of them: on the one hand, the type of agents, the amount of the projects and the technological sectors subsidised and, on the other hand, the characterisation of the networks formed.

4.1.1. Size and characteristics of approved projects: type of actors, size of projects and technology sectors supported

While 334 projects were finally approved in the five Innterconecta calls analysed, the total number of projects applied for was approximately double. The average budget of each of the 827 participating companies identified amounted to 639,679.85 €, while

CDTI support covered almost half of this amount on average, with 302,406.91. The total number of directly participating companies was 1,392, while the number of companies applying to participate more than doubled (Figures 1 and 2).

Figure 1: Approved and Requested Projects, Innterconecta-Andalucía

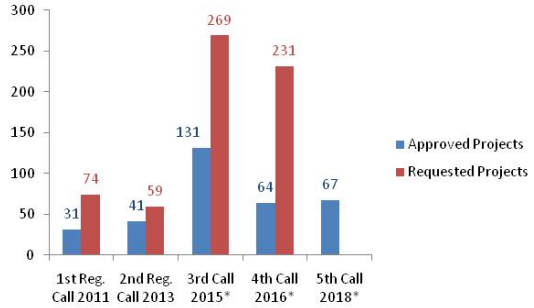
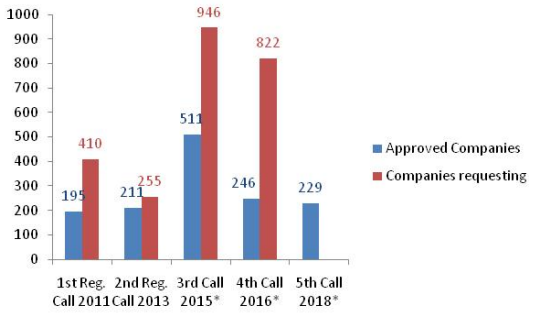


Figure 2: Approved Companies and Companies requesting, Innterconecta-Andalucía



Fuente: Elaboración propia a partir de datos de CDTI
*Note: Plurirregional, data for requested projects not available for 2018

The technological areas to which the 337 companies participating in *Innterconecta* -that made up the sample used for the impact study- were analyzed, and two types of activities are particularly relevant: industrial manufacturing activities (34.12%) and professional, scientific and technical activities (27.60%), which often correspond to consultancy and specialised services. The rest of the *Innterconecta* resources went mainly to the following technological areas: information and communication technologies (9.20%), retail and wholesale trade (8.90%) and construction (8.31%).

4.1.2. Networks conformed

Based on previous data, the average number of participating companies per project was 4.17, also taking into account the participation of research organizations in the consortia. With regard to the classification of companies by size, it was observed that almost three quarters were SMEs (73.30%) and the remaining quarter were large companies (26.70%). The latter had a strong presence as the leading companies in the projects and, therefore, with greater responsibility and a greater amount of resources managed.

The business networks formed in Innterconecta stand out for the intense participation of companies from the ICT and technical and consultancy fields, so that they became a fundamental link in the formation of the Business Groupings or Consortia of the projects. The networks also included companies from the commerce and hotel and

catering, construction, fishing and wood sectors, coinciding in part with the productive specialisation in Andalusia.

4.2. Comparative evolution of the R&D&I indicators of the companies participating in Innterconecta in Andalusia

Given the significant volume of funds mobilised by the Innterconecta initiative in Andalusia, the expected results of this policy on business R&D&I should be remarkable. In order to approximate the impact of Innterconecta on companies, an attempt has been made to study the behaviour of the main R&D&I indicators of companies, depending on their characteristics, once the policy has been applied. It should be noted that the results observed do not remain unaffected by other factors such as the financial crisis suffered after 2007-2008 (Great Recession), the application of other public policies, regulatory changes in company accounting, or the different management of each company.

4.2.1. General data on the evolution of indicators

This research initially analyses the evolution of the main economic indicators of the innovative activity of companies during the period 2007-2020: revenue, GVA, employment, economic profitability, profit for the year and investment in research (R) and development (R & D). The data used are based on company accounting information collected from the database held by ARDÁN. An additional difficulty in this study was the coincidence in time with the deep economic crisis that began in 2008, which has resulted in greater difficulty in identifying the sensitivity of company variables to innovation policy in the face of a break in their regularity.

