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A comprehensive review of regional innovation policy research: policy paradigms, evolution and underexplored topics

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ABSTRACT

Although regional innovation policy (RIP) has become increasingly relevant, the literature still lacks a specific and comprehensive review. Apart from addressing this gap, this article also challenges several limitations and interpretations of previous studies. For this purpose, we conduct a bibliometric analysis based on the bibliographic coupling technique, combined with a set of methodological and analytical novelties that allow us to explore the evolution of RIP topics and their framing across the different innovation policy paradigms. First, the results show that RIP research constitutes a substantial and coherent field, rather than a subtype of (national) innovation policies. Second, the RIP literature transcends the usual reviews on regional innovation systems (RIS) and smart specialization strategies (S3), encompassing other underexplored issues. Third, RIP topics are framed across the three policy paradigms, not just within the innovation systems tradition. Fourth, in addition to identifying long-term and emerging topics, our analysis reveals four phases in RIS evolution (including the latest challenge-oriented turn) and questions the notion that S3 is an extension from RIS. Fifth, while European authors (and journals) remain dominant, contributions from developing countries are slowly diversifying the field. Finally, the article highlights remaining gaps and outlines future research and policy agendas.

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1. Introduction

Throughout the twenty-first century, the fields of innovation policy in general and regional innovation policy (RIP) in particular have undergone a steady evolution, accompanied by a growing interest in these issues (Fratesi 2025; Ghazinoory, Ranjbar, and Saheb 2024; González-López, Asheim, and Sánchez-Carreira 2019; Isaksen, Martin, and Trippl 2018). Among other aspects, this evolution has implied changes in the focus and objectives of these policies, from merely fostering regional growth and

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competitiveness to promoting alternative paths for regional restructuring and, more recently, to addressing sustainable development and other grand societal challenges, such as rising social and regional inequalities (Bai, Chu, and Hassink 2024; Karlsen, Rypestøl, and Trippl 2025). Although RIP research has largely focused on Europe, the discussion has also spread to other continents in recent decades (Doloreux and Porto Gomez 2017; Kruse 2025; Rosas Rodríguez and Demmler 2023).

These dynamics take place within a broader and long-standing context, characterized by the emergence and overlap of various innovation policy paradigms. Even with partially different names, there is widespread consensus in the literature on the evolution and coexistence of three major paradigms (Diercks, Larsen, and Steward 2019; Edler and Fagerberg 2017; Grillitsch, Hansen, and Madsen 2021; Lindner, Edler, and Daimer 2024; Schot and Steinmueller 2018): 'classical' science and technology (S&T) or research and development (R&D) policies (since the 1950s-1960s), innovation system policies (from the 1980s to 1990s) and, more recently, transformative and mission-oriented innovation policies (especially since the 2010s). Beyond the periodization, it is generally agreed that the evolution of innovation policies has been a gradual and incremental process, in which the emergence of new paradigms has not necessarily implied the replacement of previous ones. This has led to the coexistence of different layers of policies and instruments, each with distinct objectives, rationales and intervention logics.

The growing interest in innovation policies in general, and in RIP in particular, has given rise to numerous review studies. However, no study has yet done a specific and comprehensive analysis of the literature on regional innovation policies, along with other limitations and questions that this article aims to address. First, we argue that RIP research has not been specifically or sufficiently addressed, since in many general reviews (on innovation policies, innovation systems and, in some cases, innovation ecosystems) the regional dimension is usually treated as something marginal or as an appendix, subset or subtype of the national approach (Martin 2012; Meneses 2023; Uriona-Maldonado, dos Santos, and Varvakis 2012). Against this interpretation, how can we measure the specific weight of RIP research within the entire literature on innovation policy?

On the other hand, we sustain that a comprehensive study of the RIP literature is still lacking, as strictly regional reviews have concentrated on two topics: regional innovation systems (RIS) (Bai, Chu, and Hassink 2024; Doloreux and Porto Gomez 2017; Fernandes et al. 2021; López-Rubio, Roig-Tierno, and Mas-Verdú 2022) and, more recently, smart specialization strategies (S3) (Foglia 2023; Lopes, Ferreira, and Farinha 2019; Mora, Deakin, and Reid 2019; Rosas Rodríguez and Demmler 2023). Despite their undeniable relevance, is the debate on RIP limited to these topics, or are there other underexplored issues?

