Mapping the Field of Smart Specialisation and Regional Innovation Strategy Literature – A Bibliometric Analysis

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Abstract:

Purpose: The purpose of the article was to determine and map the field of smart specialisation (SS) and regional innovation strategy (RIS) literature.

Design/Methodology/Approach: The longitudinal bibliometric analysis of the SS and RIS literature based on extensive examination of publications indexed in the Scopus database was conducted. The timespan of the analysis covered the years 1991-2020. The quantity, quality and structural bibliometric indicators were applied. Using the VOSviewer software tool the network analyses were performed and major clusters of the SS and RIS research were determined.

Findings: The conducted analysis made it possible to indicate the most productive authors, sources, organisations and countries in the analysed scientific field. The most popular research topics and subject areas, the most influential research channels and impact from authors, sources, countries in the SS and RIS literature were indicated. Moreover, it was recognised how the SS and RIS publications are clustered.

Practical Implications: Determination of sources with the highest productivity and citations can be used by potential authors of publications to adopt an appropriate publication strategy. The information about the most active countries and organisations and the most influential authors may constitute the valuable basis for establishing future collaboration. The analysis results can also be useful for decision-makers in regions by indicating the most influential publications in terms of the SS and RIS development and implementation.

Originality/Value: There is a paucity of research presenting the bibliometric analysis of the SS and RIS literature. This article comprises an up-to-date comprehensive analysis of this domain and enriches the understanding of its existing patterns and trends.

Keywords: smart specialisation, regional innovation strategy, bibliometric analysis.

Paper Type: Research article.

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1. Introduction

In the early 1990's growing gaps between the economic performance of European regions prompted policy makers to find a practical way to approach this problem. It was argued that these differences were due to the inadequate intensity of the innovation effort and its poor adaptation to the specific needs and conditions in the less developed regions. It was suggested for such regions to develop Regional Innovation Strategy (RIS) to design new ways of introducing technological innovation in the regional economic development agenda (Landabaso, 1997).

In 1994 first pilot projects in this field were launched to develop regional innovation processes and provide a framework for a more optimal strategy for future regional investments in research and technological development initiatives (Morgan, 1997). It must be noted that since the 1990's, especially since the financial crisis of 1997, developing RIS has also become an important policy issue out of European Union (Cheung, 1991; Park, 2001).

During next years the RIS exercises have been more or less continuously revised and refreshed which resulted in the appearance of the concept of Research and Innovation Strategies for Smart Specialisation (RIS3) (Foray, 2014). The concept of Smart Specialisation (SS) very quickly made a significant impact on the European policy and relevant strategic documents, including 'Europe 2020 Flagship Initiative Innovation Union' and 'Regional Policy contributing to smart growth in Europe 2020'.

Moreover, SS became a key vehicle for ensuring Cohesion Policy's contribution to the Europe 2020 agenda and was proposed as an ex-ante conditionality for the allocation of structural funds.

Considering the SS and RIS literature, in general, after the publication of the first policy briefs, these concepts started to move out from the grey literature (i.e. published without academic peer-review process) and enter the scientific publishing system, opening up a new research field (Mora *et al.*, 2019). The dynamically growing number of publications in this field tend to be very centred on either the process of designing RIS and SS or on their implementation (Lopes *et al.*, 2019), including identification of weaknesses and emerging bottlenecks in these processes and possible solutions to overcome such problems (Capello and Kroll, 2016). In addition, during last years the move from theory to practice is noticeable.

However, it must be noted that many statements and arguments about SS were not based on a sound base of empirical work which caused gap between the policy practice and the theory (Foray *et al.*, 2011). There are multiple scientific paradigms on which regional innovation processes have been drawn, e.g., economic geography, evolutionary geography, evolutionary theory of innovation, neo-Schumpeterian theories on local development (Capello and Lenzi, 2013).

Nevertheless, the theoretical foundations of this domain still remain scarce and no definitive view on these concepts has so far been reached. Therefore, there is still space for academic interpretation and discussion on most issues related to efficient design and implementation of SS (Capello, 2014).

There is a paucity of research presenting the results of bibliometric analysis in the field of the SS and RIS literature. In addition, the existing studies are focused on selected issues, e.g. productivity of publications, authors, organisations and citations (Mora *et. al,* 2019), co-citation analysis (Fellnhofer, 2018) or they are based on very limited number of publications included in the analysis (Lopes *et al.*, 2019). Moreover, the timespan of the latest of these studies was limited up to 2016. This undoubtedly needs expansion and updating due to the significant increase in the number of the SS and RIS publications.

Therefore, this paper presents comprehensive and longitudinal bibliometric analysis of the SS and RIS literature based on systematic examination of patterns and trends of research in this field. The Scopus database was used for an extensive search of relevant literature items from multiple perspectives.

Three types of bibliometric indicators were applied: quantity indicators (for measuring productivity), quality indicators (for measuring the impact), and structural indicators (for measuring the connections) (Durieux and Gevenois, 2010). A network analysis (i.e. co-keyword analysis, co-authorship analysis, and citation networks analysis) was also performed, and major clusters of the SS and RIS research were determined.

