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Smart specialization at local level: a practical application

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Abstract

Smart Community concept, considering it as a participatory model for territorial development, is particularly relevant in the context of current understanding of smart specialization at local level, usually limited to Smart City approaches. The aim of this paper is to identify the elements of a Smart Community and its complementarities with the smart specialization policies. To this end, this paper used a mixed qualitative and quantitative methodology to identify the pattern of specialization and diversification opportunities (entrepreneurial discovery opportunities) in the city of Seville, and how these opportunities can be complementary to those of its Region(included in the Smart Specialization Strategy -RIS3 of Andalusia).

Keywords: Smart Specialization; Smart City; Smart Community; Entrepreneurial discovery; RIS3

JEL classification: O18, O31, O38

Introduction

Smart specialization is a model of territorial development [1] that has become very important in current innovation strategies at national and regional levels, especially in Europe. Indeed, it has become one of the key elements of the European Regional Policy [2] through the Regional Innovation Strategies for Smart Specialization (from now on RIS3). These strategies seek for territorial development alternatives using the policy instruments available and encouraging innovation through prioritization [3,4].

Smart specialization has acquired this importance due to the role innovation and territory play as tools for social and economic improvements in the long term. Although in Europe smart specialization has been applied fundamentally at regional level, participatory governance and bottom-up approaches of the RIS3 make the local level approach of smart specialization a key aspect to be considered too.

In this context, the importance of the urban level, coupled with the rise of Information and Communications Technology (ICT) has led to an understanding of local smart specialization through Smart City concept. However, local smart specialization approach is slightly different to Smart City approach. Indeed, the later have had different interpretations, precluded a clear definition. According Hollands [5], the different Smart City cases do not create a standardized norm. Besides, with its international extension, the term has virtually been reduced to the implementation of ICT in various fields aimed at achieving more effective and efficient urban management [6-8].

The exercises of identifying and prioritizing within a strategic exercise are not simple, and it is quite common to find "coffee for all" experiences when trying to elaborate a territorial strategy [9]. In the case of smart specialization at local level, these errors, together with the rise of Smart City and its high popularity, is leading to confusion in defining local RIS3 and processes.

For this reason, we consider it essential to define a concept that collect the real needs of a smart specialization model for local contexts, and that these, in turn, are coordinated with regional and national strategies. In this paper, the new term we propose is Smart Community, and integrates the main elements of smart specialization but applied to local level (participatory governance, specialized diversification mix, multilevel integration of policies, etc.).

The paper is organized as follows. First, the theoretical framework will be analyzed from three perspectives: smart specialization and its role in territorial development, the importance of cities and their contribution in achieving regional policy objectives, and finally the concepts of Smart City and Smart Community regarding RIS3. This theoretical analysis is then applied to the municipality of Sevilla, which is discussed in terms of its relationship with the RIS3 of the region of Andalusia. Finally, a number of recommendations are proposed to translate the concept of smart specialization to local levels in coordination with the exercised currently developed at regional and national levels.

Theoretical Framework

Smart specialization

The concept of smart specialization appeared between 2006 and 2009 from a strategic reflection carried out by a group of European expert's kwon as "Knowledge for Growth Group" (K4G). They pointed out that the less specialization and ability to prioritize resources at the territorial (regional) level is one of the main causes of the traditional gap between the US and Europe [10]. Elements included in the concept comes from the ideas of Dominique Foray and other authors, that linked it to complex processes of entrepreneurial discoveries at territorial level and how them contribute to economic transformation [11-15]. Later developments update these ideas linking them to the challenges of the global knowledge economy [15]. In parallel, other authors such as Del Castillo et al., [16] and McCann and Ortega-Argilés [17] define smart specialization as the prioritization at a regional level considering a small group of sectors and technologies that have the potential to compete in international markets and to generate new activities with competitive and comparative advantages against other territories.

In this period, the European Commission proposed a new European regional policy framework where smart specialization (though RIS3 exercises) became ex ante conditionality to access the European Regional Development Fund (ERDF) in the field of R&D and innovation between 2014 and 2020. This update in regional policy looked for and improvement of the process begun with the old Regional Innovation Strategies (RIS) during the 90s [18], and more epicyclically, emphasizing innovation and focusing human and financial resources in a small number of globally competitive areas [19].

