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Rethinking Andalusian RIS3 Strategy Design through Regional Benchmarking

Francisco Yépez Muñoz, Luis Palma Martos**, Noemí Pulido Pavón****

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Abstract:

Research and innovation strategies for smart specialisation (RIS3) has played a key role in the European Union regional policy in the 2014-2020 programing period.
Regional benchmarking exercises are encouraged by the European Commission to provide a better vision of the position of the region and detect its strengths and weaknesses.
In our work we intend to reinforce the SWOT analysis included in the RIS3 strategy of Andalusia 2014-2020 using the benchmarking methodology proposed by the European Commission. This exercise allows us to outline new proposals for action and a cualitative methodology that could be useful in the design of RIS3 strategies in the period 2021-2027.

Keywords: European Union regional policy; smart specialisation; regional research and innovation strategies for smart specialisation (RIS3); SWOT Analysis.
JEL classification: R10; O18; O21; O38; R58.

Análisis del Diseño de la Estrategia RIS3 de Andalucía a través del Benchmarking Regional

Resumen:

Las estrategias de investigación e innovación para la especialización inteligente (RIS3) han jugado un papel clave en la política regional de la Unión Europea en el período de programación 2014-2020.
La Comisión Europea fomenta los análisis regionales comparativos para proporcionar una mejor visión de la posición de las regiones europeas y detectar sus fortalezas y debilidades.
En nuestro trabajo pretendemos reforzar el análisis DAFO incluido en la estrategia RIS3 de Andalucía 2014-2020 utilizando la metodología propuesta por la Comisión Europea. Este ejercicio nos permite esbozar nuevas propuestas de actuación y una metodología cualitativa que puede ser útil en el diseño de las estrategias RIS3 del período 2021-2027.

Palabras clave: Política regional de la Unión Europea; especialización inteligente; estrategias de investigación e innovación para la especialización inteligente (RIS3); análisis DAFO.
Clasificación JEL: R10; O18; O21; O38; R58.

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1. INTRODUCTION

1.1. RIS3 STRATEGIES 2014-2020, PRIORITIES OF SPECIALISATION AND BENCHMARKING

Research and Innovation Strategies for Smart Specialisation (RIS3), promoted by the European Commission in the 2014-2020 programming period, try to boost the contribution of the Europan Union (EU) regional policy to the priority of smart growth established in the Europe 2020 strategy, through the improvement of the performance of regional innovation systems (European Commission, 2010, 2011).

The importance of RIS3 strategies in the EU programming period 2014-2020 is highlighted by the fact that Regulation (EU) 1303/2013, laying down common provisions concerning the ESIF funds (European Parliament and Council of the European Union, 2013), established the design of these strategies as a condition required prior to receiving investments in the field of R&D&i from the EU Regional Development Fund, which is the main investment instrument of EU regional policy.

Smart specialisation strategies are framed within the theoretical framework of innovation systems (Freeman, 1987; Lundvall, 1988, 1992) in which the regional level has been gaining increasing relevance (Cooke, 1992) (Hong, Oxley, McCann, & P., 2012), due to the assumption of increasing powers by regional authorities in innovation policies and the rise of theories of the industrial economy that emphasize the relevance of the regional level, such as industrial districts (Becattini, 1990), clusters (Porter, 1990) and the *New Economic Geography* (Krugman, 1991, 1995; Fujita, Krugman & Venables, 1999). Innovation systems studies focus on relations between public and private agents that perform R&D&i activities in a given country or region, considering these agents as part of a system in whose coordination the public sector plays an essential role. This approach is a natural consequence of the predominant trend in the study of innovation economics since the end of the 20th century, which gives increasing relevance to the historical evolution and the institutional, economic and legal framework in the innovative performance of organizations in a given society (Nelson & Winter, 1977, 1982; Rosenberg, 1976; Dosi, 1982; Pérez, 1983; Freeman & Pérez, 1988; Malerba & Orsenigo, 1990).

One of the key assumptions of smart specialisation is that regions at an intermediate or low level in terms of innovation should focus their efforts on promoting applied technology activities in specific strategic areas, since their possibilities of competing in the development of inventions of technologies of general application are very limited. Therefore, these regions should try to identify those areas in which they have a greater competitive capacity and focus efforts on applied research in these fields (Foray, David, & Hall, 2009; McCann & Ortega-Argilés, 2013a).

It should be noted that the approach proposed is a specialisation in broad strategic priorities, which is not limited to economic sectors in a strict sense, but to areas of specialisation. Therefore, these priorities are open to innovative actors from many different economic sectors and, likewise, it is intended that specialisation in these areas can lead to new specialisations in adjacent areas through the principle of "*related variety*" (Frenken, Van Oort, & Verburg, 2007).

When identifying the most convenient specialisation priorities for a region, a key aspect is to have all the relevant public and private actors of the regional innovation system involved in the identification process, through the so-called "*entrepreneurial process of discovery*" (McCann & Ortega-Argilés, 2013b; European Commission, 2012). Thus, the European Commission recommend the performance of regional benchmarking exercises (Navarro et al., 2014), in order to detect good practices that may be applicable in different regions as well as to analyze the comparative position of the region with respect to others, since competition and the position in the international value chain is a key aspect in the performance of regional innovation systems (Rakhmatullin et al., 2020). Benchmarking analysis, which has its origins in the field of business strategy, is gaining increasingly relevance as a practical tool in the field of regional innovation systems (Huggins, 2010), and have been proven useful to make comparisons of regional innovation systems and public policies applied to them (Groenendijk, 2010).

1.2. Andalusian RIS3 strategy 2014-2020 and regional benchmarking

Andalusia is a peripheral region of the EU located in southern Spain that has almost 8.5 million inhabitants. Its population, together with its 87,597 square kilometers of territory, makes Andalusia one of the largest regions in Europe in population and size, superior in these magnitudes to several EU countries. In 1985, one year before Spain entered the European Economic Community, Andalusia had a GDP per capita equivalent to 52.92% of the average GDP per capita of the Europe of Fifteen. This situation of disadvantage in the economic sphere, together with its large population, has caused that Andalusia has been one of the regions most benefited by the reception of EU funds in the field of EU regional Policy over the last thirty years.

Table 1.
Priorities of specialisation of Andalusian RIS3 Strategy 2014-2020

Priorities of specialisation	Lines of action	Priorities of specialisation	Lines of action
P1. Mobility and logistics	L 1.1. Research and Innovation in integral logistics: Intermodality L 1.2. Innovative business development in international value chains L 1.3. New models of sustainable mobility and distribution L 1.4. Incorporation of logistics not linked to productive activity	P5. Health and social welfare	L 5.1. Development of the biosanitary business sector L 5.2. Creation of applications and technologies for new health and social welfare services L 5.3. Advanced therapies and regenerative medicine L 5.4. Population-based social health research L 5.5. Research and Innovation in healthy life and active aging,
P2. Advanced industry linked to transportation	L 2.1. Advanced manufacturing in the transportation industry L 2.2. Research and Innovation in new materials L 2.3. Development of innovative products for the transport industries L 2.4. Transfer of technology and manufacturing processes	P6. Agribusiness and healthy food	L 6.1. Advances in quality, traceability and food safety L 6.2. Functional and personalized food L 6.3. Take advantage of new opportunities in the blue economy and green economy L 6.4. Innovation in processes and products of the food industries
P3. Territorially based endogenous resources	L 3.1. Research and Innovation on the management of natural resources and cultural heritage L 3.2. New processes and products for the use of agricultural resources L 3.3. Mining Integrated in the territory L 3.4. Innovation for the adaptation of the territories to climate change L 3.5. Optimization of ecosystem services	P7. Renewable energy, energy efficiency and sustainable construction	L 7.1. Development of renewable land and marine energy L 7.2. Smart energy networks L 7.3. High capacity energy storage systems L 7.4. Energy efficiency in companies, homes and institutions L 7.5. Energy sustainability of rural areas L 7.6. New designs and materials for sustainable construction and processes
P4. Tourism, culture and leisure	L 4.1. Research and innovation in innovative tourism products L 4.2. Development of new tourism models L 4.3. Research and innovation on accessibility for tourism L 4.4. Innovation in the cultural and creative industries	P8. ICT and digital economy	L 8.1. New ICT developments L 8.2. ICT for business development L 8.3. Development of new instruments for E-Government L 8.4. Innovation in digital content

Source: Junta de Andalucía (2015, pp. 122-123).