The research results presented in this paper are expected to enable academics and practitioners, including decision makers developing and implementing RIS3: (1) to indicate the most productive authors, sources, organisations and countries in the analysed scientific field, (2) to determine the most popular research topics and subject areas, the most influential research channels and impact from authors, sources, countries in the SS and RIS literature, (3) to recognise how the SS and RIS publications are clustered, and (4) to indicate potential publication strategies in this domain.

The remainder of the paper is organised as follows. Section 2 includes literature review which constitutes a theoretical basis for the conducted research. The research methodology is described in Section 3. The results and discussion of the bibliometric analysis are presented in Section 4. The last section indicates final conclusions and limitations of this study.

2. Literature Review

Three decades ago, the RIS emerged as a promising solution for inadequate intensity of the innovation effort by the public and private sector, in particular in the less

developed regions. The aim of RIS was to encourage public-private and inter-firm cooperation and creating the institutional conditions for a more efficient use of scarce public and private resources for the promotion of innovation (Landabaso, 1997). This means that RIS was to be designed and implemented to address the gap that existed between public innovation supports and the real needs of companies and innovators. At first, the significance of RIS was dismissed by critics who argued that it offered little or no prospect of alleviating problems such as mass unemployment and social exclusion. However, RIS could not resolve these problems because it was not designed to do so (Morgan, 1997).

Several years of experience with RIS exercises in the European regions have resulted in the new concept named the RIS3 (Foray, 2014). This is integrated, place-based economic transformation agenda that focuses policy support and investments on key priorities, challenges and needs for knowledge-based development; builds on strengths, competitive advantages and potential for excellence; supports technological as well as practice-based innovation and aim to stimulate private sector investment; gets *stakeholders* fully involved and encourage innovation and experimentation; and is evidence-based and include sound monitoring and evaluation systems (EC, 2012).

The idea of SS was originated in the literature analysing the key factors which underpinned the increasing productivity gap between the United States and Europe in 1990's (McCann and Ortega-Argilés, 2015). However, the SS concept as a driving force behind the RIS3 was conceived around 2009 in Knowledge for Growth Expert Group (Foray, 2014). In 2010 the Europe 2020 strategy was established and a wide range of activities have been necessary to underpin its priorities.

In order to manage this challenge 'Innovation Union' flagship initiative was developed and it highlighted the SS concept as a way to achieve the main Europe 2020 strategy goals. The SS has also been promoted by 'Regional Policy contributing to smart growth in Europe 2020' that encouraged RIS3 as a mean to deliver a more targeted ERDF support, i.e. every EU member state and region was obliged to develop RIS3 in order to qualify for structural funding in the 2014-2020 period.

The SS concept does not aim at improving general framework conditions and capabilities, it concentrates resources and is focused on specific technological fields and group of firms in desirable areas for innovation policy interventions. The main goal of such a policy is to concentrate resources on the development of those activities that are likely to effectively transform the existing economic structures through R&D and innovation (Foray, 2014).

The SS concept introduced at least two main novelties (D'Adda *et al.*, 2020). The first is the emphasis on the 'entrepreneurial discovery process'. This means that 'smart' in the SS approach refers to the identification of domains of competitive

advantage through the 'entrepreneurial discovery' (Asheim, 2019), an accumulative process that bridges present with future strengths of a regional economy in a particular activity and knowledge domain and is based on a bottom up approach in the identification of the specialisation fields.

The second novelty is that regions are required to identify technological domains rather than industry sectors. The SS is not about 'specialisation' as known from previous regional strategies, i.e. a Porter-like cluster strategy, but about diversified specialisation. Targeting technological domains instead of specific industries is expected to enhance product innovation and diversification by creating and implementing new technologies (Asheim, 2019; D'Adda *et al.*, 2020; McCann and Ortega-Argilés, 2019).

Regardless of the undeniable advantages of the SS concept, it should be mentioned that the concept has furthermore come in for criticism. For example, Hassink and Gong (2019) formulated six critical topics which are the examples of issues which deserve attention in the future exploration. The basis for this article was the assumption that mapping the field of the SS and RIS literature based on comprehensive bibliometric analysis will make it possible to enhance the understanding of patterns and trends in this area and it will facilitate unlocking interesting research in the analysed domain.

3. Materials and Methods

Mapping the field of the SS and RIS was developed using bibliometric analysis (Janik *et al.,* 2020). The analysis included the SS and RIS publications collected in the Scopus database. This database was selected because it is a well-known academic database that provides reliable and the most relevant information on scientific work enabling users to explore the results of global research in many research areas.

The bibliometric analysis presented in this article was carried out comprising the following phases: (1) data collection, (2) initial data analysis, (3) descriptive bibliometric analysis, (4) network analyses, (5) drawing conclusions.