In this context, the fact of being a precondition for obtaining European funds has forced European regions to devote a high importance to elaborate RIS3 agendas. Thus, each region has now its own strategy of economic transformation, based on its own regional scientific excellence and innovation capacities. More specifically they are based on three pillars: specialization, diversification and internationalization [20].

Specifying and prioritizing diversification opportunities in the context of global economy have not been an easy task for RIS3 exercises and, as a consequence, in general they have resulted in quite broad strategies. To solve this handicap, the local approach to smart specialization would provide greater concretion, prioritization and, finally, better place-based policies.

The importance of local environments

2007 was the first year in history where urban areas population exceeded the population in rural areas. According to World Bank data, in 2016 more than 54% of the world population lives in cities, compared to 10% in 1900, to 36% in 1966 and 45% in 1996. And although the growth rate has fallen 2% in 2016, the United Nations (UN) predicts that by 2050, about 70% of the world population will live in urban centers. In addition, it is estimated that cities consume 75% of global energy and generate 80% of greenhouse gases. This growth will be one of the main factors of economic, demographic, social and environmental change in the coming years [21,22], causing a threat to the sustainability of cities. On the other side, it will be also an opportunity as long as these factors are considered as pillars of territorial competitiveness through innovation. In any case, to transform threats into opportunities a process there the quadruple helix of a territory (people, companies, and public administration and research institutions) play a central role is needed.

For these reasons, smart specialization at local level could be a tool to ensure that urban development is aligned (and contributes) to regional and national strategic priorities, answering to the current lack of specificity at the sub-regional level of many reflections on smart specialization (e.g. when dealing with identifying and implementing entrepreneurial discoveries).

Smart city and smart community

The beginning of smart local services as we understand it today took place in the Greater London Council in 1986, being the first municipality with Open Data. Later, in 1992, at the UN Conference in Rio on Environment and Development, Smart Growth term used for the first time. However, the origin of the concepts Smart City and Smart Community took place in 1997 at the Global Forum World Foundation for Smart Communities, where it was suggested that around 50,000 cities should develop intelligent initiatives.

In 2004, the Ministry of Industry of Spain launched a first program involving ICT and municipalities, called "Digital Cities". In the same year, and also in Spain, the company ACCEDA created "Digital Community" initiative, where the first elements of a connected, digital technology and urban environment were presented [23]. This initiative, supported by large technological multinationals, presented the first prototype of a digital city, which IBM dubbed "Smart City", name used today for this kind of initiatives at urban level.

However, despite the numerous examples of cities qualified with this "label", many authors agree that it is very difficult to establish a definition of Smart City, mainly due to the lack of precision in the different definitions and implementations observed [24,25]. These same authors recognize that cities are self-labeled as "Smart" by using ICTs to urban management thereof, but nothing more behind that. For example, Batty et al. [26] defines the concept of Smart City as a city in which ICTs merge with traditional infrastructure, to develop urban management through the use of digital technologies. Meanwhile, Caragliu et al., [27] Chourabi et al., [28] link the concept to the use of ICT to protect and improve the environment. Thus, literature differentiates the different use of ICT topics such as energy, natural resources and water management, waste and pollution management, transportation and mobility, health, safety, education, culture, social inclusion, governance, economy and business, etc.

In this context, in 2012 the European Commission launched the project "European Innovation Partnerships on Smart City and Communities" which allocates resources for urban development only in ICT-related projects. For this reason, it can be understood that this concept of Smart City is very reductionist, and specially when is defined simply as applying the use of ICT in different areas of urban management.

The aim of this paper is to propose a smart specialization for local level that overcomes the limitations of the current understanding of Smart City concept, and include additional elements that now are not considered in this reductionist approach. According to the European Commission [29], the success of local smart specialization should include an active participation of citizens that creates a sense of belonging and commitment, local coordination with regional and national strategies, and public administration involvement into local networks. Based on this, the concept of "Smart Community" is therefore defined in this paper.

Methodology

The methodology used in the analysis is based on characterizing the economic structure at local level, a comparison of local specialization in terms of regional RIS3 priorities, and identification of potential specialized diversification. Table 1 provides a summary of the stages and contents of the methodology proposed.

From the theoretical developments raised in Europe, the methodology is going to identify the specialized diversification through the related diversity possibilities frontier. To do this, first, the value chain of local priorities identified will be obtained. Secondly, the areas of related diversity will be identified in commercial terms. The third step will consist in identifying areas of related diversity in terms of technological convergence over time. This methodology is based on several previous researches at regional level by Del Castillo et al., [30] and Paton [31].