Additionally, in some reviews of the RIS literature, as well as in S3 studies, smart specialization has been presented as an extension or derivation of the regional innovation systems approach (Bai, Chu, and Hassink 2024; González-López, Asheim, and Sánchez-Carreira 2019; Kruse 2025; Lopes, Ferreira, and Farinha 2019; López-Rubio, Roig-Tierno, and Mas-Verdú 2022). In just a decade, S3 has gained increasing political and academic prominence in Europe and has begun to be applied and studied in other continents (Rosas Rodríguez and Demmler 2023). In fact, after reviewing a diverse set of innovation policy instruments, some studies present S3 separately as the modern approach to RIP

(Fratesi 2023; McCann and Ortega-Argilés 2013). But beyond all this, is it correct to consider S3 as an extension of the RIS literature?

Given the historical relevance of the RIS approach in regional innovation policies (González-López, Asheim, and Sánchez-Carreira 2019; Isaksen, Martin, and Trippl 2018) and its supposed connection with the recent wave of S3, the literature on RIP has generally been framed within the innovation systems paradigm. However, does the discussion end here? More specifically, how does RIP research fit into the new paradigm of transformative and mission-oriented innovation policies?

In summary, this article aims to provide a comprehensive review of the evolution and framing of the RIP literature, addressing key questions related to limitations and research gaps of previous studies:

(1) How can the RIP field be comprehensively identified or delimited within the literature on innovation policies?
(2) How do the different RIP topics fit into the three innovation policy paradigms and their overlaps?
(3) How has the RIP literature evolved over time (and, to a lesser extent, across space)?

By answering these questions, the article contributes to theoretical debates on the evolution of (regional) innovation policies across paradigms and policy waves (Fratesi 2025; Ghazinoory, Ranjbar, and Saheb 2024), as well as among different approaches and policy frameworks, from the widely recognized RIS and S3 (Fratesi 2023; Isaksen, Martin, and Trippl 2018; McCann and Ortega-Argilés 2013) to other less considered topics. After describing and justifying the methodology and bibliometric analysis techniques used, the three questions will structure the presentation of the results and their discussion in light of previous studies. Finally, the concluding section will summarize the main answers and findings of the article, along with some future research and policy agendas.

2. Methodological strategy

The previous questions not only aim to define the cognitive space of RIP studies but also to frame them within the more general literature on (paradigms of) innovation policies. Therefore, it is necessary to establish a methodological strategy broad enough to ensure the inclusion of all relevant literature, while at the same time maintaining specificity. To this end, we resort to a bibliometric tool commonly applied to determine the structure of a field of study: bibliographic coupling (BC) (Kessler 1963). In this article, however, we use this technique with a dual purpose: first, to delimit the analytical object or 'corpus' of RIP research, based on the clusters obtained through BC; and second, to conduct an in-depth analysis of the network of regional clusters identified. To avoid the limitations of some semi-automated bibliometric systems (such as VosViewer or Bibliometrix), which operate as 'black boxes' and introduce a degree of opacity into the analysis, we rely on the programming scripts that we have progressively developed as a team (Grauwin and Jensen 2011; Levin and De Filippo 2021; Levin et al. 2016). As we will see, this allows us to initially manage a large volume of information and to modify and validate certain parameters that are either fixed in other systems or often overlooked in previous studies. The methodological strategy was developed in four stages: (1) database selection,

search strategy and corpus construction; (2) clustering process through BC; (3) analysis, interpretation and labelling of clusters; and (4) iterative clustering and other consistency validations.

Unlike other approaches, such as many systematic literature reviews, which first establish a complex set of search terms and their combinations to reduce the scope and volume of information, a rather different search strategy is required to address our first question. Therefore, we opted for one of the simplest and most inclusive strategies for data collection, looking for the term 'innovation polic*' in titles, keywords or abstracts. Regarding the database used, we evaluated three alternatives: SCOPUS, Web of Science and Openalex. After analysing the preliminary results and taking into account criteria such as similarity, overlap and inclusion, we decided to work with SCOPUS.[1] Thus, on March 21, 2025, a total of 6497 publication records were downloaded, corresponding to articles, books, book chapters and conference proceedings, without time limits or other restrictions. Finally, given the central role that bibliographic references play in BC, we carried out a meticulous process of cleaning, correcting and standardizing references and author names to maximize the couplings, which depend on the exact match of all elements.