Initially, an identification of the participating entities was carried out, and it was possible to differentiate 827 companies. Of these companies, information was available for 337 of them. The general data for this part of the study is extracted from these. Those companies that had more than 250 employees in 2007 were taken as GE. These companies received annual aid between 2012-2020, so if there is an impact, the indicators should show changes in these and subsequent years.

The variation in the values broken down for Andalusian companies was analysed using a control sample of 355 companies in the Autonomous Community that have not

participated in the policy. What was observed were very small differences in behaviour between the entities participating in the policy and those that have not, depending on the size of the companies. The breakdown at territorial level and by calls did not provide additional relevant information, which is why all the calls are analysed together.

4.2.2. Comparative development of indicators according to company characteristics

In order to carry out the analysis of the comparative evolution of the indicators of GE and SMEs participating in this programme, data from 337 entities have been taken, of which 247 are SMEs (72.29%) and 90 GE (26.71%). For the purposes of enriching the data analysis, other differentiations have also been considered to compare the results between leading companies (63, 18.69%) and partners (274, 81.31%) of the projects and the companies that did not innovate in 2007 (327, 93.03%) and those that did (10, 2.97%), also considering the control sample (355 companies) as a reference. Table 1 shows the descriptive statistics with the variation produced in each of the variables by size and role of the participating companies.

GE and SMEs participating in the first two calls of the Innterconecta programme show better performance in four of the previously selected variables (revenue, GVA, number of employees and investment in development, plus investment in research in the case of the former and productivity and annual results in the case of the smaller firms in the latter). Lead and partner companies would show positive values in the comparison with the control sample for four of the indicators (revenue, GVA, and R&D investment, plus number of employees and productivity in the case of partners). In a similar vein, companies that did not innovate in 2007 (R&D expenditure=0) show positive evolution for five indicators (revenue, GVA, number of employees and investment in R&D), while for those that already innovated, only three indicators show a better result (revenue and investment in R&D). A summary of the information is shown below (table 2).

In an approximation to the first group of variables, and if we focus on what has happened since the Innterconecta programme was launched in 2011-2012, we can see that all groups of companies show a favourable evolution for several of the proposed indicators, with the exception of productivity. In view of the evolution data, it would be companies with fewer than 50 employees, project partners and those that did not

innovate previously that would show the greatest relative improvements in these indicators, with the exception of investment in research for the former. Medium-sized companies (between 50-250 employees), project leaders and which were already innovating prior to the existence of this policy, are those which a priori could be absorbing to a lesser extent the results of the financial efforts made for most of the indicators.

Table 1: Aggregate change in the main indicators of the companies participating in Innterconecta by size and role, 2007-2020

Size and rol	Numberº Companies	Income (€)	GVA (€)	Employees	Profitability (%)	Year Result (€)	R Inv (€)	D Inv (€)
LE>250 employees	90	3,230,866,799	5,085,114,943	41,185	-2,73%	-1,094,366,101	10,579,619.8	58,145,451
SME<250>50 employees	89	1,034,908,517	430,749,246	5,871	0,26%	-19,112,103	-258,750.2	29,366,413.9
SME>50 employees	158	577,617,647	101,599,749	1,438	1,40%	9,948,966	-96.73	24,929,372.4
R&D Exp.=0 (2007)	327	4,931,110,470	5,630,448,241	47,744	0,04%	-1,089,426,090	9,093,624.08	114,822,195
R&D Exp.>0 (2007)	10	142,436,792	21,135,802	487	-2,34%	-14,604,928	4,553,850.88	3,327,502.19
Leaders	63	1,350,730,030	2,657,887,517	-565	-4,15%	-702,786,076	7,098,678.47	54,655,055.3
Partners	274	3,677,416,642	2,980,849,421	48,984	1,22%	-325,585,468	6,549,081.37	58,657,908.4
Companies Andalucía	355	260,240,502	1,552,694,833	21,861	0,62%	-340,179,638	7,450,036.81	-171,630,638