The first phase of the study involved data collection. The data was retrieved on 15th June 2020 from the Scopus database. To conduct an in-depth analysis of the structure of knowledge and research in the field of SS and RIS, the following query wordings were selected: 'Smart Specialisation', 'Smart Specialisation Strategy', 'Regional Innovation Strategy', 'Research and Innovation Strategy for Smart Specialisation' and 'RIS3'.

Both American and English spellings, as well as singular and plural of individual query words were taken into account. All query wordings were then used to identify the publications indexed in Scopus, which include these words in the title, abstracts

and keyword lists (TITLE-ABS-KEY). It should be stated that no restrictions for languages, document types and timespan were imposed to filter the results. The use of searched query wordings in conjunction with the Boolean operator 'OR' allowed to indicate 630 publications. The timespan of analysis was narrowed to 1991-2020 due to the fact that the first publication in the analysed area appeared in 1991.

In the second phase of study, the initial data analysis was performed. The title and abstract of each publication were checked in order to identify if the publications were relevant to this study. When the title and abstract were not sufficiently clear, an attempt was made to access the whole text of the publication to read. In addition, taking into account that the data extracted from scientific databases contained errors (Mora, 2019), the collected data was checked for accuracy and, if necessary, changed in relation to information obtained from the full texts of source documents or information on the publisher's website. Finally, 612 records were selected for the detailed bibliometric analysis.

In the next phase, the collected data was subject to a descriptive bibliometric analysis. To show trends in the development of the SS and RIS literature, the number of publications and the total number of citations that were published in 1991-2020 were determined. In addition, the main research areas, the most prolific authors, sources, organisations and countries publishing relevant scientific works were identified.

In the fourth phase of the study, a network analyses were performed. These analyses were conducted using the VOSviewer (version 1.6.15) software tool supporting creation of networks composed of many elements based on a distance-based visualisation approach. The created networks consist of nodes (representing keywords, countries or sources) and lines (representing the relationships between items – co-occurrence, co-authorship or mutual citation). The node (represented by circle) size depends on the number of occurrences or number of documents. The more documents or occurrences, the bigger the circle. The width of the line depends on the link strength between connected items.

Due to the large number of analysed items and linked data, the Lin/Log modularity normalisation method was chosen to determine the strength of the links between items. The application of this technique is described in detail by Newman (2004). The nodes are grouped into clusters (each node is assigned to exactly one cluster). The clustering technique used by VOSviewer was discussed by Van Eck and Waltman (2014).

The network analyses were divided into two parts: (1) Keyword and co-keyword analyses; (2) Scientific collaboration mapping. Keyword and co-keyword analyses are methods of describing and visualising the structure of scientific fields of a particular group of publications (Zhang *et al.*, 2016). The level of scientific collaboration is measured, among others, by co-authorship and citation network

analyses (Eck and Waltman, 2014).

Therefore, scientific collaboration was mapped and analysed using the results of the co-authorship network of countries and the citation network of sources. It was assumed that the networks would contain an optimum range of information to make the network legible and draw attention to its most significant elements, relations and structures. Therefore, to avoid accidental occurrences or insignificant items in the network, the boundary conditions were always set to 3 (occurrences or documents). The final phase of the study included composing and presentation of final conclusions and practical implications of the conducted research.

4. Results and Discussion

4.1 Descriptive Bibliometric Analysis of the SS and RIS Literature

The exploration of the evolution of patterns and trends in the SS and RIS scientific field was started with descriptive analysis. Based on the initial data analysis, it was found that there are 612 publications comprising the SS and RIS literature in the Scopus database. In this number, articles constitute 68.3% of all publications, conference papers - 14.2% of all publications, books and book chapters - 12.7% of all publications.

Most, as many as 93.5% of publications, were written in English. Remaining 6.5% of publications were prepared in other languages, including in Spanish (2.0% of all publications), in Russian (1.1%), in Italian (1.0%), in Portuguese (0.6%) and French (0.5%). Despite the fact that the first publication in this domain appeared in 1991 (Cheung, 1991), around 90% of publications on SS and RIS were published after 2012.

The same situation relates to the number of citations – this number also began to increase significantly after 2012. This is undoubtedly influenced by the fact that initially SS and RIS publications were not subjected to the traditional academic peer-review process and for that reason they are not indexed in Scopus database. The number of publications and total citations related to the SS and RIS literature are presented in Figure 1.

The performed research revealed that 612 publications on SS and RIS indexed in Scopus database cited 6,277 references. The most cited article is 'The learning region: Institutions, innovation and regional renewal' written by K. Morgan (1997). This article was cited 1,227 times in publications from the analysed area. In the second place, with 317 citations, is 'Smart Specialization, Regional Growth and Applications to European Union Cohesion Policy' written by P. McCann and R. Ortega-Argilés (2015), while the third place is taken by the article 'Regional innovation patterns and the EU regional policy reform: Toward smart innovation policies' written by R. Camagni and R. Capello (2013) with 180 citations.