The reform of EU regional policy in the 2014-2020 programming period has had an important impact for the region, mainly in terms of reduction of the allocated financial resources and reorientation of investments. As regards the destination of the investments, in the 2014-2020 period the actions to promote the regional innovation system through the RIS3 strategy of Andalusia have had a very important weight.

Following the steps of the Guide on Research and Innovation Strategies for Smart Specialisation (European Commission, 2012), the actors involved in the design of the Andalusian RIS3 Strategy 2014-2020 (Junta de Andalucía, 2015) proceeded to perform a SWOT analysis of the Andalusian innovation system, and to identify the specialisation priorities most relevant to its development.

Table 1 shows the main priorities of specialisation selected, as well as the lines of action defined to improve the competitiveness of the region in each of them.

Once the priorities of specialisation and lines of action detected in the so-called "*entrepreneurial process of discovery*" (European Commission, 2012) had been selected, Andalusian RIS3 Strategy 2014-2020 defined the axes and political measures through which it was intended to implement the strategy, as we can see in table 2.

The main objective of our work is to rethink the design of the Andalusian RIS3 Strategy 2014-2020 using the Regional Benchmarking Tool promoted by the European Commission (Navarro et al., 2014), with the data that regional authorities had at their disposal in 2015. While the SWOT analysis contained in the Andalusian RIS3 strategy lacked a comparative perspective, the use of this tool allow us to perform a detailed qualitative analysis of the situation of the region in relation to a selection of regions at the time of the design of the srategy, focusing our analysis on structural dimensions considered crucial for innovative performance.

This exercise allows us to enrich the SWOT analysis performed in the Andalusian RIS3 Strategy 2014-2020 and, therefore, analyse the relevance of the priorities of specialisation and axes of action included on it and propose new lines of action and political measures that could have been taken into account. Likewise, we verify that this kind of tools can be useful for the design of the RIS3 strategies in the period 2021-2027, whose preparatory work is starting in 2021 and should be developed based on the improvement of the previous RIS3 strategies.

TABLE 2.
Political axes of Andalusian RIS3 Strategy 2014-2020

Axes	Measures
1. Eficient and Competitive Industry	1.1. Support for business R&D&i projects 1.2. Incorporation of technologists and researchers 1.3. Support for participation in international calls 1.4. Integration of tractor companies 1.5. Support for the incorporation of enabling technologies 1.6. Implementation of ICT in industry
2. Enabling Technologies	2.1. Support for the generation of KET knowledge 2.2. Collaboration boost 2.3. Internationalization of KET knowledge generation 2.4. New ICT developments
3. Innovative and job creating SMEs	3.1. Innovative entrepreneurs 3.2. Protection of Industrial and Intellectual Property 3.3. Integration into global value systems 3.4. Collaborative R&D 3.5. ICT implementation in SMEs

TABLE 2. CONT.
Political axes of Andalusian RIS3 Strategy 2014-2020

Axes	Measures
4. Internationalization	4.1. Immersion in innovative environments 4.2. Internationalization of the generation of knowledge 4.3. Internationalization of companies 4.4. International cooperation projects 4.5. Attracting innovative companies
5. Education, Talent and Creative Environments	5.1. Technology transfer 5.2. Support for excellent research 5.3. Support for the generation of knowledge 5.4. Entrepreneurial culture 5.5. Training for innovation 5.6. Support for creating a creative environment 5.7. Culture of creativity
6. Social Innovation	6.1. E-Administration and E-Government 6.2. Support for knowledge management 6.3. Innovative public procurement 6.4. Promotion of new models of public-private cooperation 6.5. Support for new proposals for social organization 6.6. Pilot projects 6.7. Digital Strategy
7. Networking	7.1. Support for the development of new collaborative approaches 7.2. Deepening participation in networks 7.3. Information and awareness systems for innovation 7.4. Support for the maturation of business projects
8. Infraestructures	8.1. Research Infrastructures 8.2. Innovation spaces 8.3. Communication infrastructures 8.4. ICT infrastructures

Source: Junta de Andalucía (2015, p. 169).

In section 2 of the article we will describe the methodology used in our work. Next, in section 3 we will describe the results of our benchmarking analysis, while in section 4 we explain how these results are policy relevant and directly applicable to the political measures introduced in the Andalusian RIS3 strategy. Finally, we will dedicate section 5 to the general conclusions of our work.

2. METHODOLOGY

The most widespread methodologies at the European level to evaluate the innovative performance of the territories are based on the elaboration of synthetic indexes, built on variables related to innovation. Some of the most prominent examples of these indices are the Global Competitiveness Index (World Economic Forum, 2020), the European Innovation Scoreboard (European Commission, 2020) and the Regional Innovation Scoreboard (European Commission, 2019).

Following a similar approach, the European Commission commissioned a group of researchers to develop a tool to help regional authorities to perform benchmarking exercises, useful in the design and implementation of their respectives RIS3 strategies (Navarro et al., 2014).

This tool allows us to have data from 205 regions of the EU in a wide range of variables, related to seven key dimensions determining the innovative potential of the regions according to the specialised literature: geodemography, educational level of human resources, technological structure, sectoral structure, company size, economic openness and institutions and values.

From these data, Navarro et al. built a distance matrix of 205 European regions in relation to the performance in these seven dimensions. As regards the selection of the regions with which performing benchmarking exercises, the authors propose to make comparisons with regions that have similar structural characteristics, based on the idea that these conditions cannot be changed in the short term and determine the innovative capacity of the regions and the suitability of the policies to be implemented. These authors based their approach to the selection of reference regions in abundant literature of the evolutionary approach, which defends the uselessness of the replication exercises of good practices in regional policy without attending to the peculiar structural characteristics of the regions, determined by their historical evolution (Tomlinson & Lundvall, 2001; Balzat, 2006; Nauwelaers, Veugelers, & Van Looy, 2003).

In our work we perform a comparative SWOT analysis of the Andalusian innovation system in relation to the innovation systems of the ten European regions considered more similar to Andalusia according to the methodology proposed by Navarro et al. (2014). The ten selected regions, ordered from least to greatest similarity with Andalusia, are Murcia, Valencian Community, Catalonia, Canary Islands, Sardinia, Campania, Sicily, Castilla la Mancha, Galicia and Castilla y León.

To implement our analysis, we take the data from the variables used by Navarro et al., which provide us with an idea of the comparative situation of the regions with the most recent data available at the time of preparation of the RIS3 strategy of Andalusia, in 2015.

This allows us to introduce a comparative perspective, trying to enrich the SWOT analysis of the Andalusian innovation system contained in the RIS3 strategy of Andalusia 2014-2020 and make new proposals for action that would have been relevant in it, as well as establish a work methodology that could be useful in designing smart specialisation strategies in the period 2021-2027.

3. Benchmarking SWOT Analysis

In this section we resume the data used and the main conclusions obtained in our comparative SWOT analysis of the Andalusian innovation system, divided in each of the seven dimensions taken into account.

3.1. Geodemography

Table 3.
Population structure and accessibility

Region	% Population >= 65 (2011)	% Population <15 (2011)	% Pop. in urban and comm. areas (2006)	Multimodal accessibility (2006)
Galicia	23,98%	11,97%	65,57%	39,97
Castilla y León	24,02%	12,17%	64,72%	32,24
Castilla-la Mancha	18,31%	15,51%	42,80%	32,76
Catalonia	18,41%	15,97%	76,93%	68,63
Valencian Community	18,53%	15,29%	69,69%	51,33
Andalusia	16,24%	16,43%	68,55%	40,43
Murcia	15,17%	17,67%	71,53%	32,84
Canary Islands	14,98%	14,24%	72,39%	24,32
Campania	17,56%	15,48%	77,72%	62,98
Sicily	19,89%	14,46%	49,35%	41,61
Sardinia	21,58%	11,94%	45,98%	44,16

Source: Navarro et al. (2014).