In the second stage, as already mentioned, the information was structured using BC, forming clusters of publications based on the references they share. Since the number of references shared by two publications can be easily modified in our scripts, we tested the consistency of the results with 1, 2, 3, 4 and 5 (minimum) references in common. This allowed us to determine an appropriate number of clusters for the analysis, identifying the point at which the change in the number of references does not significantly affect the quantity of clusters obtained. The opposite case would indicate that the cluster structure is an artifact of the method rather than a reflection of the cognitive structure. Accordingly, we selected a minimum threshold of four shared references, a relatively high criterion compared to standard values used in the BC literature or those set by default in bibliometric systems. This configuration reduced the dataset from 6497 records to 3321. What might initially be seen as a loss of information is, in fact, counterbalanced by a gain in thematic coherence among the 3321 retained publications, as those records with fewer (bibliographic) links to the rest of the corpus were discarded.

In addition, our scripts allow us to define different levels of clusters. In this article, we evaluate two levels, obtaining 9 top clusters in the first level and 38 sub clusters in the second, for the overall literature on innovation policies (whether regional or not). For the first level of top clusters, we set a minimum threshold of 100 publications, which brings the dataset to 2744 records (577 belong to top clusters with fewer than 100 publications). For the second level of sub clusters, we lowered the threshold to 20 publications, aiming to capture a greater number and diversity of topics. This resulted in a dataset of 2249 records (within the 9 top clusters, 495 records belong to sub clusters with less than 20 publications).[2]

For the third stage of interpretation and labelling, we extracted the metadata of each (top and sub) cluster, characterizing authors, keywords, title words, sources, cited sources, references, institutions, countries and subject categories, according to two parameters: the frequency of occurrence within the cluster and its representativeness, that is, a measure of the specificity of the frequency of a record in its cluster, compared to the whole corpus. In addition, we retrieved the sets of most-cited and most-representative publications and authors in each cluster, for further reading. Finally, we analysed the

publication dynamics of each cluster, weighting their internal trends against all publications in each year. This allowed us to understand whether the cluster's publications were above, below or in line with the average of the population.

As a complement to the previous analyses, we isolated all sub clusters that, in a broad sense, were related to regional aspects of innovation policy. This subset, identified through a careful interpretive process, consists of 11 sub clusters with a total of 753 publications[3] (see Figure 2). As will be mentioned in some sections, this more limited dataset was reprocessed using the above methods in an iterative logic, in order to obtain more specific and segmented information.[4] At the same time, it allowed us to compare and evaluate the consistency of our main results with other bibliometric techniques, such as keyword co-occurrence.[5]

3. Delimitation of RIP research

As can be seen from the circle sizes in Figure 1, among the 9 top clusters identified in the innovation policy literature, the largest one brings together the publications and topics

