STYLIZED FACTS ON SMART SPECIALISATION RESEARCH

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ABSTRACT
Smart Specialisation has generated a paradigmatic change in regional innovation policies and the European Union has shown a strong interest in supporting research that investigates the developments of this new science-related topic. This paper helps to generate the intellectual capital necessary to support the European Union's project of Smart Specialisation. It explores the dynamic nature of scientific knowledge production dealing with Smart Specialisation by reporting on a bibliometric analysis of the first decade of literature relating to this emerging research field. This analysis captures a number of stylized facts on Smart Specialisation research and renders them in statistical properties which are instrumental in answering the following questions: (1) What is the total and annual production of scientific publications on Smart Specialisation and what are their characteristics in terms of type and influence; (2) How large is the community of researchers and organisations working in this field? (3) What is their influence and productivity? (4) What are the key knowledge producers? (5) What is the core literature published by the research community?
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1. INTRODUCTION

In order to accelerate the transition to a knowledge-based economy and society, in 2005, the European Commission set up the Knowledge for Growth (K4G) Expert Group: a group of European economists whose remit was to operate as an independent advisory body and provide recommendations on how to move Europe towards a competitive knowledge-based economy (European Commission - Directorate-General for Research 2008; Knowledge for Growth Expert Group 2007; 2009). The recommendations proposed by the Expert Group were published between 2005 and 2009 as a series of reports and policy briefs which advise on those policy challenges that the European Union needs to address to enable a competitive knowledge economy. These relate to: the deficit in R&D and innovation; the governance of science and technology systems; the globalisation of R&D; the interrelation between technology production and diffusion; and the relationship between higher education institutions and industry. In addition, these advisory documents also introduce the concept of Smart Specialisation, which emerges as a leading theory of the K4G Expert Group and is presented in the policy briefs from Foray and Van Ark (2007) and Foray et al. (2009).

The K4G Expert Group suggests Europe is losing its position as one of the main centre for research and innovation. Creating European-based global R&D hubs that are able to compete with foreign hubs and attract more research capacities and knowledge resources is the solution proposed by the Expert Group (European Commission - Directorate-General for Research 2008). However, this requires regions across Europe to engage in the so-called Smart Specialisation process, which implies the identification and development of the most promising research and innovation domains. These research and innovation domains are considered as being "areas of specialisation" that can best support the growth of the regional economy (Foray et al. 2009). The concept of Smart Specialisation has generated a paradigmatic change in regional innovation policies and the European Union has shown a strong interest in supporting research that investigates the development of this new science-related topic. This paper helps to generate the intellectual capital necessary to support the European Union's project of Smart Specialisation. It explores the dynamic nature of scientific knowledge production dealing with Smart Specialisation by reporting on a bibliometric analysis of the first decade of literature belonging to this emerging field of research. In presenting the results as a set of stylized facts, this analysis captures the statistical properties which are instrumental in answering the following questions:

- What is the total and annual production of scientific publications on Smart Specialisation and what are their characteristics in terms of type and influence;
- How large is the community of researchers and organisations working in this research area?
- What is their influence and productivity?
- Who are the key knowledge producers?
- What is the core literature published by the research community?

This bibliometric analysis combines the count of publications, authors, organisations and citations and is undertaken by considering the scientific literature dealing with Smart Specialisation published between 2005 and 2016[1]. The raw data necessary to perform the analysis was extracted from this group of publications, which are the source documents of this bibliometric study (Small and Crane 1979; Shiau and Dwivedi 2013). Overall, the findings of this study provide researchers working in the field of Smart Specialisation with a comprehensive picture of their research area and a more extensive understanding of how its intellectual structure is currently being shaped.

2. METHODOLOGY

The following metrics are deployed in order to address the research questions.

2.1. Metric 1: Author and organization count

Authors' full names were extracted in each source document, together with their affiliations, which are grouped in four categories: (1) University; (2) Business; (3) Government; (4) Other. This activity makes it possible to build the community of researchers and organisations working in the field of Smart Specialisation, analyse its overall structure, and compare the distribution of authors and organisations across different geographic regions.

2.2. Metric 2: Publication count

This productivity metric is used to measure and compare the scientific output at any level of aggregation (author, organisation and country). During the count, publications that are

[1] The literature search was conducted in February 2017 by using Web of Science and Scopus and produced. This search produced 274 results, which can be grouped in five main categories: Books (4); Book chapters (8); Conference papers (58); Articles published in scholarly journals (128); Other (7).

produced by multiple entities are split and each entity is assigned an equal share. This means that a publication is only counted once, even when it is co-authored by several authors, organisations and countries.