For the quantitative analysis, first, the specialization level of the economic structure must be obtained. Here, the well-known specialization coefficient method (EC) based on Porter [32] is used.

$$EC\left(x_{ij}\right)\frac{\frac{x_{ij}}{\sum_{i=1}^{n}\chi_{ij}}}{\frac{\sum_{j=1}^{z}\chi_{ij}}{\sum_{i=1}^{n}\sum_{j=1}^{z}\chi_{ij}}}100 \quad (1)$$

xijxij ≤ 1 Sector with no specialization (lower or similar to average)

xij> 1 xij Sector with specialization (above average)

Table 1: Stages and content of the analysis.

Stages of the analysis	Contents of the analysis
Quantification and detail of the local economic structure	Data on No. of companies, turnover, employment and exports
	2- and 3-digitsdetail of the NACE
	Enterprise databases
Comparative analysis of RIS3 priorities in economic terms	quantized priorities of the local economy
	Comparison (in %) by theme for regional priorities and local priorities.
Analysis of specialisation level of the local economic structure	Obtaining the specialisation level for all sectors of local economic structure
	Comparison of the specialisation level of local and regional priorities
	Other sectors specialised but not considered among the priorities
Analysis of the potential specialized diversification of the local economic structure	Identification of the value chains linked to the local priorities
	Identification of related variety/diversification at local level (hybridization between sectors)
	Identification of technological convergence between sectors over time

Source: own elaboration.

Second, cross-sector commercial relationships are calculated using the input-output tables available, the technical coefficients of these tables and network analysis techniques [32] .Thus, the ratio of a sector (column) with respect to a different sector (row) is calculated as follows:

$$a_{ij} = \frac{\chi_{ij}}{\chi_j} \qquad (2)$$

Where aij is the technical coefficient for the sector j, xij are the inputs of the sector j with respect to sectori, and Xj total output of sector j. The value of aij is always within the range [0; 1) and∑_(i=1)^n▒a_ij <1

From this calculation, and considering the economic sectors identified in the previous step, the value chain can be obtained from a boundary value "a" as following:

$$\forall j, i \subset A_j si a_{ij} \succ a_{fj} \qquad (3)$$

Where Aj is the value chain for the sector j, i any other different from j, and aFja minimum frontier value that must be met by the technical coefficients of each sector j to be considered part of the value chain.

Technical coefficients represent the inputs and outputs from one sector to another and therefore they are an excellent indicator of the existing commercial relationships. Thus, with higher values of the coefficient, it can be considered a higher intensity in the relationship. Based on the previous expression 3, the frontier value aFj can be obtained as follows:

$$a_{Fj} = \frac{\sum a_{nn}}{n} \qquad (4)$$

Applying this condition to the expression of the value chain (3), for each of the different sectors "j", inputs to sectors "i"above aFj value are retained as part of the value chain. In other words, those sectors that provide intermediate inputs above the average value for a given sector may be considered as part of the value chain for that sector.

Thirdly, inter-sectoral technological relationships are calculated using a multidimensional scaling methodology from the cosenic distance of the inverse coefficients of the input-output table [33,34]. These relationships are calculated as follows:

If the aggregate demand vector is denoted by "Y", the vector of total outputs by "X", and the technical coefficient matrix by "A", a production model equationis obtained through the following matrix:

$$(I - A)\mathrm{X} = YI \qquad (5)$$

Where I is the identity matrix, A is the technical coefficients matrix (denoted each by aij), X is the vector of production values, and Y is the total aggregate demand.

Rearranging terms in expression 5:

$$\mathrm{X} = (I - A)^{-1} Y \qquad (6)$$

This equation matrix shows the possibility of obtaining the total production of each sector in relation to the technical coefficients for each pair of sectors (element "ij" denoted by "aij"), i.e., the increase of production of a sector "i" needed to meet the increase of final demand of a sector "j". Thus, inverse coefficients are the elements resulting from the inversion process of the I-A matrix:

$$(I - A)^{-1} = \frac{1}{\left|(I - A)\right|} Adj(I - A) \qquad (7)$$

Where [I-A] is the determinant of the matrix I-A and Adj (I-A) is the adjunct.