In table 3 we can observe the data of the regions in the variables related to this dimension.

The main conclusions of our comparative SWOT analysis in this dimension are included in figure 1.

3.2. Educational level of Human Resources

In table 4 we can observe the data of the regions in the variables related to this dimension.

Table 4.
Population with upper secondary and tertiary education

Region	2012	2013	2014	2015
Galicia	51,40%	51,20%	53,00%	55,30%
Castilla y León	56,80%	57,30%	57,70%	57,50%
Castilla-la Mancha	45,80%	46,90%	48,80%	49,50%
Catalonia	54,40%	56,10%	57,40%	58,80%
Valencian Community	52,30%	52,60%	55,30%	56,30%
Andalusia	45,80%	47,10%	47,60%	48,60%
Murcia	46,60%	47,90%	48,90%	49,40%
Canary Islands	48,90%	49,80%	49,40%	50,70%
Campania	49,70%	50,80%	51,20%	51,30%
Sicily	48,20%	48,10%	49,20%	49,80%
Sardinia	47,70%	47,80%	47,20%	49,60%

Source: Navarro et al. (2014) and Eurostat.

The main conclusions of our comparative SWOT analysis in this dimension are included in figure 2.

FIGURE 1.
Comparative SWOT analysis Geodemography

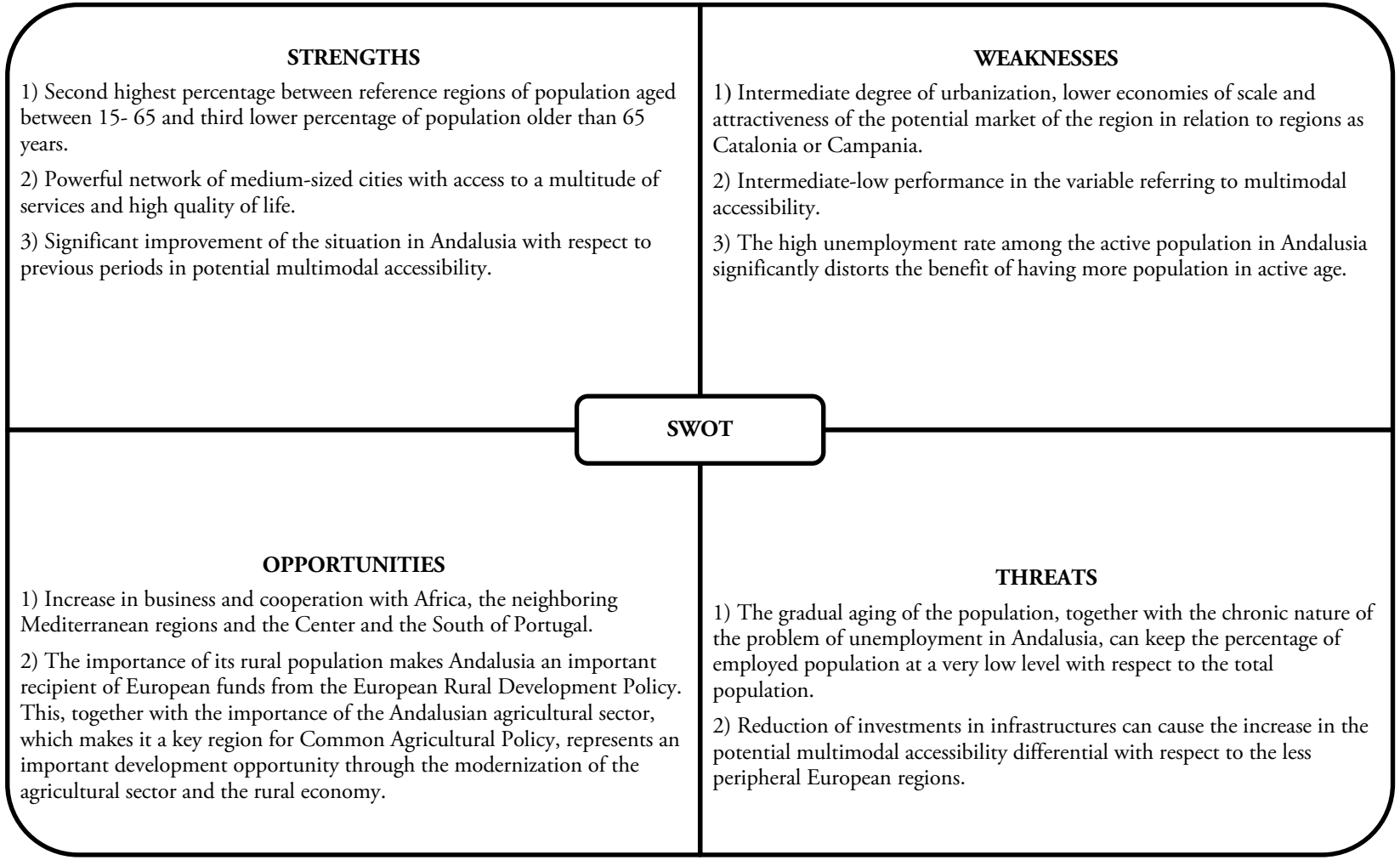
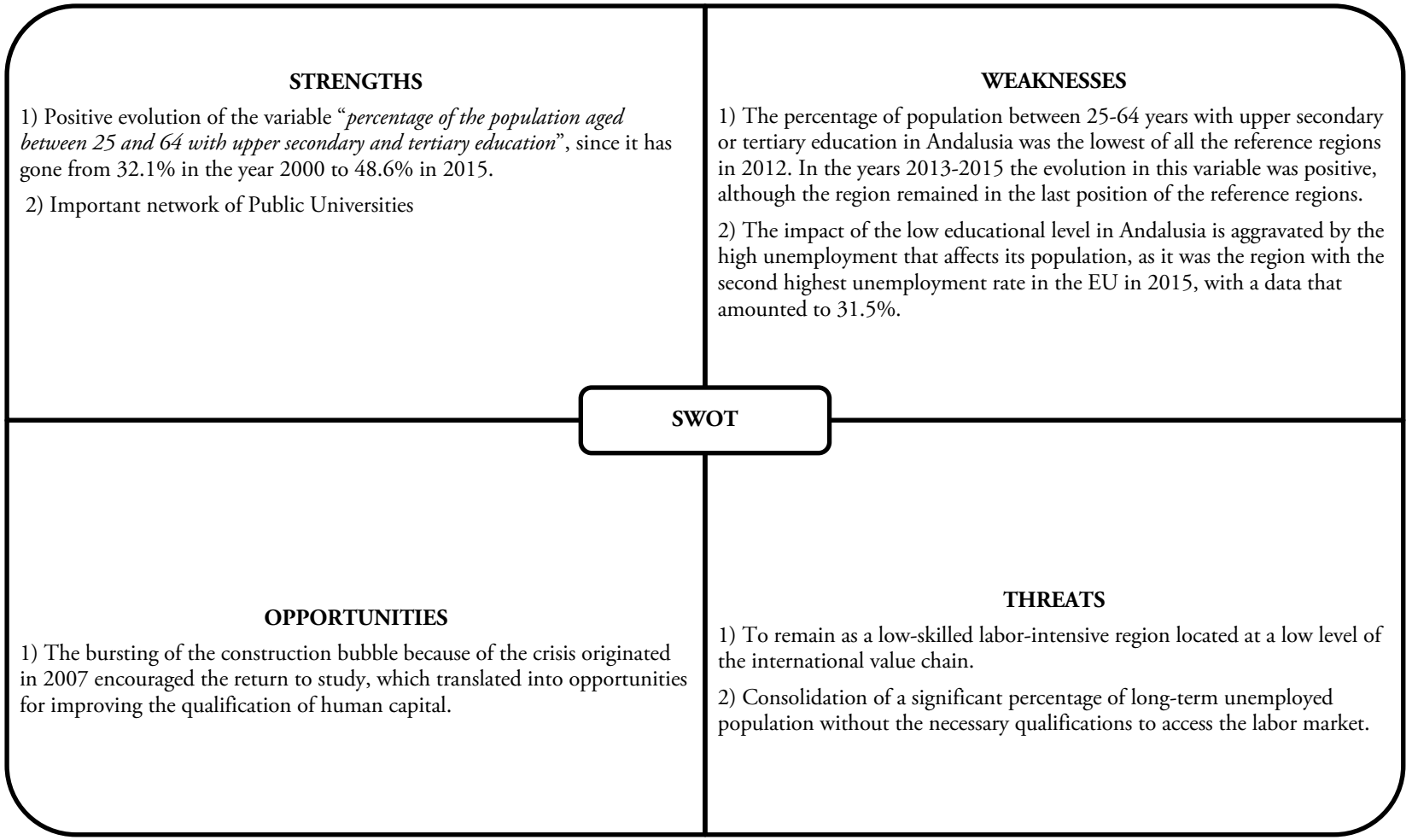