Figure 1. *The number of publications and total citations related to the SS and RIS literature indexed in the Scopus database*
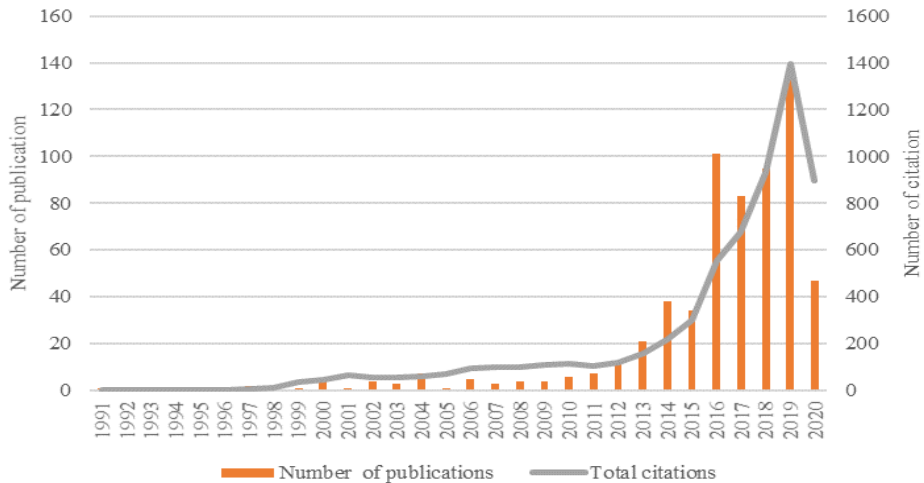
Considering the research areas of SS and RIS literature, it should be stated that they cover a diverse area of research and represent various disciplines. So far, most publications have been published in Social Sciences (25.3% of all publications), Business, Management and Accounting (17.3%), as well as in Economics, Econometrics and Finance (16.9%). The diverse research areas are related to numerous sources that publish the SS and RIS literature items.

Most often SS and RIS publications appear in such sources as: European Planning Studies (51 publications), Regional Studies (26) and Journal of the Knowledge Economy (18). Considering publications in terms of authors, it should be stated that the most prolific author with the most frequent contributions to the SS and RIS literature is P. McCann (17 publications). In the second place is R. Ortega-Argiles (14), and the third place go ex aequo to K. Morgan and M. Benner (9).

The conducted analysis allowed to indicate the most active organisations in the SS and RIS field. These organisations include in particular: European Commission Joint Research Centre (37 publications), University of Groningen (15) and Utrecht University (13). Considering the most active countries it should be noted that of the 59 contributing countries, only 19 (around 32%) published around 81% of SS and RIS research items.

The dominant countries include: Italy (with 91 publications), the United Kingdom (82), Spain (71), Poland (50) and the Netherlands (45). The detailed information about the most prolific authors, sources, countries and organisations in the SS and RIS literature indexed in the Scopus database are presented in Table 1.

4.2 Network Analyses

4.2.1 Keyword and Co-Keyword Analyses

In the first step of network analyses, the dynamics of the occurrence of authors' keywords in the SS and RIS literature was investigated. The analysis comprised 10 most frequent occurrences of 1405 terms used by authors.

Figure 2 shows that the number of all 10 analysed occurrences increases over time. For some of them the increase is much more dynamic, e.g. 'smart specialisation/specialization', 'regional development', 'innovation' and 'innovation policy'. Considering the number of occurrences, these words can be divided into three groups (from the most to the least frequent occurrences per year): (1) 'smart specialisation' and 'smart specialization', (2) 'regional development', 'innovation' and 'innovation policy', and (3) 'regional policy', 'smart specialisation strategy', 'entrepreneurship', 'regional innovation systems' and 'entrepreneurial discovery'.

In the second step, the co-occurrence network of authors' keywords was investigated to determine research hotspots in the SS and RIS scientific field (Figure 3). 130 authors' keywords were classified as visualisation items (with at least three occurrences).

**Figure 2.** *Dynamics of authors' keywords in the SS and RIS literature indexed in the Scopus database*
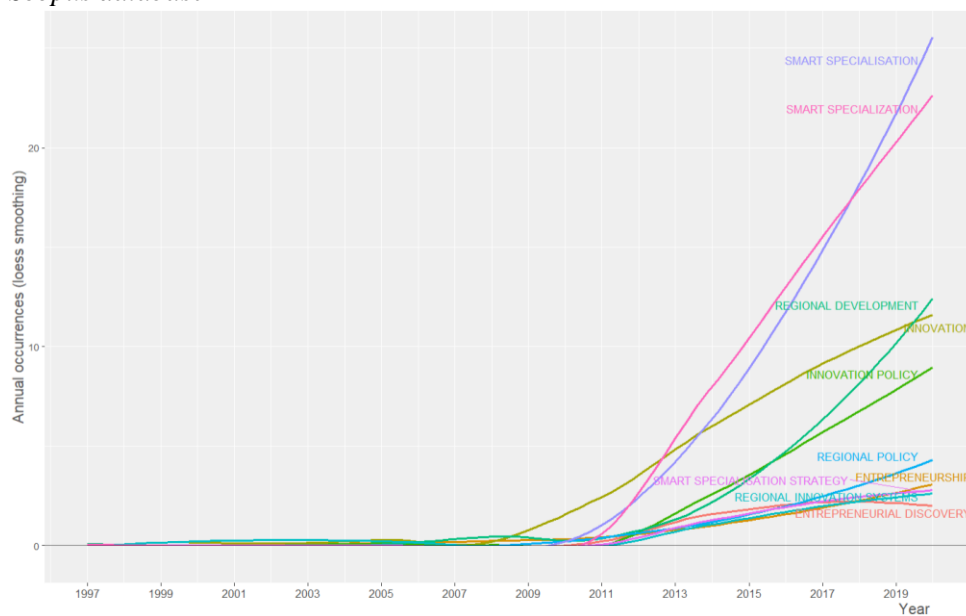
Source: *Own elaboration*