In line with the proposal by Jaffe [33], after obtaining the inverse matrix coefficients, each new element of this matrix is transformed by the following expression to obtain the cosenic distance between a pair of sectors "i" and "j":

$$\mathrm{w}_{\mathrm{ij}} = \frac{\sum_{\mathrm{k}}^{\mathrm{n}} = 1^{\mathrm{a}_{\mathrm{ik}}\ \mathrm{a}_{\mathrm{jk}}}}{\sqrt{\left(\sum_{\mathrm{k}}^{\mathrm{n}} = 1_{\mathrm{ik}}^{\mathrm{a2}} \sum_{\mathrm{k}}^{\mathrm{n}} = 1_{\mathrm{jk}}^{\mathrm{a2}}\right)}} \qquad (8)$$

Where wijare the new matrix coefficients that have values between 0 and 1, and aik are the technical coefficients of sector "i" regarding to each of the supplier sectors"n" (sector column "I"). All the elements of the main diagonal have values of 1, and at both sides of the diagonal the matrix is symmetric.

The "wij" elements of the transformed matrix are an indirect measure of the technological proximity for each pair of sectors "i" and "j". Values close to 1 for a pair of sectors show a high technological similarity, compared to those close to 0 and technologically very different.

Unlike commercial relationships, where suppliers (columns) and customers (rows) are distinguished, the symmetry of this new matrix makes the value of each technological proximity coefficient unique for each pair of sectors (same lecture by rows or by columns). This coefficient can be considered as a relative measure of technological proximity between two sectors, and not necessarily linked to their commercial relationships.

Once this technological matrix is obtained, the multidimensional scaling method proposed by Frenken et al., [34] is applied. As a result, relative positions of each sector in a two-dimensional space are obtained, as well as their x and y-coordinates.

Using these x and y-coordinates, and index is elaborated to observe the differences these coordinates shown between two periods. The periods must be long enough (e.g. one or two decades) in order to record changes in the technological structure of the economy. The index is calculated following Del Castillo et al., [30], and specifically aggregating coordinates between two given periods A and B:

$$a_{ij} = \left[\left(CoorDimA_{ia} - CoorDimA_{ja}\right)\right]^2 + \left[\left(CoorDimB_{ia} - CoorDimB_{ja}\right)\right]^2 - \left[\left(CoorDimA_{ib} - CoorDimA_{jb}\right)\right]^2 + \left[\left(CoorDimB_{ib} - CoorDimB_{jb}\right)\right]^2$$

Where aij here is the coefficient inside the matrix that contains technological proximity variations for each pair of sectors between periods A and B.

With these coefficients, a new matrix is elaborated containing all the distances for every pair of sectors and, finally, the related diversity possibilities frontier for a given territory is also obtained.

Application to a real case: the case of Seville

The methodology proposed in the previous chapter has been applied to a municipality in Spain, Seville, capital of Andalusia Region and one of the biggest urban areas of the Country. This choice was deliberate: being Andalusia also one of the largest and most populated regions in Europe, the differences in smart specialization priorities and opportunities between Seville and the Region may be clearer than in a case where a city holds a significant percentage of total regional economy (e.g. Madrid, Barcelona, etc.).

The data used comes from the Regional Statistical Office of Andalusia -IECA (that in turn comes from the National Statistical Institute of Spain -INE), specifically data on business establishments, employment, turnover and exports at territorial level (Andalusia and Seville). Besides, the input-output tables from Andalusia from 1995 to 2014 have been obtained, and then calculated for Seville. Finally, data on business establishments at 3 level of NACE has been used, and 2 level for turnover and employment.

Next Table 2 includes data on number of companies, employment, turnover and exports in Sevilla in 2014. The share of Seville in terms of total Andalusia risesto 18-19% of total regional firms, employment and turnover, and slightly less in exports (14.7%).

Total specialization priorities in Sevilla account for more than 17% of total regional priorities in number of companies, employment and turnover, and more than 15% in terms of exports. These figures show the fact that Seville maintains its average share in total regional economy also in terms of regional smart specialization priorities. Besides, regarding exports, the share of Seville in regional figures is even higher (15.63% against 14.66%).

Sectoral specialization

This section analyzes the specialization coefficients of Seville municipality and its metropolitan area in terms of regional RIS3 priorities. Specialization coefficients are a measure popularized by Porter [32], and it shows a relative comparison of the share of a sector

Table 2: Number of companies, employment, turnover and export regarding RIS3 priorities.