Figure 2.
Comparative SWOT analysis educational level of Human Resources



3.3. Technological specialisation

In the table 5 we can observe the data of the regions in the variables related to this dimension.

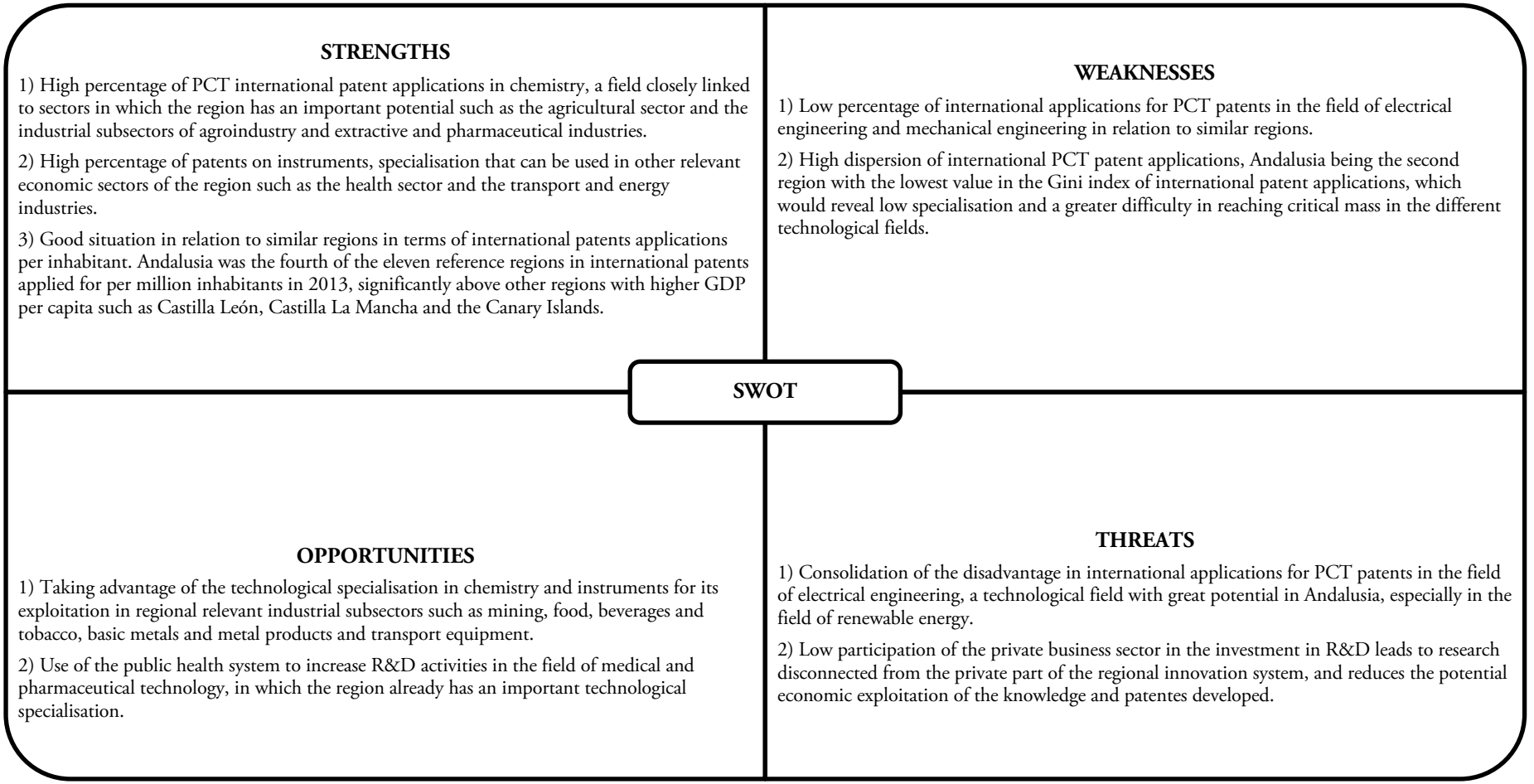
Table 5.
Percentage of patents by technological fields (2006-2010)

Region	% patents PCT electrical engineering	% patents PCT instruments	% patents PCT chemistry	% patents PCT mechanic engineering	% patents PCT other fields	Technological concentration (Gini Index of distribution of patents by sub-technological fields)
Galicia	7,60%	8,97%	35,60%	33,87%	13,97%	0,50
Castilla y León	12,93%	13,23%	33,32%	30,48%	10,04%	0,44
Castilla-la Mancha	12,67%	10,59%	36,72%	21,47%	18,54%	0,57
Catalonia	12,99%	12,61%	38,51%	23,44%	12,46%	0,43
Valencian Community	12,57%	14,97%	32,37%	19,98%	20,10%	0,37
Andalusia	9,34%	16,36%	39,20%	23,18%	11,93%	0,43
Murcia	7,52%	15,40%	34,47%	24,96%	17,64%	0,47
Canary Islands	12,01%	14,93%	24,21%	27,85%	21,01%	0,54
Campania	18,55%	15,21%	33,86%	24,45%	7,93%	0,44
Sicily	21,25%	21,18%	33,70%	15,08%	8,79%	0,52
Sardinia	9,71%	15,15%	35,62%	27,55%	11,97%	0,47

Source: Navarro et al. (2014).

The main conclusions of our comparative SWOT analysis in this dimension are included in figure 3.

FIGURE 3.
Comparative SWOT analysis Technological specialisation



3.4. Sectoral specialisation

In tables 6 and 7 we can observe the data of the regions in the variables related to this dimension.

Table 6.
Percentage of employment by economic sectors (2012)

Region	Agriculture, forestry and fishing	Industry (except const.)	Construction	Wholesale and retail trade, transport	Information and communication	Financial and insurance activities	Real estate activities	Professional, scientific and technical activities	Public administration	Arts, entertainment and recreation	Top of 5 subsectors (2 digits) (% total employment) (2011)
Galicia	6,3%	15,7%	7,2%	27,6%	2,1%	1,7%	0,3%	8,3%	22,8%	8,0%	9,47%
Castilla y León	7,2%	16,3%	6,9%	26,6%	1,7%	2,0%	0,2%	7,5%	24,9%	6,6%	8,98%
Castilla-la Mancha	6,8%	15,4%	7,0%	28,1%	1,7%	2,4%	0,3%	7,0%	25,1%	6,1%	7,60%
Catalonia	1,6%	18,9%	5,9%	28,4%	3,2%	2,7%	0,6%	11,4%	19,4%	7,9%	9,23%
Valencian Community	3,7%	17,5%	6,1%	32,4%	1,8%	2,0%	0,8%	9,0%	19,0%	7,9%	9,77%
Andalusia	7,9%	8,3%	5,4%	31,9%	1,6%	1,9%	0,6%	9,6%	24,8%	8,0%	10,01%
Murcia	12,8%	12,8%	5,2%	31,1%	1,4%	1,7%	0,4%	7,9%	19,8%	6,8%	8,71%
Canary Islands	3,0%	4,5%	5,2%	45,6%	1,4%	1,5%	0,9%	9,7%	20,0%	8,1%	10,83%
Campania	4,3%	13,8%	7,4%	28,4%	1,5%	1,8%	0,6%	10,2%	23,5%	8,4%	9,82%
Sicily	7,7%	9,4%	6,7%	27,3%	1,2%	1,6%	0,4%	9,9%	28,9%	6,9%	9,93%
Sardinia	7,3%	9,1%	6,8%	26,3%	1,4%	2,2%	:	10,8%	27,2%	8,8%	9,34%

Source: Navarro et al. (2014).