2.3. Metric 3: Citation count

This impact metric is used to compare the influence of authors, organisations and countries working in the field of Smart Specialisation. The influence of each entity is measured by counting the number of citations that its source documents have received from other source documents[2]. As in the case of the publication count, where the source document is authored by two or more entities, the total number of citations it has received is divided equally and each entity is assigned an equal share. The citation count is also used to identify the core documents, i.e. those publications which have obtained the highest number of citations from other publications in the group. Core documents represent the main cognitive nodes of the research field they represent (Glanzel and Thijs 2011; Meyer et al. 2014).

3. RESULTS OF THE BIBLIOMETRIC ANALYSIS

3.1. Knowledge production

The data related to both the annual count and the cumulative growth of source documents shows research on Smart Specialisation begins in 2011 (see Table 1), with three publications discussing this new science-related topic. The first one is a conference paper describing the user-driven and open innovation model promoted by TestLab, a living lab created by the Italian Province of Trento, in collaboration with the European Network of Living Labs. Drawing on this experience, the paper suggests the living lab methodology generates "a mechanism of bottom-up Smart Specialisation, whereby regional priorities can be determined by the willingness of local actors to join forces and strive for common goals" (Ferrari et al. 2011: 332). The second publication is a journal article from Di Anselmo and Lo Cascio (2011), which discusses the challenges posed by the recent economic crisis, highlighting the need for smarter forms of policymaking able to support innovation at the regional level by means of public investments. The authors go on to suggest that the Smart Specialisation process is an effective tool for meeting this aim, because it supports the establishment of new and sustainable regional development paths that provide for "a selective use of resources" and concentration of investments "in a narrower range of measures which offer better returns". This allows to move away from a deregulated provision (Di Anselmo and Lo Cascio 2011: 468). Finally, the third publication reports on a study aimed at supporting the Smart Specialisation process in Cape Town by explaining how this European concept can be exported to South Africa (Lorentzen et al. 2011).

Table following on the next page

[2] Citation data is extracted manually by analyzing the references from each source document

YEAR	PUBLICATIONS		AUTHORS	
	Annual count	Cumulative Growth	Annual count	Cumulative Growth
2005	0	0	0	0
2006	0	0	0	0
2007	0	0	0	0
2008	0	0	0	0
2009	0	0	0	0
2010	0	0	0	0
2011	3	3	9	9
2012	3	6	9	18
2013	22	28	47	65
2014	53	81	93	158
2015	54	135	112	270
2016	70	205	125	395

Table 1: Annual count and cumulative growth of publications and authors

These publications open up a scientific debate that has grown steadily over the years, notably between 2014 and 2016, a period in which 86% of the available literature on Smart Specialisation is published. This literature is mainly produced in Europe (93.0%), where universities are the most active organisations. Universities contributed 69.9% of the publications under consideration (corresponding to approximately 144 of the 205 source documents), while businesses, governments and other institutions belonging to European countries only account for 23.1% of the publication volume. The top universities for publication output are found in Italy, which has the highest level of production (15.4%), followed by Poland (8.9%), Spain (8.5%), United Kingdom (7.4%), Netherlands (6.8%), Lithuania (5.2%), Latvia (4.9%) and Romania (4.9%). In contrast, Cyprus (0.2%), Serbia (0.4%), Ukraine (0.5%), France (0.5%), Norway (0.5%), Slovenia (0.6%), Malta (0.7%), Bulgaria (1.0%) and Portugal (1.0%) follow a different path. With a total publication output lower than or equal to two source documents, they have the lowest level of involvement amongst all the European countries conducting research in the field of Smart Specialisation (see Table 2).