2014 (estimate)		TOTAL METROPOLITAN SEVILLA 2014				% TOTAL ANDALUSIA 2014 *			
RIS3 Priority (Andalusia)		No. of companies	Employees	Turnover (k €)	Exports (k €)	No. of companies	Employees	Turnover (k €)	Exports (k €)
P1	Mobility and logistics	4,577	19,078	1,980,653.97	372,797.20	18.65%	17.75%	17.15%	15,95%
P2	Advanced transport industry	464	4,723	798796	336582	19.85%	18.90%	18.71%	18.32%
P3	Endogenous territorial assets	275	5,580	1336811	719563	13.62%	14.56%	17.14%	19.82%
P4	Tourism, culture and leisure	10,397	48244	3900755	29872	16.62%	15.91%	16.06%	23.84%
P5	Health & Wellness	4,553	48190	3487465	88540	22.66%	22.50%	22.98%	41.72%
P6	Agribusiness and healthy food	789	7,210	1607154	700512	11.01%	10.97%	10.79%	10.91%
P7A	Renewable energy and energy efficiency	687	2,600	1622877	126,751	24.81%	23,60%	24.84%	23.28%
P7B	Sustainable construction	6,256	29,303	4060800	118956	15.11%	14.97%	14.96%	11.94%
P8	ICT and digital economy	928	7,249	1391336	62838	24.60%	23.59%	21.01%	25.02%
TOTAL, Priorities **		28,926	172177	20,186,648.74	2,556,410.42	17.36%	17.37%	17.07%	15.63%
TOTAL, economics ***		89421	446112	41,858,235.98	4,518,423.57	18.67%	18.75%	18.07%	14.66%

Source: data from IECA

The % share of Sevilla on Andalusia priorities is quite below the average in each indicator
The % share of Sevilla on Andalusia priorities is around the average in each indicator
The % share of Sevilla on Andalusia priorities is quite above the average in each indicator

* Percentages by priority refer to the share of each priority in Sevilla regarding the same priority at regional (Andalusia) level

** Percentage refers to the share of total priority aggregation for Seville regarding total priority aggregation for Andalusia.

*** Percentage refers to the share of total Seville regarding total Andalucía (for each indicator).

Table 3: Specialization coefficients of employment and exports in terms of RIS3 priorities.

2014 (estimate)	Priority (P)	METROPOLITAN AREA		SEVILLE	
		Employment	Exports	Employment	Exports
P1	Mobility and logistics	94.64%	108.83%	90.33%	161.33%
P2	Advanced transport industry	100.79%	124.97%	77.72%	130.94%
P3	Endogenous territorial assets	77.66%	135.25%	52.15%	97.50%
P4	Tourism, culture and leisure	84.85%	162.65%	87.43%	273.21%
P5	Health & Wellness	120.01%	284.66%	141,61%	607.93%
P6	Agribusiness and healthy food	58.50%	74.41%	23.97%	44.39%
P7A	Renewable energy and energy efficiency	125.88%	158.85%	128.69%	216.36%
P7B	Sustainable construction	79.85%	81.46%	50.77%	37.40%
P8	ICT and digital economy	125.81%	170.68%	134.34%	225,75%

Source: data from IECA

Specialization coefficient for Seville and its metropolitan area lower than Andalusian average
Specialization coefficient for Seville and its metropolitan area similar to Andalusian average
Specialization coefficient for Seville and its metropolitan area higher than Andalusian average

A priority is considered as specialized with a coefficient equal or above 110%.
In contrast, a priority is considered not specialized with a coefficient lower than 75%.

(or economic activity) in a given territory against the share of that sector but in terms of an upper administrative level (in this case Seville in terms of Andalusia).

Therefore, using this measure, the following Table 3 shows, for each of the RIS3 priorities, the specialization coefficient for employment and exports data of Seville and its metropolitan area compared to regional values.

The metropolitan area of Seville has a high employment specialization coefficient in health and wellness (P5) (20% above the regional average); renewable energy and energy efficiency (P7A) (25% above the average); and ICT and digital economy (P8) (25.8% higher than the average). In terms of exports, the specialization coefficients show a significative increase regarding the Andalusian average: this is 184.66 percentage points above the average for health and wellness priority; 58.85 for renewable energy and energy efficiency; and 70.68 for ICT and digital economy. Besides, other significant values can be observed in advanced transport industry (P2), with a value 24.97% above the Andalusian average.