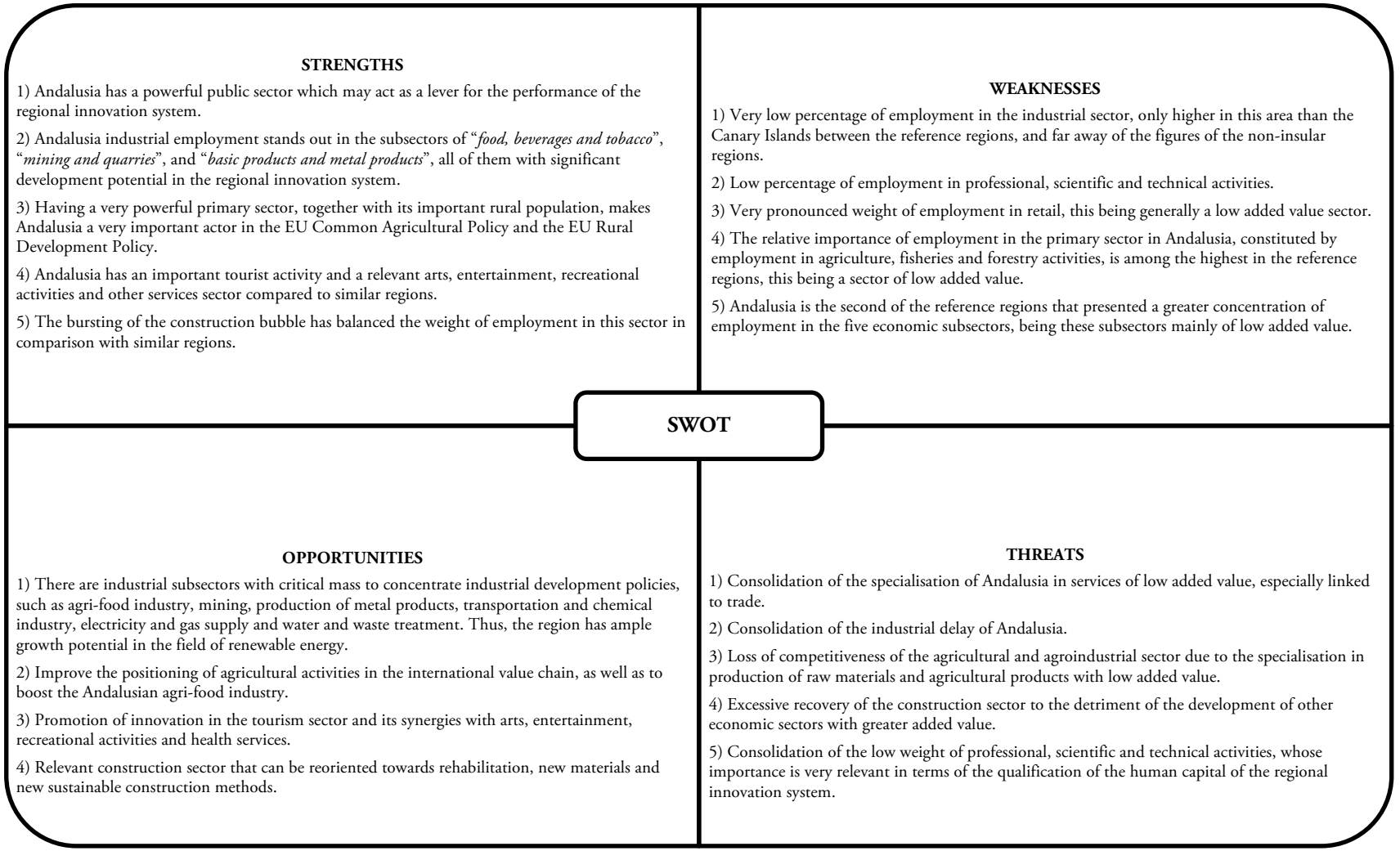
TABLE 7.
Percentage of employment by industrial sectors (2011)

Region	Mining and quarrying	Food, drinks and tobacco	Textiles, apparel and leather	Wood, paper and printing	Chem., pharm., rubber, plastic and refined petroleum	Non-metallic mineral products	Basic metals and metal products	Electric, electronic, computer and optical equipment	Machinery	Transport equipment	Other manufacturing
Galicia	9,00%	21,94%	7,49%	8,03%	4,37%	4,17%	13,12%	1,20%	3,04%	16,14%	11,52%
Castilla y León	10,33%	27,07%	2,44%	7,93%	11,30%	4,86%	9,96%	2,46%	3,59%	12,73%	7,33%
Castilla-la Mancha	10,45%	23,95%	7,33%	8,03%	6,51%	6,70%	12,87%	5,76%	3,37%	3,87%	11,15%
Catalonia	6,91%	15,74%	7,39%	7,85%	15,27%	3,48%	11,54%	5,36%	6,95%	10,83%	8,69%
Valencian Community	8,47%	15,74%	17,03%	6,48%	11,29%	10,57%	9,17%	3,91%	4,67%	5,99%	6,68%
Andalusia	15,53%	21,75%	4,53%	7,41%	7,29%	4,49%	11,44%	2,94%	2,58%	7,48%	14,55%
Murcia	9,03%	31,89%	2,86%	5,54%	13,64%	2,91%	13,32%	2,04%	4,70%	3,56%	10,50%
Canary Islands	17,14%	28,17%	3,87%	8,65%	5,32%	4,81%	12,80%	1,49%	1,01%	1,89%	14,84%
Campania	15,83%	15,74%	9,74%	7,71%	5,59%	4,25%	14,21%	5,29%	2,57%	12,04%	7,03%
Sicily	22,48%	17,02%	3,62%	4,96%	10,44%	6,67%	12,73%	4,62%	1,90%	3,42%	12,16%
Sardinia	22,60%	17,57%	2,82%	8,98%	10,06%	8,22%	14,97%	1,56%	1,82%	0,33%	11,08%

Source: Navarro et al. (2014).

The main conclusions of our comparative SWOT analysis in this dimension are included in figure 4.

FIGURE 4.
Comparative SWOT analysis Sectoral specialisation



3.5. Firm size

In table 8 we can observe the data of the regions in the variables related to this dimension.