Table 1. *Most productive authors, sources, countries and organisations in the SS and RIS literature indexed in the Scopus database*

Author	Number of publications	Source	Number of publications	Country	Number of publications	Organisation	Number of publications
McCann, P.	17	European Planning Studies	51	Italy	91	European Commission Joint Research Centre	37
Ortega-Argilés, R.	14	Regional Studies	26	United Kingdom	82	University of Groningen	15
Benner, M.	9	Journal of the Knowledge Economy	18	Spain	71	Utrecht University	13
Morgan, K.	9	Scienze Regionali	11	Poland	50	Universidad de Deusto	12
Capello, R.	7	Empirical and Institutional Dimensions of Smart Specialisation	9	Netherlands	45	Politecnico di Milano	11
Kroll, H.	7	Regional Studies Regional Science	8	Germany	31	Cardiff University	11
Aranguren, M.J.	6	European Journal of Innovation Management	7	Portugal	31	Lappeenrannan Teknillinen Yliopisto	10
Fellnhofer, K.	6	International Journal of Knowledge-Based Development	7	Sweden	30	Lunds Universitet	10
Foray, D.	6	International Multidisciplinary Scientific Geoconference Surveying Geology and Mining Ecology Management (SGEM)	7	Finland	27	Newcastle University	9
Margo, E.	6	Smart Innovation Systems and Technologies	7	Russian Federation	27	Università degli Studi di Reggio Calabria	9

Source: Own elaboration

Figure 3. *Co-occurrence network of authors' keywords in the SS and RIS literature indexed in the Scopus database*
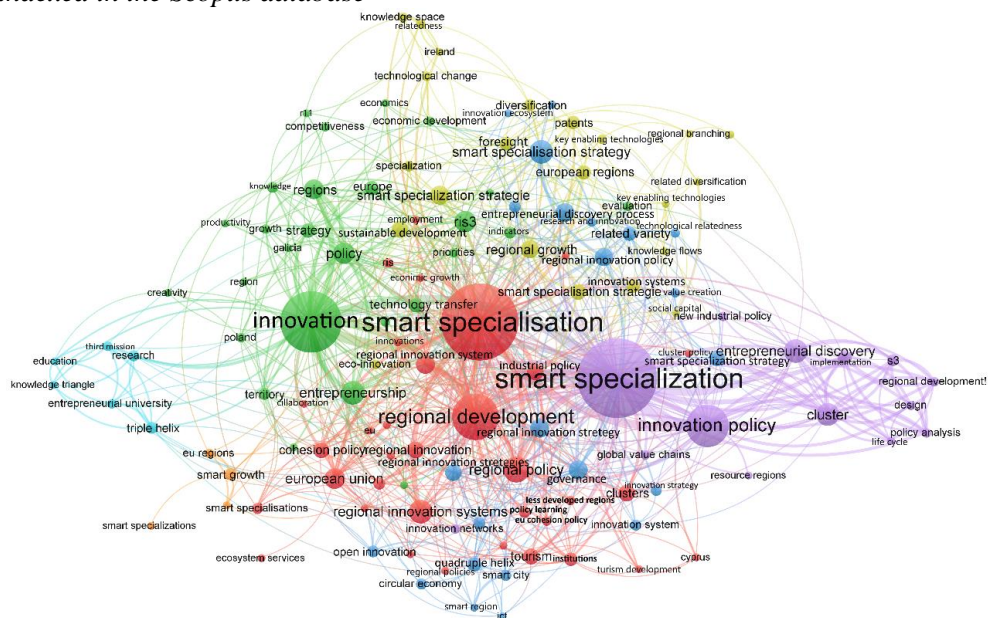
Source*: Own elaboration*

The core topics in the SS and RIS literature are: 'smart specialization', 'smart specialisation', 'innovation', 'regional development', 'innovation policy' and 'regional policy'. The analysis made it possible to indicate 7 distinct clusters representing individual subfields of the research areas in the SS and RIS literature. These subfields and the most relevant words (words with the highest total link strength within a subfield) that form them are as follows:

- red cluster, grouping together such authors' keywords as: 'smart specialisation', 'regional development', 'regional policy', 'European Union', 'regional innovation systems' and 'cohesion policy';
- green cluster: 'innovation', 'policy', 'entrepreneurship', 'regions', 'RIS3' and 'Europe';
- dark blue cluster: 'smart specialisation strategy', 'governance', 'regional innovation strategies', 'quadruple helix' and 'entrepreneurial discovery process';
- yellow cluster: 'patents', 'smart specialization strategies', 'European regions', 'foresight', 'regional growth' and 'diversification';
- purple cluster: 'smart specialization', 'innovation policy', 'cluster', 'entrepreneurial discovery', 'implementation' and 'S3';
- light blue: 'triple helix', 'research', 'entrepreneurial university', 'third mission', 'education' and 'knowledge triangle';
- orange cluster: 'smart growth', 'EU regions', 'social cohesion', 'smart specializations.

These results indicate that the co-occurrence of authors' keywords in individual publications in the SS and RIS literature varies considerably, which demonstrates that this particular scientific field has a multi-faceted and a multi-dimensional nature.

4.2.1 Mapping Scientific Collaboration

In the first step of mapping scientific collaboration, the co-authorship network of countries was investigated (Figure 4). The conducted analysis revealed that:

- there are 59 countries represented by authors collaborating in the SS and RIS literature;
- 38 countries are classified as visualisation items (they have relations and at least three documents);
- Italy, Spain, Sweden and Portugal are characterised by the closest academic collaboration;
- main scientific communities that published in the SS and RIS literature comprise two groups: (1) – consisting mainly of western European countries, such as Italy, Spain, Sweden, Portugal, the Netherlands and (2) – consisting mainly of countries from eastern Europe, such as the Czech Republic, Slovakia, Croatia, Romania, Serbia.

Figure 4. *Co-authorship network of countries in the SS and RIS literature indexed in the Scopus database.*
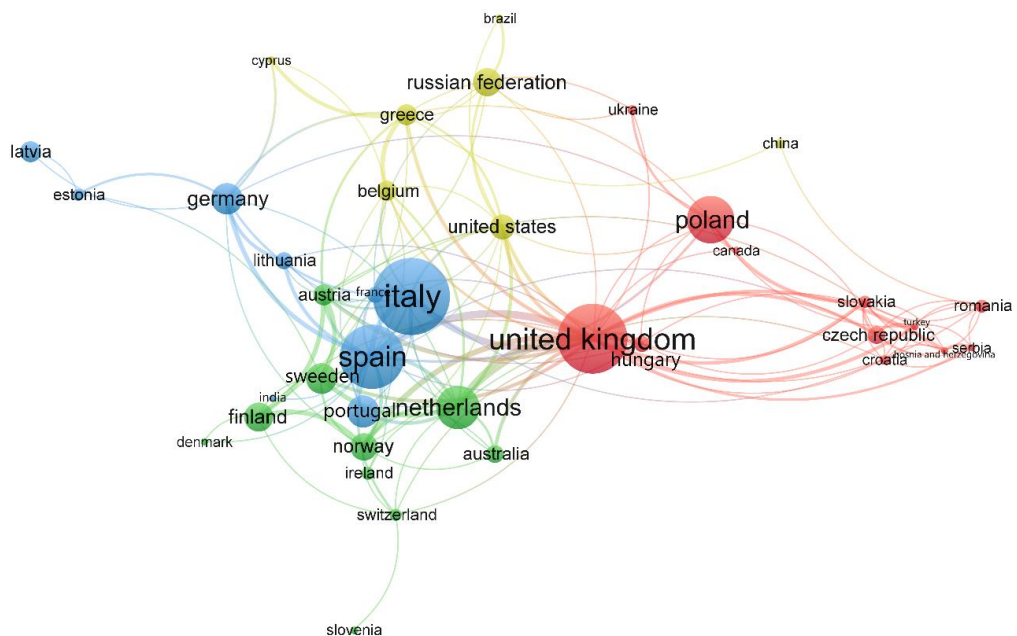
Source: *Own elaboration*

In the second step, the citation network of sources was investigated (Figure 5). The source-citation analysis reflects the collaboration level and significance of individual sources in the creation of the SS and RIS knowledge. This analysis made it possible to conclude that:

- there are 178 sources whose publications in the SS and RIS literature were cited by another source;
- 38 sources are classified as visualisation items (they have a relation and published at least three documents);
- European Planning Studies, Regional Studies and Scienze Regionali have the strongest mutual relations;
- there are three clusters of significant sources in the investigated scientific field. The main items in these clusters are as follows: (1) European Planning Studies, Regional Studies, (2) Journal of the Knowledge Economy, European Journal of Innovation Management, International Journal of Knowledge-Based Development, and (3) Scienze Regionali, SpringerBriefs in Applied Science and Technology, and Smart Innovation, System and Technologies;
- the sources with the highest collaboration level (the highest total link strength) are: European Planning Studies (total link strength 303), Regional Studies (190), Scienze Regionali (121), European Journal of Innovation Management (105);
- despite the small number of publications, the significance of the following sources: European Journal of Innovation Management (7 documents and the total link strength of 105), International Journal of Knowledge-Based Development (7 and 64), Papers in Regional Science and Cambridge Journal of Economy and Society Regions (4 and 39) is relatively high (a relatively small number of publications but a high total link strength);
- despite the relatively large number of publications, the significance of the following sources: Smart Innovation, Systems and Technologies (7 documents and the total link strength of 10), and SGEM Proceedings (7 and 3) is relatively low.