Source: Own elaboration based on ARDÁN and CDTI data

Table 2: Relative impact of participation in Innterconecta by size and role

Size and rol	Income (€)	GVA (€)	Employees	Profitability (%)	Year Result (€)	R Inv (€)	D Inv (€)
LE>250 employees	+	+	+	**-**	-	+	+
SME<250>50 employees	+	+	+	**-**	**-**	**-**	+
SME>50 employees	+	+	+	+	+	**-**	+
R&D Exp.=0 (2007)	+	+	+	**-**	**-**	+	+
R&D Exp.>0 (2007)	+	-	-	**-**	**-**	+	+
Leaders	+	+	**-**	**-**	**-**	+	+
Partners	+	+	+	+	**=**	+	+
Empresas Andalucía	+	+	+	+	-	+	-

Source: Own elaboration based on ARDÁN and CDTI data
* Note: = is considered for percentage changes < 5%

Nevertheless, the overall results are rather discrete. In order to appreciate more accurately what has happened with the implementation of the Innterconecta programme, the behaviour of the following specific innovation performance variables for the groups identified will be shown graphically below: investment in research and investment in development. The form chosen for the presentation of the data is base 100, as this allows the differences in behaviour to be identified more clearly. Due to the reduced

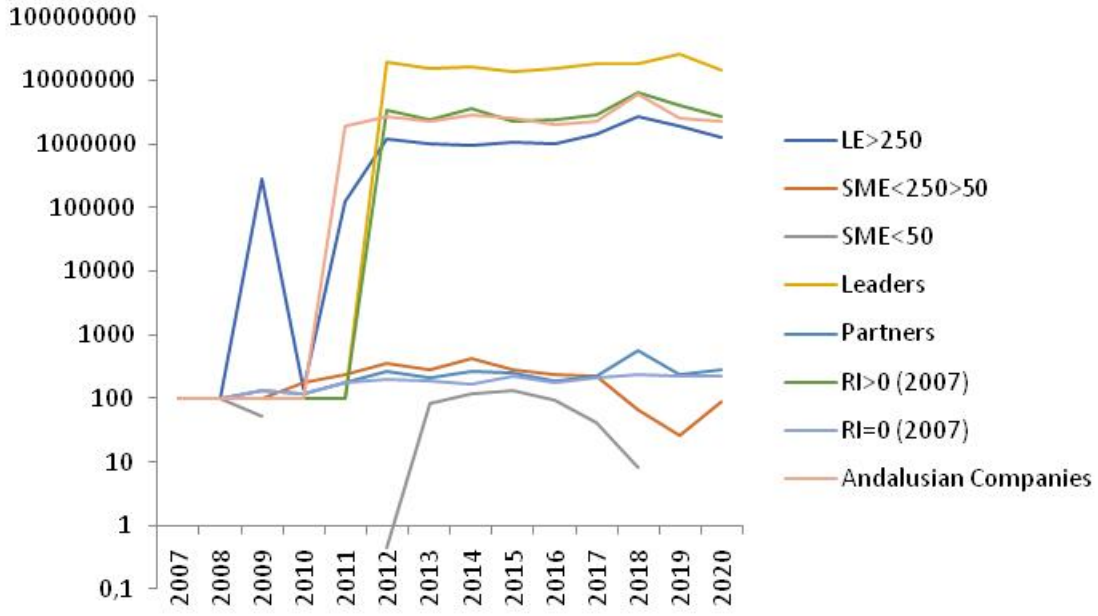
figures that the companies presented for these indicators at the beginning of the period considered, it was considered convenient to represent these figures using a logarithmic scale in base 10. In order to calculate the values initially in base 100, in the specific cases in which the initial data for 2007 is zero, the first positive value of the series was taken. At this point it should be remembered that, by definition, the logarithmic base does not allow negative values or values that are zero to be represented, which may be reflected in some cases in discontinuities in sections of these lines or in the graphic absence of some value. These values have also been compared with those obtained for the total number of Andalusian companies in the control sample for which information is available.