Considering only the municipality of Seville, the City accounts for employment coefficients that corroborate the results by priority obtained at metropolitan level, indeed with slightly higher values. Regarding exports coefficients, the three priorities with values above the regional average in employment increase their value to more than 100 percentage points. In the case of the health and wellness priority, exports coefficient reaches more than 500 percentages above the regional average.

Considering the rest of priorities, at city level coefficients account for higher values than the metropolitan ones. An exception is the endogenous territorial assets priority (P3) and agribusiness and healthy food (P6).

Specialized diversification (1st part)

This section presents the opportunities behind territorial specialized diversification using some theoretical developments that, as mentioned, have appeared form current smart specialization models.

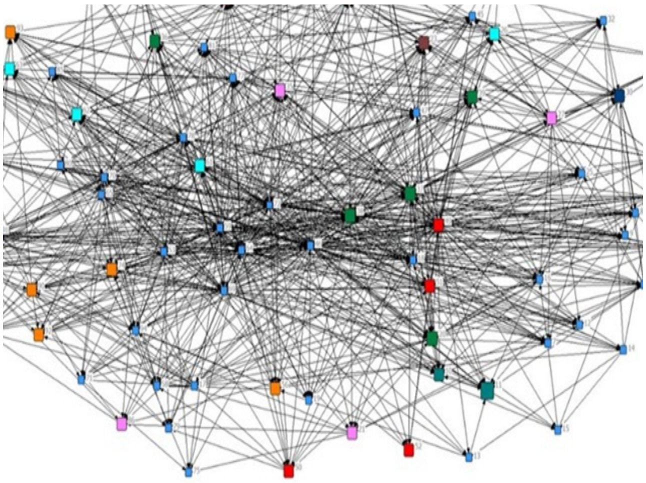
Specialized diversification can be understood as a strategic mix between specialization niches and diversification opportunities. Specifically, as "the process by which a territory seeks options for reinventing its economic structure by relying on those activities in which it has a relative specialization compared to other territories" [35]. This exercise is usually referred in the literature as related diversity exploitation or related diversification.

In this context, and taking into account the theoretical developments used in European RIS3, the analysis begins with the identification of the value chain of each RIS3 priority in Seville (and its metropolitan area). Then, the analysis continues with the identification of related diversification possibilities in both, commercial and technological terms. The convergence paths from this related diversification opportunities let to obtain the specialized diversification possibilities frontier, understood as all the intersectoral mixing possibilities a given territory has in order to develop new economic activities from its current economic specialization structure.

The main data used for the identification of related diversification for both commercial and technological terms, is the Input-Output matrix. In the case of Seville, we have to use a transformed regional matrix from the IECA, since there are no city level IO matrixes available. Once we transform the regional IO matrix into a local one [36] the commercial relationship between Seville economic sectors are mapped in Figure 1. Here, the RIS3 priorities are marked with different colors to differentiate them.