The main parameters characterising authors' top 10 keywords (in the co-occurrence network of authors' keywords), top 10 countries (in the co-authorship network of countries), top 10 countries (in the citation network of countries), and top 10 sources (in the citation network of sources) in the SS and RIS literature indexed in the Scopus database are presented in tables A1-A4 in the Appendix section.

5. Conclusion

The results of conducted bibliometric analysis revealed that starting from 1997 the number of publications on the SS and RIS concepts increases year by year. Initially, the annual growth in publications in this area was slight and until the end of 2012 only 10.6% of all publications were published. In the first period, publications focused primarily on the presentation of knowledge in the field of RIS and the

possibility of its use to reduce 'technological gaps' between regions (e.g. Landabaso, 1997; Cook, 2004). In addition, these publications comprised the description of experiences in developing and implementing RIS in individual countries or regions (e.g. Thomas, 2000; Blažek and Uhlíř, 2007).

Figure 5. *Citation network of sources in the SS and RIS literature indexed in the Scopus database.*
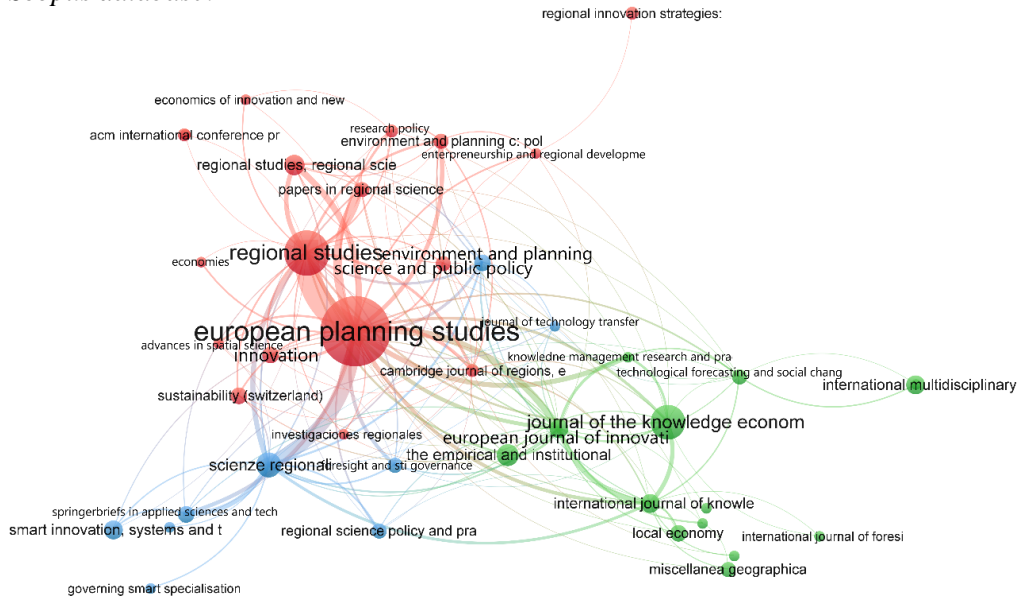
Source: *Own elaboration*

Publications on the SS concept began to appear since 2011 (e.g. Anselmo and Cascio). However, it should be noted that the SS concept as the basis for RIS3 was conceived in 2009 in grey literature. Due to the fact that these publications were not subjected to the traditional academic peer-review process, they were not included in the analysis carried out in this study. Currently, the SS and RIS publications most often relate to the description of experience in implementation RIS3 in different countries and regions (e.g. Bosch and Vonortas, 2019), assessment of the implementation of RIS3 (D'Adda *et al.*, 2020), as well as indicating opportunities and challenges arising in the process of implementing SS (e.g. Gianelle *et al.*, 2019). In general, the move from theory to practice is noticeable in recent years.

The descriptive bibliometric analysis indicated that studies on the SS and RIS cover diverse research areas, such as Social Sciences; Business, Management and Accounting; and Economics, Econometrics and Finance in particular. Due to the large variety of research areas in which studies in the SS and RIS scientific field are carried out, there are many sources in which publications from the analysed domain have been published. The most productive sources of the SS and RIS publications are: European Planning Studies, Regional Studies and Journal of the Knowledge

Economy. The conducted analysis showed that European countries have a dominant role in the development of literature in the field of SS and RIS. So far, 91% of all publications were published by authors from Europe - mainly from Italy, the United Kingdom, Spain, Poland and the Netherlands. It is noteworthy that among 20 countries that have published the largest number of RIS and SS scientific publications, only the United States and Australia is a non-European country. The most prolific authors in the SS and RIS scientific field are P. McCann. and R. Ortega-Argiles.