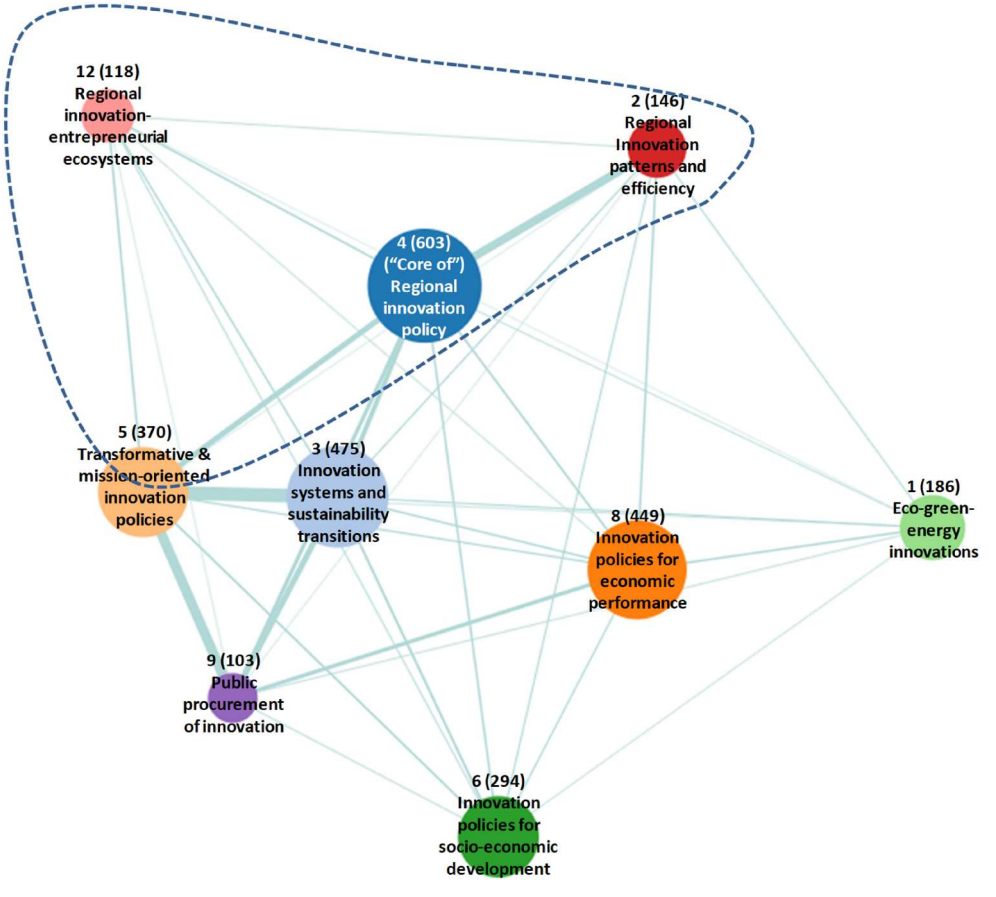


Figure 1. First level or top clusters, with emphasis on regional coverage. Source: own elaboration.

Notes: The initial numbers show the identifier of the top cluster and then, in parentheses, the number of publications contained.

that make up the 'core' of RIP (top cluster 4, with 603 publications).[6] In addition, two other top clusters (2 and 12)[7] also address regional issues and a portion of top cluster 5 (focused on transformative and mission-oriented policies) has a regional scope, specifically sub cluster 5000 (see Figure 2). Therefore, it is difficult to claim that the RIP field is merely an appendix or marginal subset of the general innovation policy literature. On the contrary, while top cluster 3 encompasses the sub clusters of national, sectoral and technological innovation systems,[8] RIS-related topics appear as a distinct body of literature, largely concentrated in top cluster 4, despite the predictable links shown in Figure 1. These two aspects, the clustering of regional studies into a separate group from the national-sectoral literature and the larger size of the regional cluster, are also reflected in Suominen, Seppänen, and Dedehayir (2019).

However, it could eventually be argued that the geographic or regional dimensions still have a limited place in the literature on transformative and mission-oriented policies (only one of the six sub clusters), a shortcoming of this field that has been highlighted by some authors (Coenen et al. 2025; Grillitsch, Hansen, and Madsen 2021; Uyarra et al. 2025a) and partially reflected in recent reviews (e.g. Al-Jayyousi et al. 2023; Vale et al. 2024).