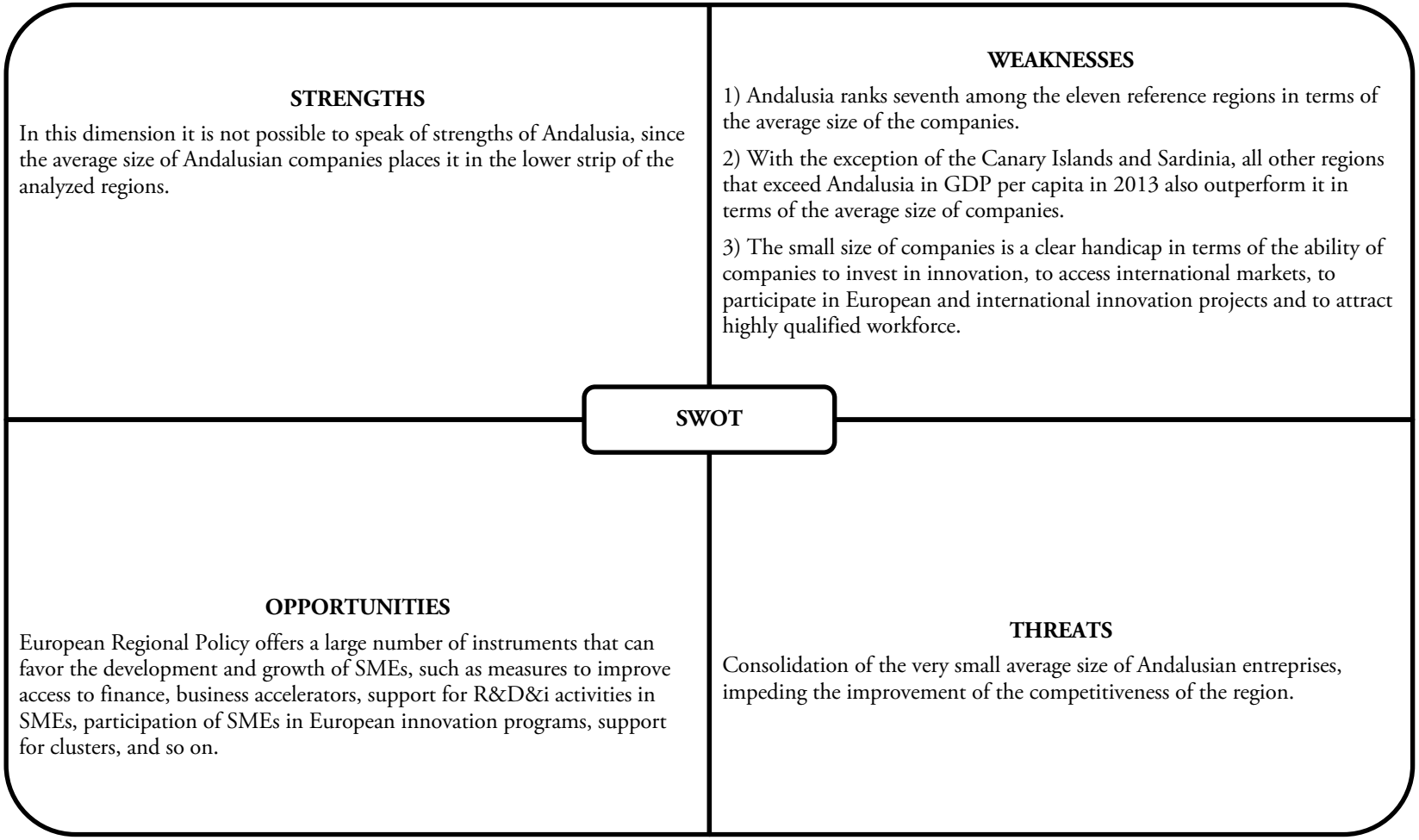
Table 8.
Average firm size (2009)

Region	Average firm size
Galicia	11,8
Castilla y León	11,6
Castilla-la Mancha	9,3
Catalonia	11,9
Valencian Community	10,4
Andalusia	7,9
Murcia	10,1
Canary Islands	6,1
Campania	6,6
Sicily	5,1
Sardinia	5,2

Source: Navarro et al. (2014).

The main conclusions of our comparative SWOT analysis in this dimension are included in figure 5.

FIGURE 5.
Comparative SWOT analysis Firm size



3.6. Economic Openess

In table 9 we can observe the data of the regions in the variables related to this dimension.

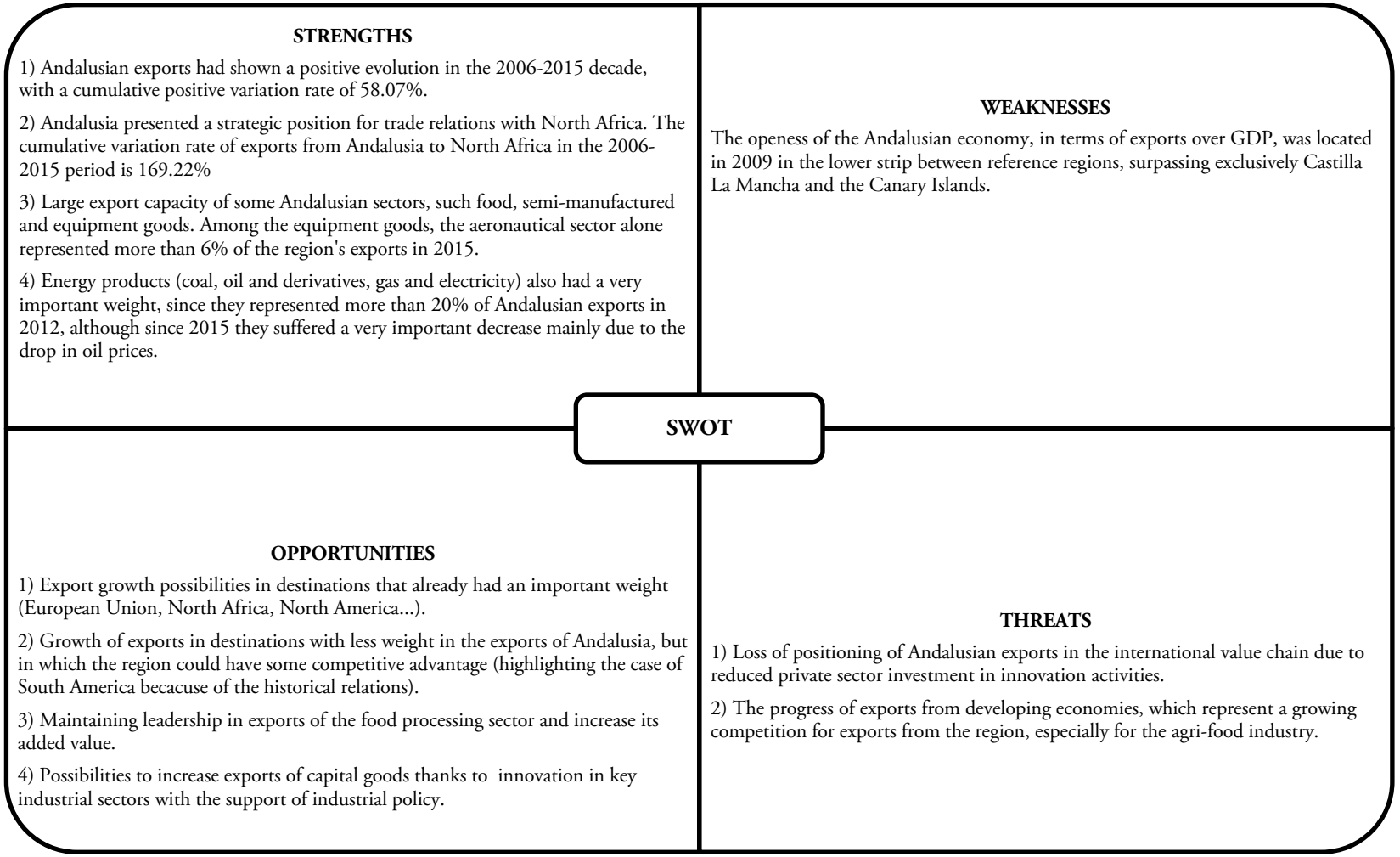
Table 9.
Total exports (% GDP) (2009)

Region	Total exports (% GDP)
Galicia	24,81%
Castilla y León	16,09%
Castilla-la Mancha	8,01%
Catalonia	20,44%
Valencian Community	16,02%
Andalusia	9,72%
Murcia	15,50%
Canary Islands	6,26%
Campania	9,81%
Sicily	11,43%
Sardinia	14,24%

Source: Navarro et al. (2014).

The main conclusions of our comparative SWOT analysis in this dimension are included in figure 6.