COUNTRY	% AUTHORS					% ORGANISATIONS					% PUBLICATIONS					% CITATIONS				
	U	B	G	O	Tot	U	B	G	O	Tot	U	B	G	O	Tot	U	B	G	O	Tot
EUROPE	**64.8**	**7.6**	**11.6**	**6.1**	**90.1**	**59.3**	**8.8**	**12.3**	**6.9**	**87.3**	**69.9**	**5.3**	**10.9**	**6.9**	**93.0**	**82.0**	**3.5**	**6.2**	**7.2**	**98.8**
Belgium	0.5	0.8	0.8	0.0	2.0	0.5	1.0	1.0	0.0	2.5	0.5	0.7	0.9	0.0	2.1	1.3	1.7	1.5	0.0	4.5
Bulgaria	1.0	0.0	0.0	0.0	1.0	1.5	0.0	0.0	0.0	1.5	1.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
Croatia	0.3	0.5	1.8	0.5	3.0	0.5	0.5	2.5	0.5	3.9	0.5	0.5	1.1	0.3	2.4	0.0	0.0	0.0	0.0	0.0
Cyprus	0.3	0.0	0.0	0.0	0.3	0.5	0.0	0.0	0.0	0.5	0.2	0.0	0.0	0.0	0.2	0.6	0.0	0.0	0.0	0.6
Czech Republic	1.8	0.0	0.0	0.0	1.8	1.5	0.0	0.0	0.0	1.5	1.4	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.0
Denmark	1.0	0.0	0.0	0.0	1.0	1.5	0.0	0.0	0.0	1.5	1.1	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0
Estonia	2.8	0.0	0.0	0.3	3.0	1.0	0.0	0.0	0.5	1.5	2.2	0.0	0.0	0.4	2.6	0.8	0.0	0.0	0.2	1.0
Finland	4.1	0.3	0.5	0.0	4.8	3.4	0.5	1.0	0.0	4.9	2.6	0.1	0.3	0.0	3.0	0.6	0.0	0.0	0.0	0.6
France	0.5	0.0	0.0	0.0	0.5	1.0	0.0	0.0	0.0	1.0	0.5	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0
Germany	1.5	1.3	0.0	0.5	3.3	2.0	1.5	0.0	0.5	3.9	0.9	0.6	0.0	1.2	2.7	0.0	0.3	0.0	4.0	4.3
Greece	1.3	0.3	0.3	0.3	2.0	1.5	0.5	0.5	0.5	2.9	1.2	0.2	0.2	0.5	2.2	0.6	0.0	0.0	0.0	0.6
Hungary	1.3	0.0	0.3	0.0	1.5	1.5	0.0	0.5	0.0	2.0	1.1	0.0	0.2	0.0	1.3	0.0	0.0	0.0	0.0	0.0
Ireland	1.0	0.0	0.3	0.0	1.3	0.5	0.0	0.5	0.0	1.0	1.0	0.0	0.5	0.0	1.5	0.0	0.0	0.0	0.0	0.0
Italy	11.1	1.8	1.5	0.3	14.7	9.3	1.5	1.5	0.5	12.7	12.0	1.3	2.0	0.2	15.4	18.7	0.0	0.7	0.0	19.4
Latvia	3.3	0.0	0.0	0.5	3.8	2.5	0.0	0.0	0.5	2.9	4.7	0.0	0.0	0.2	4.9	0.3	0.0	0.0	0.0	0.3
Lithuania	3.0	0.8	0.3	0.5	4.6	1.0	1.0	0.5	0.5	2.9	3.3	0.7	0.7	0.5	5.2	0.3	1.3	0.6	0.0	2.2
Malta	0.3	0.0	1.0	0.0	1.3	0.5	0.0	1.0	0.0	1.5	0.2	0.0	0.5	0.0	0.7	0.0	0.0	0.8	0.0	0.8
Netherlands	2.5	0.0	0.3	0.5	3.3	2.5	0.0	0.5	1.0	3.9	6.2	0.0	0.2	0.4	6.8	33.1	0.0	0.7	0.1	33.9
Norway	0.3	0.0	0.0	0.0	0.3	0.5	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0	0.5	0.3	0.0	0.0	0.0	0.3
Poland	5.1	0.3	1.5	0.3	7.1	3.4	0.5	1.5	0.5	5.9	7.4	0.2	1.1	0.2	8.9	1.2	0.0	0.0	0.0	1.2