In general terms, the data for the two selected variables show a not very favourable behaviour over the period as a whole for the companies participating in the policy. In a first approximation, it can be observed that the behaviour is different per indicator. Thus, while the companies participating in Innterconecta surprisingly show a worse evolution of investment in research than the Andalusian companies in the control sample, the exact opposite is true with respect to investment in development. In the latter case, the positive performance of SMEs with fewer than 50 employees is noteworthy. However, this result should be interpreted bearing in mind that the starting values of these companies were small, so that improvements which do not necessarily have to be so significant in absolute terms can be shown to be outstanding in relative terms. Nor are the results very significant if we look at what happened with the leading and partner companies. In general, a very slight improvement can be observed in these companies compared to the control sample, with the exception of the partner companies for the first indicator. Focusing on the results obtained for companies that were already innovating (R&D expenditure>0 in 2007) and new innovators (R&D expenditure=0 in 2007), it can again be seen that the results are not very positive. While the companies that were already innovating take advantage of the funding to continue to perform better than the control sample, the companies that were not innovating in 2007 do not show a positive evolution in the first indicator and hardly any in the case of the second.

- Impact on research investment by type of firm

At the beginning of the period, it should be noted that almost no company was activating amounts for this concept, which is why very high values were obtained in some cases. The result in the last financial year continues to improve, although it manages to reach €47m in the group of companies studied. The GE (+12,397.77%), leading companies (+142,716.69%) and those that did not innovate in 2007 (RI=0) showed the greatest growth in the period (+22,265.17%), compared to the control sample (+16.66%). Partner companies (+185.54%) and those that were already innovating in 2007 (RI>0) also had a very positive performance (+129.02%). The results are negative in the case of medium-sized (-10.48%) and small (-26.24%) SME enterprises (figure 3).

Figure 3: Comparative evolution of research investment of companies participating in Innterconecta-Andalucía 2007-2014, by size and company role (index 2007=100, log10(x))



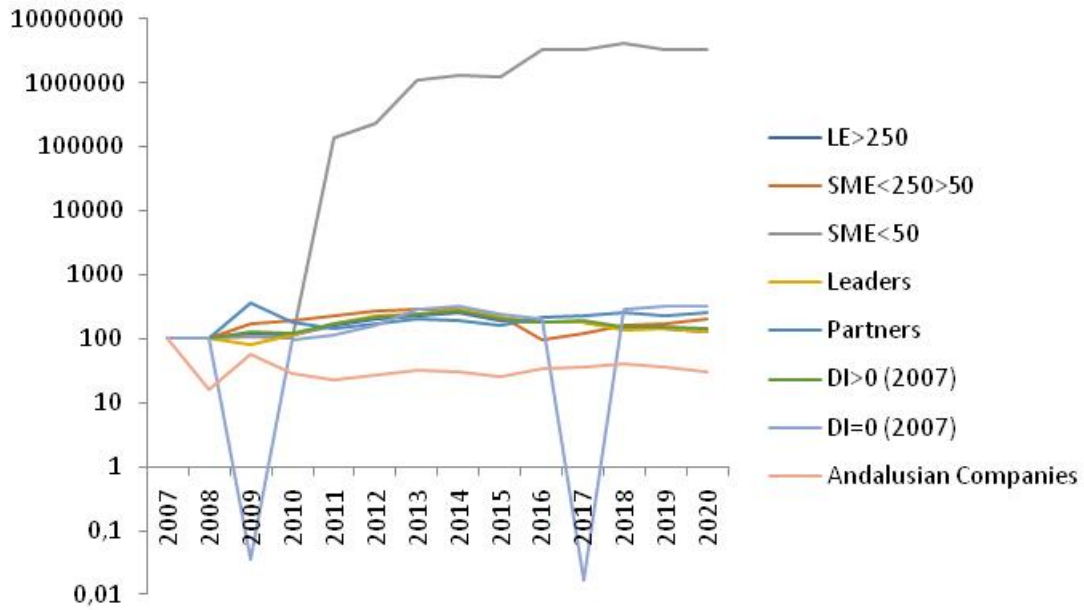
Source: Own elaboration based on data from Ardán and CDTI