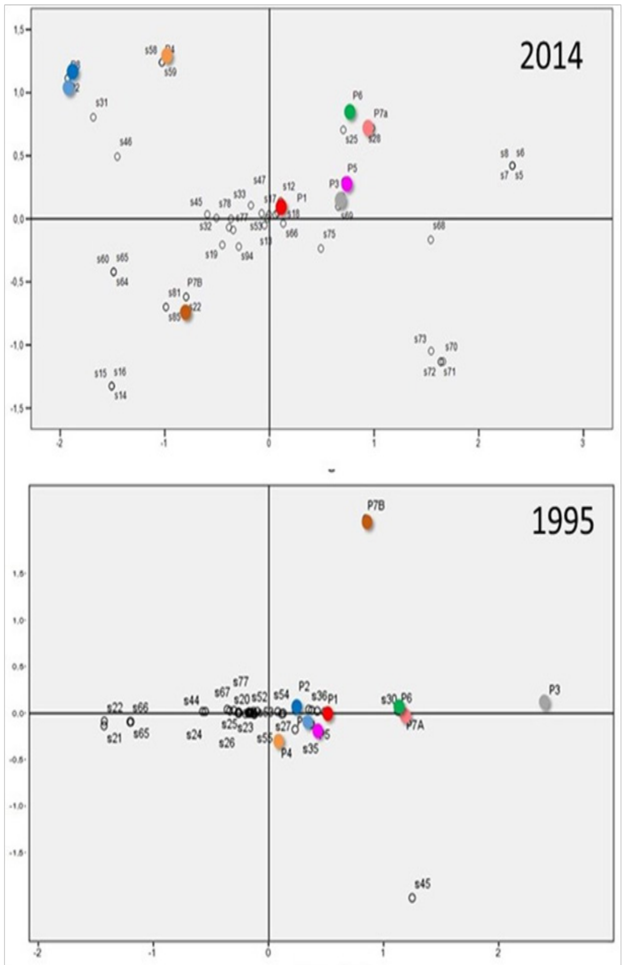
As a result, the network analysis used to map the commercial relationships has allowed identifying how agri business and healthy food (P6) and tourism, culture and leisure (P4) accounts for highest number of relationships with other non specialized sectors. On the contrary, in terms of relationships with specialized sectors, it should be noted that tourism, culture and leisure (P4) and endogenous territorial assets (P3) accounts for highest numbers. Finally, priorities with more transfers ability are mobility and logistics (P1) and ICT and digital economy (P8). These sectoral interrelationships open up possibilities for exchange and cooperation in technology, innovation and entrepreneurship, which in terms of smart specialization usually know as entrepreneurial discovery opportunities.

For identifying related diversification in technological terms, the input-output matrix is analyzed by the method explained in chapert 3 (methodology). The objective is to obtain groups of sectors where radical innovations can occur through the combination of shared technology domains or knowledge. Using MDS method we represent the technological similarities between sector in Figure 2 for two given periods 1995 and 2014.



	Mobility and logistics		Agribusiness and healthy food
	Advanced transport industry		Renewable energy and energy efficiency
	Endogenous territorial assets		Sustainable construction
	Tourism, culture and leisure		ICT and digital economy
	Health & Wellness		Non RIS3 sectors

Figure 1: Commercial relationships in Sevilla.



	Mobility and logistics		Agribusiness and healthy food
	Advanced transport industry		Renewable energy and energy efficiency
	Endogenous territorial assets		Sustainable construction
	Tourism, culture and leisure		ICT and digital economy
	Health & Wellness		Non RIS3 sectors

Figure 2: Technology similarity between Seville economic sector (2014 top; 1995 bottom).

Source: own elaboration from the transformed Input-Output tables for Sevilla.

The relative position of the sectors in the two graphs reflects the change experienced between 1995 and 2014. Thus, with this information we are able to identify the current technological similarity (proximity) as well as the evolution of technological convergence (or gap) between sectors from 1995 to 2014.

Specialized diversification (2nd part)

As mentioned in the previous section, the data from the transformed Input-Output tables of Andalusia allows us to obtain the related diversity of Sevilla from commercial relationships and technology proximity and convergence between sectors and RIS3 priorities. Therefore, in commercial terms, we can highlight 6 groups where related diversity opportunities can be found, as can be seen in Table 4.

From a technological proximity perspective (considering 2014 data), the combination of sectors and priorities allows find other 6 groups, as can be seen in Table 5.

Finally, the study of related diversification in terms of technological convergence (this is, considering the evolution pf technological proximities from1995 to 2014) results in 4 main groups, as shown in Table 6.

Next, combining the 3 criteria (commercial, technological proximity and technological convergence) the specialized diversification possibilities frontier can be obtained. Thus, Figure 3 summarizes the number of bidirectional combinations within the possibilities frontier, as well as multidirectional combinations resulting from considering commercial, technological proximity and technological convergence criteria.

Table 4: Related diversity groups regarding intersectoral commercial relationships.

GROUP	COMBINATION OF RIS3 PRIORITIES
Group 1	Tourism, culture and leisure (P4) + health and wellness (P5)
Group 2	Tourism, culture and leisure (P4) + ICT and digital economy (P8) + endogenous territorial assets (P3)
Group 3	Mobility and logistics (P1) + advanced transport industry (P2) + ICT and digital economy (P8)
Group 4	Agribusiness and healthy food (P6) + ICT and digital economy (P8) + Mobility and logistics (P1)
Team 5	Endogenous territorial assets (P3) + Renewable energy / energy efficiency (P7A) + ICT and digital economy (P8)
group 6	Sustainable construction (P7B) + ICT and digital economy (P8) + endogenous territorial assets (P3)

Source: Own elaboration from input-output tables (IECA)

Table 5: Related variety groups regarding technological proximities.