Portugal	1.0	0.0	0.0	0.3	1.3	1.0	0.0	0.0	0.5	1.5	0.8	0.0	0.0	0.2	1.0	0.0	0.0	0.0	0.0	0.0
Romania	4.6	0.0	0.5	0.0	5.1	4.4	0.0	1.0	0.0	5.4	3.9	0.0	1.0	0.0	4.9	0.0	0.0	1.0	0.0	1.0
Serbia	0.8	0.0	0.0	0.0	0.8	0.5	0.0	0.0	0.0	0.5	0.4	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0
Slovakia	2.5	0.0	0.0	0.0	2.5	2.0	0.0	0.0	0.0	2.0	2.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0
Slovenia	1.3	0.0	0.0	0.0	1.3	1.0	0.0	0.0	0.0	1.0	0.6	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0
Spain	3.3	1.0	2.8	2.0	9.1	3.4	1.0	0.5	1.0	5.9	3.1	0.5	2.2	2.7	8.5	0.7	0.0	1.0	3.0	4.6
Sweden	1.8	0.0	0.0	0.0	1.8	1.0	0.0	0.0	0.0	1.0	1.7	0.0	0.0	0.0	1.7	8.3	0.0	0.0	0.0	8.3
Switzerland	0.5	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0	0.5	2.0	0.0	0.0	0.0	2.0	12.2	0.0	0.0	0.0	12.2
Ukraine	0.5	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0
United Kingdom	5.8	0.8	0.0	0.3	6.8	8.8	1.0	0.0	0.5	10.3	6.8	0.4	0.0	0.2	7.4	3.1	0.2	0.0	0.0	3.3
OTHER	**7.1**	**0.0**	**2.3**	**0.5**	**9.9**	**9.8**	**0.0**	**2.0**	**1.0**	**12.7**	**5.3**	**0.0**	**1.5**	**0.2**	**7.0**	**1.2**	**0.0**	**0.0**	**0.0**	**1.2**
Australia	2.5	0.0	0.3	0.0	2.8	2.5	0.0	0.5	0.0	2.9	1.1	0.0	0.2	0.0	1.3	0.0	0.0	0.0	0.0	0.0
Canada	0.5	0.0	0.3	0.5	1.3	1.0	0.0	0.5	1.0	2.5	0.2	0.0	0.2	0.2	0.7	0.0	0.0	0.0	0.0	0.0
China	0.3	0.0	0.0	0.0	0.3	0.5	0.0	0.0	0.0	0.5	0.2	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
Israel	0.3	0.0	0.0	0.0	0.3	0.5	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0
Kazakhstan	0.0	0.0	0.8	0.0	0.8	0.0	0.0	0.5	0.0	0.5	0.0	0.0	0.5	0.0	0.5	0.0	0.0	0.0	0.0	0.0
Mexico	0.5	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0	0.5	0.3	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0
Russia	1.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	1.0	0.8	0.0	0.0	0.0	0.8	0.2	0.0	0.0	0.0	0.2
South Africa	0.0	0.0	1.0	0.0	1.0	0.0	0.0	0.5	0.0	0.5	0.0	0.0	0.5	0.0	0.5	0.0	0.0	0.0	0.0	0.0
United States	2.0	0.0	0.0	0.0	2.0	3.9	0.0	0.0	0.0	3.9	2.2	0.0	0.0	0.0	2.2	0.9	0.0	0.0	0.0	0.9
TOTAL	**71.9**	**7.6**	**13.9**	**6.6**	**100.0**	**69.1**	**8.8**	**14.2**	**7.8**	**100.0**	**75.2**	**5.3**	**12.4**	**7.1**	**100.0**	**83.1**	**3.5**	**6.2**	**7.2**	**100.0**