FIGURE 6.
Comparative SWOT analysis Economic openess



3.7. Institutions and values

In table 10 we can observe the data of the regions in the variables related to this dimension.

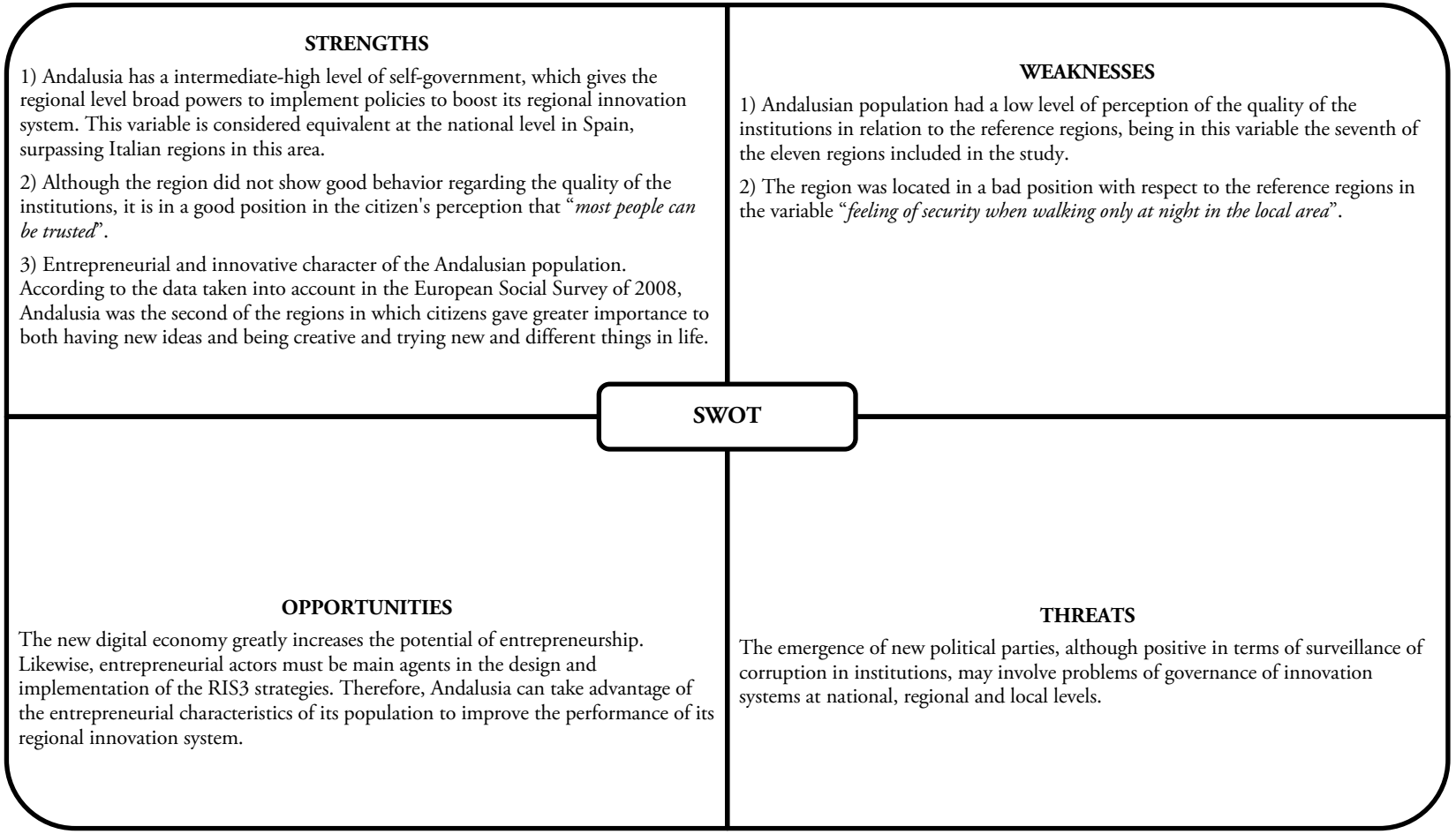
Table 10.
Decentralisation, institutional quality and creativity

Region	Decentralisation level (2009)	Quality of institutions (2012)	Feeling of safety of walking alone in local area after dark (2010)	Perception most people can be trusted or you can't be too careful (2010)	Important to think new ideas and being creative (2010)	Important to try new and different things in life (2010)
Galicia	58	0,58	1,74	4,99	2,44	2,57
Castilla y León	58	-0,06	1,93	4,50	2,18	2,94
Castilla-la Mancha	58	0,21	1,84	6,06	2,46	2,64
Catalonia	58	-0,47	2,03	5,16	2,51	3,08
Valencian Community	58	0,15	2,12	5,14	2,32	2,85
Andalusia	58	-0,20	1,84	5,19	2,64	2,98
Murcia	58	0,28	2,13	4,47	2,61	2,96
Canary Islands	58	0,27	1,94	4,54	1,98	2,31
Campania	50	-2,41	2,36	4,75	2,34	2,61
Sicily	54	-1,91	2,43	3,69	2,66	2,85
Sardinia	54	-0,97	1,63	4,74	2,38	2,22

Source: Navarro et al. (2014).

The main conclusions of our comparative SWOT analysis in this dimension are included in figure 7.

FIGURE 7.
Comparative SWOT analysis Institutions and values



4. Applicacion of results to Andalusian RIS3 Strategy 2014-2020

In this section we will apply the results of our comparative SWOT analysis to revise the relevance of the priorities specialisation and axes of action defined in the Andalusian RIS3 strategy 2014-2020, as well as to propose new lines of action and political measures that could have been included.

4.1. Priorities of specialisation and lines of action

As regards the importance of the specialisation priorities defined in the strategy, listed in the table 2, in the light of our comparative SWOT analysis we would highlight the relevance of the priorities of specialisation "*territorially based endogenous resources*", "*tourism, culture and leisure*", "*health and social welfare*" and "*renewable energy, energy efficiency and sustainable construction*". The lines of action contained in these four specialisation priorities are those that have impact on a greater number of the dimensions analysed in our work, and in which Andalusia has stronger points compared to the similar regions analised.

On the contrary, the lines of action included within the specialisation priority "*ICT and digital economy*" are those that have less weight in relation to the dimensions of our comparative SWOT analysis. However, this should not downplay this priority, as this area is considered a key horizontal aspect because of its influence on the performance of the regional innovation system as a whole.

On the other hand, in relation to the conclusions of our analysis, we consider that it would have been interesting to include in the strategy the following four new lines of action:

a) Within the priority of specialisation "*territorially based endogenous resources*":
   - Promotion of European Funds synergies in the field of agriculture, food and environmental sector.
   - Innovation in waste and water resources management.

b) Within the specialisation priority *"tourism, culture and leisure*":
   - Development of the health tourism business industry.
   - Cooperation in innovation between cultural and tourism sectors.

To conclude with this subsection, we would highlight that the structural dimensions of our comparative SWOT analysis which concentrate a higher number of the specialisation priorities and lines of action defined in the Andalusian RIS 3 strategy 2014-2020 are "*geodemography*", "*technological specialisation*" and "*sectoral structure*".

The relevance of "*technological specialisation*" and "*sectoral structure*" was predictable since the priorities of specialisation and lines of action have been defined by the public and private actors of the regional innovation system, which are themselves representatives of the technological and economic specialisation of the region. However, the influence of "*geodemography*" mainly due to the concentration of R&D&i activities in areas that depend fundamentally on natural resources, highlighting the specialisation priorities "*territorially based endogenous resources*", "*agribusiness and healthy food*" and "*renewable energy, energy efficiency and sustainable construction*". Likewise, the geographical situation of Andalusia and its peculiar climatic and natural conditions also have a great influence on the specialisation priorities "*mobility and logistics*", "*advanced industry linked to transportation*", "*tourism, culture and leisure*" and "*health and social welfare*".