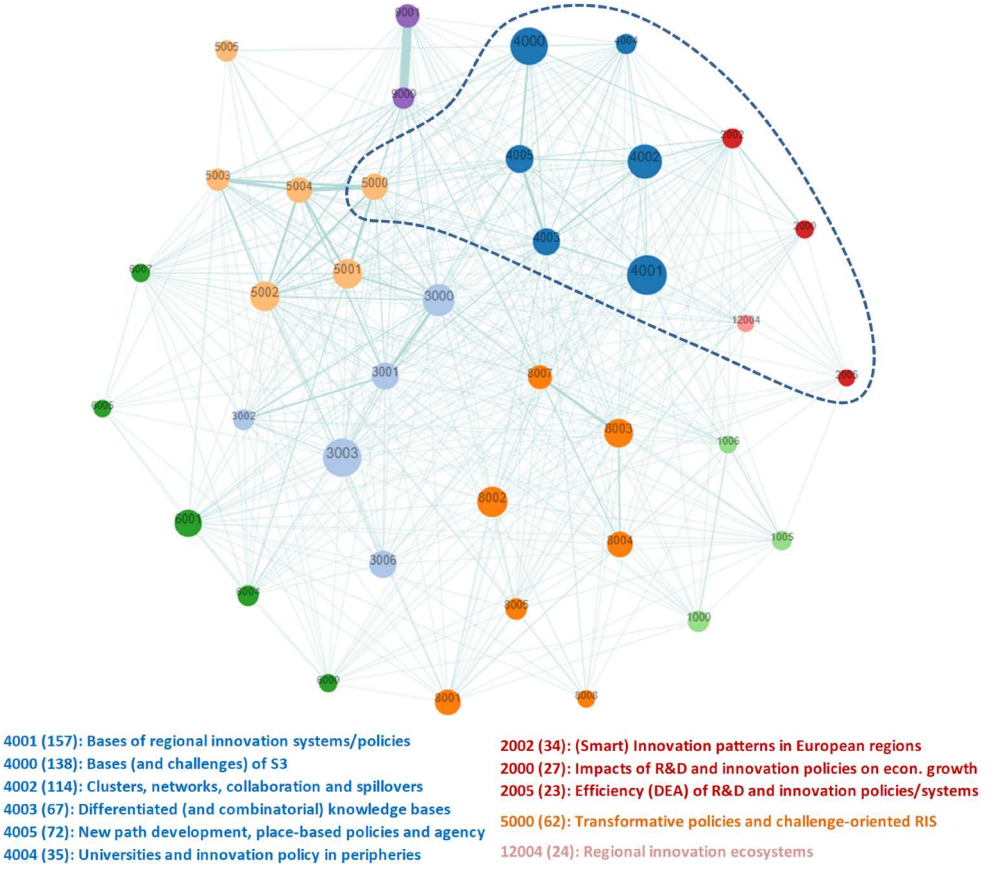


Figure 2. Second level or sub clusters, with emphasis on the regional ones. Source: own elaboration.

Notes: The initial numbers show the identifier of the sub cluster (e.g. 4001, where the first digits indicate the corresponding top cluster) and then, in parentheses, the number of publications contained in each cluster.

On the other hand, this first glance at the RIP literature (Figure 2) reveals several under-explored topics beyond the traditionally studied fields of RIS and S3.

As a methodological comparison and consistency check, it is interesting to contrast the 11 RIP topics obtained by our BC analysis with the results of a keyword co-occurrence analysis based on the 753 RIP publications – Vale et al. (2024) also compare both methods. In this case, the closest specification to our results is achieved with 6 clusters (Figure A1 in the Annex). While it is possible to further break these down, reaching up to 11 clusters, the additional groups contain few keywords and lack an appealing interpretation. This shows that our methodology is more effective for identifying (sub)topics. For example, one of the groups generated by keyword co-occurrence corresponds, as a whole, to our top cluster 2 (highlighted in red in the Annex) and another one seems to combine four of our sub clusters (in blue, 4001, 4003, 4004 and 4005), without being able to distinguish them. In contrast, the other four clusters effectively match our results: light blue (4000), violet (4002), orange (5000) and pink (12004). Although we will explore this issue using other tools, the fact that S3 (light blue) appears separately from the blue cluster that encompasses several RIS topics provides a first indication of a certain distance, rather than continuity, between them.

4. Innovation policy paradigms, overlaps and framing of RIP topics

In Figure 3, we present both the conceptual model of the three innovation policy paradigms proposed in this article and our theoretical interpretation of the distribution of the 11 RIP topics (sub clusters) across this framework. Both issues are discussed in the following sections. Although our focus and objectives differ from those of Ghazinoory, Ranjbar, and Saheb (2024) – who reviewed the general S&T literature and the evolution of policy generations – we share with them the proposal and application of new conceptual frameworks, employing 'a mix of bibliometric and thematic analyses' (Ghazinoory, Ranjbar, and Saheb 2024, 162).