Table 2: Publications, organisations, authors and citations by country and organization type. U: University; B: Business; G: Government; O: Other

3.2. Workforce

In the period between early 2005 and late 2016, the scientific community conducting research on Smart Specialisation is composed of 395 researchers from 204 organisations, which are located in 40 different countries. Table 1 shows the progressive growth of this community, in which the number of active researchers has increased annually, together with the number of source documents. The data in Table 2 suggests these authors work mainly for European-based organisations (90.1%), where universities have the highest share of authors (64.8%). They also show that the percentage of researchers from businesses (7.6%) and governmental institutions (11.6%) reflects the low level of production of both sectors. In addition to having the highest volume of output, Italy is also the country with the highest number of active researchers (14.7%). This positive correlation between workforce and publication output is found in the majority of the most productive countries, where the percentage of researchers working in the field of Smart Specialisation is comprised of between 3.3% and 9.1%: Spain (9.1%); Poland (7.1%); United Kingdom (6.8%); Romania (5.1%); Lithuania (4.6%); Latvia (3.8%); and Netherlands (3.3%). Germany, Finland, Croatia and Estonia are the only countries which display a reverse trend where despite the workforce being similar to the most productive countries, the production of literature is markedly lower (see Table 2).

3.3. Influence

Looking at the share of citations that each country has obtained during the period under investigation, it is evident that research on Smart Specialisation is mainly driven by European countries and their universities. Together, these 30 active countries account for about 98.8% of the 303 total citations obtained by the source documents, and their universities have received the highest share (82.0%). Only 16.9% of citations are related to the research activities conducted by governmental organisations, the business sector and civic organisations (see Table 2). Moreover, by comparing the data on both influence and publication output, the following insights emerge, which make it possible to split the European countries conducting research on Smart Specialisation into four clusters:

- 18 of the 30 European countries have a very limited or no influence in the field of Smart Specialisation and this lack results from the low level of publication output. These countries are Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Ireland, Malta, Norway, Portugal, Serbia, Slovakia, Slovenia and Ukraine (Cluster 1);
- Despite the high level of publication output, Latvia, Lithuania, Poland and Romania's influence is moderate (Cluster 2);
- Belgium, Germany, Sweden and Switzerland (Cluster 3) are among the most influential countries in the field of Smart Specialisation. However, they leverage a far lower number of publications compared to Spain, Italy, Netherlands and the United Kingdom (Cluster 4), which are the top countries for both research output and influence.

The results of the analysis suggest that Belgium, Germany, Spain, Sweden, Switzerland, Italy, Netherlands and the United Kingdom can be considered as the main regional knowledge hubs in the field of Smart Specialisation. The eight knowledge hubs are mapped in Figure 1, along with the key knowledge producers, which are listed as the top 15 organisations for number of citations. It is not surprising that most of these knowledge producers are in the regional knowledge hubs, where research is mainly driven by universities: Politecnico di Milano and Università Politecnica delle Marche in Italy; University of Groningen and Utrecht University in the Netherlands; Lund University in Sweden; Ecole Polytechnique Federale de Lausanne in Switzerland; University of Antwerp in Belgium; and Cardiff University in the United Kingdom. The list of key knowledge producers also includes: the non-governmental institutions

Fraunhofer Institute for Systems and Innovation Research and Orkestra - Basque Institute of Competitiveness, located in Germany and Spain respectively; the European Commission and one of its Joint Research Centre; the Brussels' office of the consultancy Technopolis Group; the Institute of National Economy in Romania; and Visionary Analytics in Lithuania.