GROUP	COMBINATION OF RIS3 PRIORITIES
Group 1	Tourism, culture and leisure (P4) + ICT and digital economy (P8)
Group 2	ICT and digital economy (P8) + advanced transport industry (P2)
Group 3	renewable energy / energy efficiency (P7A) + Agribusiness and healthy food (P6)
Group 4	Health & Wellness (P5) + endogenous territorial assets (P3)
Team 5	Health & Wellness (P5) + Agribusiness and healthy food (P6)
group 6	Renewable energy / energy efficiency (P7A) + Endogenous territorial assets (P3)

Source: Own elaboration from input-output tables (IECA)

Table 6: Related variety groups by technological paths between 2014 and 1995.

GROUP	COMBINATION OF RIS3 PRIORITIES
Group 1	Mobility and logistics (P1) + Endogenous territorial assets (P3)
Group 2	Endogenous territorial assets (P3) + tourism, leisure and culture (P4) + health and wellness (P5) + Agribusiness and healthy food (P6) + Renewable energy / energy efficiency (P7a)
Group 3	Advanced transport industry (P2) + ICT and digital economy (P8)
Group 4	Health & Wellness (P5) + Agribusiness and healthy food (P6) + Renewable energy / energy efficiency (P7a)

Source: Own elaboration from input-output tables (IECA)

	P1	P2	P3	P4	P5	P6	P7A	P7B	P8
P1									
P2	C								
P3	T2								
P4			C T2						
P5			T1 T2	C					
P6	C		T2		T1 T2				
P7A			C T1 T2		T2	T1			
P7B			C						
P8	C	T1 T2	C	C T1		C		C	

Groups of priorities that meet only 1 criterion
Groups of priorities that meet 2 criteria
Groups of priorities that meet 3 criteria

Figure 3: Specialized diversification possibilities frontier for Seville.

Source: own compilation from the results commercial, technology and convergence criteria on specialized diversification

C: high potential of related diversity in terms of commercial relationships

T1: high potential of related diversity in terms of technological proximity

T2: high potential of related diversity in terms of technological convergence

Results

Sevilla case allows analyzing how in the metropolitan area of Seville, sectors linked to regional smart specialization represent 38.6% of total employment. Here, health and wellness priority, and tourism, culture and leisure priority account for over 50% of total employment within all smart specialization priorities in the metropolitan area.

In addition to employment data, in terms of exports, Sevilla has a higher level specialization than the regional average, that can be understood as a more productive and value-added activities than outside the city and metropolitan area.

Analysis shows also a high sectoral interdependence in Seville economy, with a high density of local economic networks as base to enhance specialized diversification. An important share of this density is located within each value chain, where the commercial transactions are more important. However, outside each value chain, the potential of sectoral hybridization is very high, especially among the priorities of the RIS3.

Finally, the list of possible specialized diversification opportunities in Sevilla and its metropolitan area shows around 25 combinations of sectors and priorities where entrepreneurial discovery initiatives could be developed.

Recommendations

This study aims to emphasize the importance of a broader concept known as "Smart Community" against the current concept of "Smart City", which has been limited to the application of ICT solutions in urban management.

Thus, the paper defines "Smart Community" as a limited local area where different agents (companies, R&D entities, public institutions and society) are involved in the definition and implementation of actions and projects directly related to the challenges of their community, and altogether seek for specialization and diversification opportunities to achieve a sustainable social and economic development.

The analysis and uses of techniques own of a RIS3 in a local context such as Seville, has demonstrated that the application of smart specialization model to local levels is feasible and, in turn, that can be used to contribute to specialization and diversification opportunities at regional level (especially when dealing with entrepreneurial discovery possibilities at regional level). This has made it possible to reaffirm the concept of "Smart Community", including aspects that are being excluded from the "Smart City" concept such as radical innovation through entrepreneurship, specialized diversification, and social capital and participative local governance.

Finally, this analysis has made it possible to specify the priorities of the RIS3 Andalusia in the case of Seville and its metropolitan area, in both current specialization strengths and future specialized diversification opportunities.

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