4.2. Axes of action and political measures

With regard to the axes of action and political measures of the Andalusian RIS3 strategy 2014-2020, included in table 2, we would highlight the importance of axis 5 "*education, talent and creative environments*", whose political measures are of great relevance in relation to the conclusions of our comparative SWOT analysis in the dimensions "*educational level of human resources*", "*technological specialisation*", "*sectoral structure*" and "*institutions and values*". This highlights the importance of human capital as a fundamental basis for the performance of regional innovation systems.

Secondly, we must remark the relevance of axis 1 "*efficient and competitive industry*", mainly in relation to our comparative SWOT analysis in the dimensions "*technological specialisation*", "*sectoral structure*" and "*company size*". The importance of this axis is oustanding, especially considering the relevance of the industry as a point of connection of R&D activities with the market, and the need for increase in the low weight of the Andalusian industrial sector to overcome the low private investment in R&D&i activities.

At the other extreme, we can observe the lesser relevance of axis 8 "*infrastructure"* and axis 2 "*enabling technologies*" in relation to the conclusions of our SWOT analysis. However, both axes address very important horizontal issues for the proper functioning of the regional system as a whole.

At the level of political measures, the relevance of the ones related to entrepreneurial culture and creativity within axis 5 "*education, talent and creative environments*" stands out, since the population of the region has interesting entrepreneurial and innovative characteristics according to our SWOT analysis, both of which are critical skills for the development of the regional innovation system and can have an important impact on key sectors in the region such as tourist or cultural ones.

In other axis of action, we would highlight the relevance of other political measures such as "*support for participation in international calls*" and "*deepening participation in networks*", which remarks the importance of collaboration and international calls in R&D&i activities, and it is aspect to improve taken into account the low openess of Andalusian Economy.

On the other hand, we would consider interesting having included in the Andalusian RIS3 strategy the following new political measures in relation to the conclusions of our comparative SWOT analysis:

a) Within Axis 1. Efficient and Competitive Industry:
   - Support for collaboration between public and private sectors in the scientific and technological fields related to specialisation priorities
b) Within Axis 3. Innovative and Employment Generating SMEs:
   - Growth of the size of innovative companies
c) Within Axis 4. Internationalization
   - Strengthening neighborhood relations
d) Within Axis 5. Education, Talent and Creative Environments:
   - Promotion of training and research in sciences and engineering linked to the specialisation priorities selected.
   - Strengthening research capacities in Chemistry.
   - Strengthening the professional career of the researchers, as well as the professions of R&D&i management and technology transfer.
e) Within Axis 6. Social Innovation:
   - Capacity building in innovation of public actors of the regional innovation system

To conclude this section, we have observed that the dimensions of our comparative SWOT analysis which concentrate a higher number of the political measures included in the Andalusian RIS3 strategy 2014-2020 are "*technological specialisation*" and "*sectoral structure*", since they are linked to measures aimed at strengthening the regional innovation system at the present through the development of R&D&i projects in the most relevant technological areas, related to the productive sectors with the greatest potential in the region.

However, we should not fall into an excessively short-term vision, since there are other dimensions, among which we would highlight "*educational level of human resources*" and "*institutions and values*", which are determinants for the performance of the regional innovation system in the long term and require major improvements due to the disadvantage of Andalusia in these areas.

5. CONCLUSIONS

The relevance of smart specialisation on the political agenda has risen until it reaches a key role in EU investment policies in the 2014-2020 programming period. More specifically, smart specialisation plays a key role in EU regional policy, since this policy the basis and the main source of funding of RIS3 strategies (European Commission, 2010, 2011).

In the period 2014-2020 all investments in R&D&i in Andalusia financed with EU regional policy funds have as its main policy document the RIS3 strategy of Andalusia (Junta de Andalucía, 2015). This strategy has been developed through a collaborative process between the regional government and the main players of the regional innovation system, and it tries to direct the public resources for the promotion of innovation towards those strategic areas in which the region has the greatest potential. 8 specialization priorities and 84 lines of action has been selected, as well as 8 priority axes of action and 42 political measures to support the regional innovation system. The starting point of the Andalusian RIS3 strategy 2014-2020 is the performance of a SWOT analysis of the regional innovation system, which is very complete and detailed but does not apply a comparative vision with respect to the innovation systems of other European regions.

In our work, we have carried out a comparative study of the region of Andalusia with other similar regions in structural dimensions considered decisive for innovation performance, using the Regional Benchmarking Tool proposed by the European Commission (Navarro et al., 2014).

Our results have allowed us to make contributions to the SWOT analysis contained in the RIS3 strategy for Andalusia 2014-2020. In the light of the results of our comparative SWOT analysis we have been able to evaluate the relevance of the specialisation priorities, lines of action, axes of intervention and policy measures contained in the strategy, as well as we have proposed some new lines of action and political measures.

Our work has shown that Andalusian RIS3 strategy 2014-2020 has taken into account properly the structural dimensions determining the innovative potential of the region, although the application of a comparative perspective has allowed us to complement it with 3 lines of action and 9 new policy measures.

In the new programming period 2021-2027 it is expected that regional innovation strategies will continue to have a fundamental role in EU regional policy, and we believe that Andalusia and other regions should deepen in the practice of regional benchmarking exercises, as the comparative SWOT analysis performed by us, to enrich regional innovation strategies design and its effectiveness.

Besides, it should be taken into account the impact that the NextGenerationEU Plan will have on the design of regional innovation strategies for the period 2021-2027, as it will mean an unprecedented increase in public investment in the EU, since it intends to invest an amount close to € 806,9 trillion in the period 2021-2023, being the total budget of EU Regional Policy for the period 2021-2027 of € 372,6 trillion (European Commission, 2021a).

The investments of the main instrument of the NextGenerationEU Plan, whose name is the Recovery and Resilience Facility, will be implemented through national recovery and resilience plans. These plans are subject to strict criteria for approval, highlighting the requirement that at least 37% of the investments must be destined to face the climate challenge and at least 20% of the investments to favor the digital transition. (European Parliament and Council of the European Union, 2021a). In the case of Spain, the aid of the National Recovery, Transformation and Resilience Plan amounts approximately to 70,000 million euros, a budget that must be largely implemented by the regions by virtue of their competences. The Commission's evaluation concludes that the Spanish plan dedicates 40% of its total allocation to measures that support climate objectives and 28% of its total allocation to measures aimed at the digital transition (European Commission, 2021b).

Likewise, the new Cohesion Policy Regulations 2021-2027 provide that at least 30% of ERDF investments, which are the main source of financing for RIS3 strategies, must be destined to contribute to the climate objectives of the EU (European Parliament and Council of the European Union, 2021b), in line with the EU Green Deal.

Taking into account the great conditionalities regarding the destination of investments imposed by the main financial instruments of the EU regional policy in the 2021-2027 period, it would be highly recommended to give significant weight in the design of the regional innovation strategies to investments in R&D&i related to climate change and the promotion of the digital transition. Good proof of this is the initiative launched by the European Commission called "*Smart Specialisation Strategies for Sustainability (S4)*" (Mccann & Soete, 2020). It aims to connect regional innovation strategies with EU general policies, particularly the EU Green Deal and the New Industrial Strategy for a Globally Competitive, Green and Digital Europe. The European Commission also points out that one of the main motivations for this initiative is to maximize the use of the Next Generation EU funds at the regional level. The regional authorities of Andalusia have already adhered to S4 initiative, and are currently working in the design of the Andalusian S4 Strategy 2021 -2027.

We can affirm that in the new period 2021-2027 the influence over regional innovation strategies of the political priorities set at the EU level, such as EU Green Deal or the new EU Industrial Policy, will gain importance. Nevertheless, we must not forget that the key point in the design of regional innovation strategies will continue to be a bottom-up approach based on the detection by the regional actors of the areas of specialisation in innovation in which the region has greater potential. To detect this strategic areas of specialisation the implementation of comparative exercises with other regions such as the one carried out in our work will continue to be highly recommended.

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