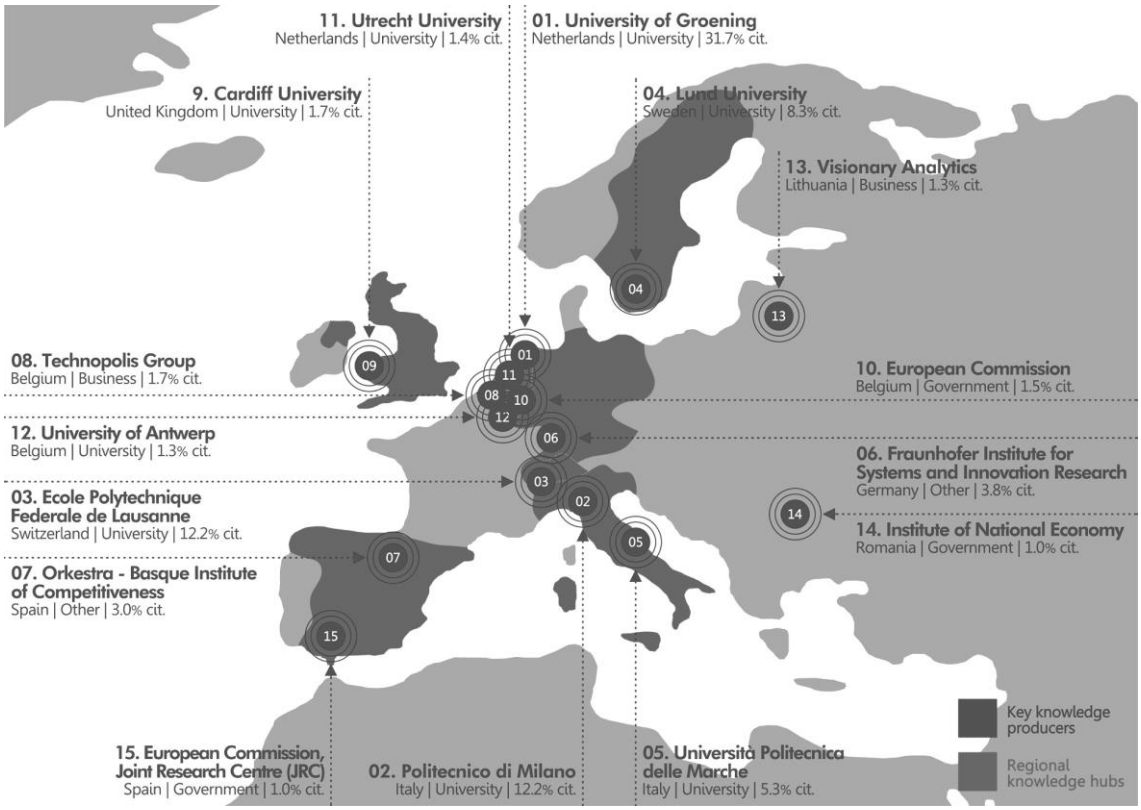

Figure 1: Regional knowledge hubs and key knowledge producers

3.4. Core documents

With 43 citations, McCann and Ortega-Argilés (2015) is the most cited publication (see Table 3). This journal article explains the origins of the Smart Specialisation concept and examines the rationale behind the policy-prioritization logic and the place-based approach to regional development it promotes. This serves to highlight "the critical role of knowledge diffusion processes between sectors, activities and occupations, and explicitly avoids automatically prioritizing high-technology sectors by taking a broader systems perspective" (McCann and Ortega-Argilés 2015: 1293). The discussion on Smart Specialisation that McCann and Ortega-Argilés offer in this publication is expanded by way of three additional articles which they subsequently co-authored. These articles explore the developments relating to regional innovation policy by reviewing the literature that international development institutions such as World Bank, OECD and European Commission have produced in recent years. These include Smart Specialisation, which is described as a policy prioritisation agenda for regional innovation policy that results from the adaptation of the debate on non-spatial innovation policy to the European Cohesion Policy (McCann and Ortega-Argilés 2013a; 2013b; 2014).

Table following on the next page

REFERENCE	YEAR	TYPE	AUTHORS AND AFFILIATIONS	N° OF CITATIONS
McCann and Ortega-Argiles 2015	2013	Journal Article	McCann, P.; Ortega-Argiles, R. [University of Groningen, Netherland]	43
Boschma 2014	2014	Journal Article	Boschma, R. [Lund University, Sweden; Utrecht University, Netherland]	24
Foray 2015	2015	Book	Foray, D. [Ecole Polytechnique Federale de Lausanne, Switzerland]	18
McCann and Ortega-Argiles 2014	2014	Journal Article	McCann, P.; Ortega-Argiles, R. [University of Groningen, Netherland]	17
Camagni and Capello 2013	2013	Journal Article	Camagni, R.; Capello, R. [Politecnico di Milano, Italy]	15
McCann and Ortega-Argiles 2013a	2013	Journal Article	McCann, P.; Ortega-Argiles, R. [University of Groningen, Netherland]	13
Iacobucci 2014	2014	Journal Article	Iacobucci, D. [Università Politecnica delle Marche, Italy]	13
Coffano and Foray 2014	2014	Journal Article	Coffano, M.; Foray, D. [Ecole Polytechnique Federale de Lausanne, Switzerland]	12
Kroll 2015	2015	Journal Article	Kroll, H. [Fraunhofer Institute for Systems and Innovation Research, Germany]	10
McCann and Ortega-Argiles 201b	2013	Journal Article	McCann, P.; Ortega-Argiles, R. [University of Groningen, Netherland]	10
Capello 2014	2014	Journal Article	Capello, R. [Politecnico di Milano, Italy]	10
Camagni et al. 2014	2014	Journal Article	Camagni, R.; Capello, R.; Lenzi, C. [Politecnico di Milano, Italy]	10