4.1. Analytical model

Our approach builds on the two dimensions proposed by Diercks, Larsen, and Steward (2019), policy agenda and understanding of the innovation process, a starting point shared with Ghazinoory, Ranjbar, and Saheb (2024). However, we especially highlight the different areas of overlap or 'grey zones' between the three paradigms, emphasizing that the boundaries may be porous. Unlike Diercks, Larsen, and Steward (2019), who only identify and illustrate two areas of overlap (see their figure 5), we incorporate an additional grey zone: the overlap between innovation systems and transformative or mission-oriented policies.

According to the authors considered (Diercks, Larsen, and Steward 2019; Edler and Fagerberg 2017; Grillitsch, Hansen, and Madsen 2021; Lindner, Edler, and Daimer 2024; Robert and Yoguel 2022; Schot and Steinmueller 2018), the first paradigm of classical science and R&D policies can also adopt other names, such as neoclassical approach, linear innovation policy, invention-oriented or innovation for growth. In the early post-war decades, the main policy measures focused on building and expanding scientific organizations, supporting the generation of basic knowledge and defining intellectual

property rights. These state interventions were primarily justified as a way to correct market failures (e.g. spillovers, when the economic benefit is not limited to the actor producing the knowledge, or the need to fund public goods), with economic growth, productivity and competitiveness as key objectives.

The second paradigm of innovation systems introduced a stronger institutional emphasis (Grillitsch, Hansen, and Madsen 2021) and promoted a non-linear and social understanding of innovation processes. Within this framework, the concept of system failures emerged as a new rationale for policy interventions, since the innovation process may require state actions to support certain socio-institutional configurations, linkages and collaborations among heterogeneous actors. Although this paradigm broadened the scope of innovation policy, the policy agenda in many developed countries remained focused on economic objectives such as competitiveness, growth and employment, targeting only a limited set of subsystems and actors. This narrower view of innovation systems is close to a grey zone with the first paradigm, especially in cases where traditional S&T policies gradually incorporated, for example, some collaborative or demand-led (and not just science-push) components. However, especially with the later and gradual application of the innovation systems approach in developing countries of the Global South, the need for a broader perspective became evident.[9] In this context, the objectives shifted towards fostering economic development processes based on (and addressing) intra- and inter-national inequalities and the potential inequitable effects of innovation (Arocena and Sutz 2000; Chaminade, Lundvall, and Haneef 2018; Dutrénit and Sutz 2014; Lundvall et al. 2009).

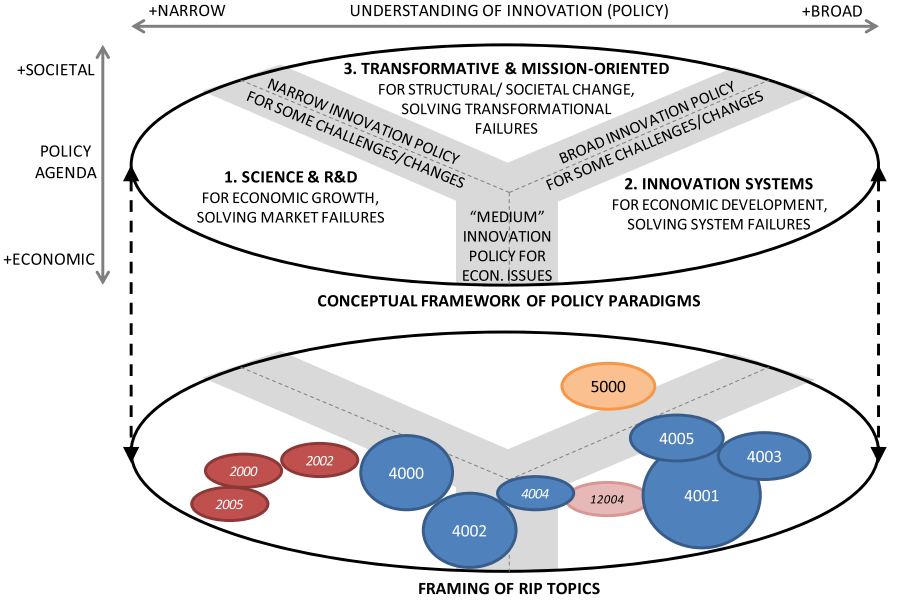
The third and newer paradigm of innovation policies also has, according to the author, different names: transformative (Diercks, Larsen, and Steward 2019; Schot and Steinmueller 2018), mission-oriented (Edler and Fagerberg 2017) or challenge-driven policies (Grillitsch, Hansen, and Madsen 2021), transformative missions (Edler et al. 2025) or transformative and structural change perspective (Robert and Yoguel 2022). In any case, a certain 'normative turn' can be observed in innovation policy (perhaps more evident than in the previous paradigm), as it aims to induce strategic directionality and guide processes of systemic and structural change to address one or more grand societal challenges (e.g. climate change, resource scarcity and inequality or population aging). Apart from market and system failures, the broader and more complex concept of transformational failures arises as a new justification for government intervention (Weber and Rohracher 2012) and some demand-side instruments are revalued (Lindner, Edler, and Daimer 2024; Robert and Yoguel 2022), such as public procurement of innovation. The latter is reflected in the previous Figure 1, due to the strong link between top clusters 5 and 9.