- Impact on development investment by type of company

In 2007, the companies participating in the policy analysed activated 747.24 million euros in development investments, reaching 1,091.14 million euros in 2020. Starting from very small values, smaller companies would show the greatest relative growth in this indicator (+33,683.42%), followed by medium-sized companies (+100.82%) and large companies (+26.44%). Partner companies also increased their investments to a greater extent (+150.62%) than the leaders (26.01%). With regard to the evolution of

the companies according to their participation in innovation, it is those that were already innovating in 2007 (DI>0) that experienced the greatest increase in the period analysed (+220.43%), with the evolution also being positive (+46.38%) for companies that were not innovating in that initial year (DI). Only companies that were previously innovative at the beginning of the period (+17.32%), SMEs with revenues of less than €5m (-100%) and the group of companies with revenues of more than €5m (-52.11%) obtained worse results in the period than the control sample (+39.22%). On the other hand, the set of SMEs with revenues below €50m show a better relative performance (+282.27%), also the EGs (+74.77%), similarly to the non-innovative companies (+115.62%) and the partner companies (+85.46%). The data analysis (figure 4) shows a significantly different behaviour from the previous case, since in this case it is not the SGs and the already innovative companies that benefit the most, but there is not such a clear difference between leading and partner companies.

Figure 4: Comparative evolution of investment in development of companies participating in Innterconecta-Andalucía 2007-2014, by size and business role (index 2007=100, log10(x))



Source: Own elaboration based on data from Ardán and CDTI

5- POLICY CONCLUSIONS AND RECOMMENDATIONS

Evaluating innovation policies is a complex task not without its difficulties, which may include choosing the appropriate methodology for measuring the effects of such a policy on the business fabric or the causal attribution of the impact of the policy. Moreover, there are some limitations to this type of work, such as the diverse causal

origin of the results observed, which could be interpreted as certain indeterminacy in the analysis of the policies. In sum, caution should be applied when extrapolating these results from a study aimed at a specific territory to cases other than the one proposed. In view of the above, and for the purpose of clearly stating the conclusions of the study, we will differentiate in these conclusions between practical implications and policy implications.

5.1 Practical implications

The average total number of participating SMEs per project in the programme analysed was low, calling into question the mobilisation of this type of agents, which have remained subordinated to the interests of the GE and leading companies in the projects. The average size of the projects approved in Innterconecta (approximately €4-5 M) has not achieved a clear attraction of multinationals and innovative LE to the Andalusian Innovation System, nor have smaller companies been able to achieve demonstrable success in terms of results in their innovation indicators.

Specifically, with regard to the impact on the main innovation indicators for the companies participating in Innterconecta, the graphical analysis shows some differences between what happened with larger and smaller companies. Indeed, it would be large companies (>250 employees) that would show this impact on the two indicators analysed, while for smaller companies this improvement would only occur in terms of investment in development, with a particular impact on smaller companies (<50 employees). For leading and partner companies, the results were similarly positive for both indicators, especially for the leaders in the case of investment in research, and with more approximate results for investment in development (although favourable in this case for partner companies). As in the previous case, this is the case for companies that did not innovate in 2007 and those that did. In this sense, large companies, project leaders and those that had already innovated previously presented a continuous line of positive results, which was not the case for smaller companies.

5.2 Policy implications

A programme such as Innterconecta, which had been endowed with almost 500 million euros to support business innovation, was able to generate high expectations regarding

the improvement of the Andalusian Innovation System. However, the implementation of this programme through the TF and the CIP produced less relevant results with respect to the formulated objectives. In view of the indicators analysed, it is difficult to affirm, for example, that the participation of SMEs, which were the specific objective of the programme analysed, was a success. The positive aspect was the large number of SMEs taking part, although this could be increased by targeting smaller projects, as was planned in other Autonomous Communities such as Galicia. On the negative side, a key indicator such as investment in research does not show a significant impact for any of the groups of companies analysed.

In view of the above results, it can be stated that the objectives of the policy have not been fully met. In this respect, the size of the projects supported and the role of these companies in the partnerships could be improved. However, these companies could have taken advantage of their participation in the projects in other key areas, such as improvements in the cost of personnel or the number of employees working on innovation, or other areas. This being the case, it would be worth rethinking the size and leadership of the projects financed, focusing on smaller projects led by Andalusian companies in strategic economic sectors with the capacity to generate greater added value.

Finally, for the future it would be advisable to have more precise indicators in innovation programmes and calls for proposals, so that the impact of these policies on the business fabric can be analysed, even at sectoral level, in order to be able to assess the effects of the implementation of funds in different dimensions.

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