Table 3: Core literature

Along with Iacobucci (2014), Kroll (2015), Foray (2015) and Capello (2014), these publications capture what is known about the concept of Smart Specialisation. In capturing this knowledge, they also suggest the practical aspects related to the design and implementation process of strategies for Smart Specialisation remains at an early stage of development and a number of critical issues are still open. As Capello (2014: 5) points out: "no definitive view on the concept has so far been reached, and the challenges, strengths and risks associated with the best design and implementation of the Smart Specialisation strategy are still much debated". Camagni et al. (2014) and Camagni and Capello (2013) contribute to the debate with two articles that support the general philosophy behind the Smart Specialisation concept, but which also criticize its direct application in regional development policies. As with McCann and Ortega-Argilés (2015), these authors suggest the Smart Specialisation approach "looks highly valuable, appropriate and a good starting point for further reflections" (Camagni and Capello 2013: 361), however, the sectoral and non-spatial logic from which it emerges "ignores the variability of regional innovation paths, [which] strongly depend on territorial elements rooted in the local society, its history, its culture and its typical learning processes" (Camagni et al. 2014: 72). According to these authors, this calls for a new "rationale for a regionalized conception, design and delivery of innovation policies based on a territorial taxonomy", that their articles outline. This taxonomy is proposed to facilitate the development of "common approaches for similar types of regions [and] prevent [any] misallocation of public resources and unlikely local strategies" (Camagni and Capello 2013: 357). The remaining core literature: (1) focuses attention on the complementary relationship between Smart Specialisation and Constructing Regional Advantage, two policy concepts which have attracted much attention at the European level, and "provides important inputs to develop a smart and comprehensive policy design that avoids rent-seeking behaviour of vested local stakeholders but instead focuses on true economic renewal in regions" (Boschma 2014: 64); (2) combines the data obtained from two questionnaire-based online surveys and a range of qualitative interviews with policy makers to gain deeper insights into the implementation processes of strategies for Smart Specialisation in

European regions (Kroll 2015); (3) explains the centrality of the entrepreneurial discovery process that drives the bottom-up and decentralized logic of Smart Specialisation (Coffano and Foray 2014).

4. DISCUSSION AND CONCLUSION

The results of the bibliometric analysis show that research on Smart Specialisation has increased steadily since the publication of the K4G Expert Group's policy recommendations, leading to the progressive development of a new and emerging research field in which the number of authors and scientific publications have grown exponentially. The first scientific publications dealing with Smart Specialisation date back to 2011, however, most of the literature belonging to this research field is published between 2014 and 2016. This three-year period accounts for about 86% of the 205 publications produced during the first decade of research. The community of researchers working in this field has expanded following a similar growth path: the 9 authors publishing in 2011 become 65 in 2013 and 395 at the end of 2016.

The production of the policy briefs that introduces the concept of Smart Specialisation in 2005 and the distribution of the first peer-reviewed publications in 2011 can be considered as two milestones in the development process of this research field. The growth in the number of active researchers and publications characterising the period between 2014 to 2016 represents the third milestone and is anticipated by relevant developments in the European Union's legislative framework. A new Regulation is formally endorsed by the Council of the European Union in December 2013, which lays down a set of common rules for governing the European Structural and Investment Funds during the period 2014-2020 (European Commission 2014). This new legislative framework provides a definition of Smart Specialisation strategies as: "the national or regional innovation strategies which set priorities in order to build competitive advantage by developing and matching research and innovation own strengths to business needs in order to address emerging opportunities and market developments in a coherent manner, while avoiding duplication and fragmentation of efforts". It also introduces the existence of a national or regional Smart Specialisation strategy as a thematic ex ante conditionality that all the Member States have to comply with in order for the European Commission to provide them with funds for research and technological development (European Union 2013). This new legislative framework has triggered the scientific debate on Smart Specialisation, which is led by European countries. The results of this study show that 93% of the literature on Smart Specialisation is produced in Europe, where universities are the most active organisations, with an overall publication output of 70%. European countries and their higher education institutions also account for the main share of available workforce and citations. Around 90% of authors work for European organisations and their publications have obtained 99% of the total citations. With 65% of the authors and 82% of all citations, universities have the highest share of both these measures. Europe is also where the regional knowledge hubs on Smart Specialisation are found. These include Belgium, Germany, Spain, Sweden, Switzerland, Italy, Netherlands and the United Kingdom. Currently, 13 of the 15 top organisations for number of citations are based in the regional knowledge hubs, where the research is mainly driven by the following universities: University of Groningen; Ecole Polytechnique Federale de Lausanne; Politecnico di Milano; Lund University; Università Politecnica delle Marche; Cardiff University; Utrecht University; and University of Antwerp.

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