The analysis of the dynamics of authors' keywords, representing the most popular research areas in the analysed field, demonstrates that the number of the most frequent keyword occurrences has been on a constant rise since 2012. The analysis of the co-occurrence network of authors' keywords indicate that the main subfields of the SS and RIS research combine keywords such as (1) 'smart specialisation', 'regional development', 'regional policy', 'the European Union', 'regional innovation systems', 'cohesion policy', (2) 'innovation', 'policy', 'entrepreneurship', 'regions', 'RIS3' (3) 'smart specialization strategy', 'governance', 'regional innovation strategies', 'quadruple helix', and 'entrepreneurial discovery process'. The diversity of the keywords included in indicated clusters proves the multi-faceted and multi-dimensional nature of the SS and RIS research field.

The analysis results of the co-authorship network of countries point to the existence of two scientific communities (1) – consisting mainly of western European countries, (2) – consisting mainly of countries from eastern Europe. It should be noted that authors from Italy, Spain, Sweden and Portugal are characterised by the closest academic collaboration. The analysis of the citation network of sources indicated that European Planning Studies and Regional Studies have fostered the strongest relations.

The obtained analysis results might have valuable practical implications. Determination of sources with the highest productivity and citations can be used by potential authors of publications to adopt an appropriate publication strategy. The information about the most active countries and organisations and the most influential authors in this field may constitute the valuable basis for establishing future collaboration. The results of the analysis can also be useful for decision-makers in regions by indicating the most influential publications in terms of the SS and RIS development and implementation.

It must be noted that every effort was made to perform this analysis in the most accurate manner. Nonetheless, this research has some limitations. It was based on Scopus-indexed publications only. For this reason, it could not be assumed as fully complete as there are important SS and RIS publications that appeared in the grey literature and therefore they are not included in the Scopus database. In order to gather more information and obtain a wider understanding of this domain, further

research should take account of analyses based on other databases (e.g. Google Scholar). Moreover, the numbers of the publications and total citations were used to measure the quality and quantity of relevant documents regardless of their actual scientific merit. In addition, the number of publications exploring analysed domain increases relatively dynamically. Therefore, the obtained results ought to be treated with caution because they might become obsolete rather fast. Nevertheless, it should be emphasised that the purpose of this study was up-to-date determination and mapping the SS and RIS scientific field based on longitudinal bibliometric analysis.

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Appendix section

Table A1*. Main parameters of authors' top 10 keywords (ranked by the total link strength) in the co-occurrence network of authors' keywords in the SS and RIS literature indexed in the Scopus database*

Keyword	Number of links	Total link strength	Occurrences
smart specialization	88	245	120
smart specialisation	83	200	114
innovation	66	173	79
regional development	55	123	51

innovation policy	45	110	44
regional policy	31	56	20
cluster	21	52	16
entrepreneurial discovery	20	51	17
policy	23	49	15
implementation	15	43	8

Source: *Own elaboration*

Table A2. *Main parameters of the top 10 countries (ranked by the total link strength) in the co-authorship network of countries in the SS and RIS literature indexed in the Scopus database*

Country	Number of links	Total link strength	Documents	Citations
United Kingdom	26	68	81	2175
Spain	20	46	71	578
Netherlands	15	35	45	1115
Italy	13	29	91	863
Austria	11	23	18	100
Norway	10	22	25	143
United States	13	22	22	313
Greece	11	21	18	104
Germany	10	19	30	260
Sweden	9	19	29	346

Source: *Own elaboration*

Table A3. *Main parameters of the top 10 countries (ranked by the total link strength) in the citation network of countries in the SS and RIS literature indexed in the Scopus database*

Country	Number of links	Total link strength	Documents	Citations
Italy	27	510	91	863
Netherlands	33	498	45	1115
United Kingdom	31	447	81	2175
Spain	29	388	71	578
Germany	28	328	30	260
Sweden	29	260	29	346
Portugal	27	234	31	145
Finland	27	233	27	185
Austria	26	213	18	100
Norway	23	164	25	143

Source: *Own elaboration*

Table A4. *Main parameters of the top 10 sources (ranked by the total link strength) in the citation network of sources in the SS and RIS literature indexed in the Scopus database*

Source	Number of links	Total link strength	Documents
European Planning Studies	30	303	52
Regional Studies	30	190	27
Scienze Regionali	22	121	11
European Journal of Innovation Management	27	105	7
International Journal of Knowledge-Based Development	16	64	7
Papers in Regional Science	11	45	5
Regional Studies, Regional Science	9	44	8
Journal of the Knowledge Economy	12	43	18
Cambridge Journal of Regions, Economy and Society	17	39	4
Environment and Planning C: Politics and Space	10	34	5

Source: *Own elaboration*