Diercks, Larsen, and Steward (2019) acknowledge that a narrow understanding of this third paradigm may resemble the old or classical post-war missions (e.g. the Apollo Program in the 1960s and many other defense-related initiatives), that is, large-scale R&D programmes rooted in the first paradigm, characterized by strong state control and a scientific focus. Based on the arguments of several authors (Fagerberg 2017; Grillitsch, Hansen, and Madsen 2021; Hekkert et al. 2020; Laatsit, Grillitsch, and Fünfschilling 2025; Lundvall 2024; Robert and Yoguel 2022), we claim that there can also be an overlap or grey zone in Figure 3 between the third paradigm and the innovation systems approach, to the extent that environmentally and socially sustainable

development processes are promoted. Accordingly, some of these authors argue that the new generation of mission-oriented policies is close to the innovation systems perspective (Laatsit, Grillitsch, and Fünfschilling 2025), or can even be conceptualized as 'mission-oriented innovation systems' (Hekkert et al. 2020). Part of this is reflected in the strong link between top clusters 5 and 3 in the previous Figure 1 (and in the emergence of new issues, such as sustainability transitions, within top cluster 3).

4.2. Framing of RIP topics

Returning to Figure 3, a significant portion of RIP topics (sub clusters) are indeed framed within the innovation systems paradigm or its overlaps with the other two paradigms. However, it is also worth highlighting the number of RIP topics located on the side of classical scientific and R&D policies for economic growth, including all those within top cluster 2, as well as S3 and, to some extent, the field of 'clusters,' networks and spillovers. Finally, the topic of challenge-oriented regional policies and systems (sub cluster 5000) is the only one that fits fully into the third paradigm of transformative and mission-oriented policies. Thus, we can reject the interpretation of previous studies that classify



4000: Bases (and challenges) of S3
4001: Bases of regional innovation systems/policies
4002: Clusters, networks, collaboration and spillovers
4003: Differentiated (and combinatorial) knowledge bases
4004: Universities and innovation policy in peripheries
4005: New path development, place-based policies and agency

2000: Impacts of R&D and innovation policies on econ. growth
2002: (Smart) Innovation patterns in European regions
2005: Efficiency (DEA) of R&D and innovation policies/systems

5000: Transformative policies and challenge-oriented RIS

12004: Regional innovation ecosystems

Figure 3. Location of RIP topics (sub clusters) in our conceptual model of innovation policy paradigms. Source: own elaboration.

Notes: The numbers indicate the sub cluster identifier (e.g. 4000). The size of the circles or ovals reflects the number of publications in four levels (+150, + 100, + 50, -50), while their colour and first digits correspond to the top cluster they belong to.

the RIP literature solely or primarily within the innovation systems paradigm. Additionally, the position of S3, distant and in a different paradigm from most RIS topics, raises new doubts about the connection between these fields (a point further discussed below).

We recognize that the location of each topic along the conceptual model has, to some extent, a subjective component and, depending on who is analysing it, some relative changes may occur. However, in addition to our prior knowledge of the literature (Niembro 2017, 2019; Niembro and Starobinsky 2023), we have reviewed multiple studies to support and justify the decisions made. In this sense, the placement of sub clusters 2000 and 2005 within the first paradigm clearly reflects the (neo)classical motivation to empirically determine the impact (and efficiency) of science and research policy on productivity and economic growth, as well as to compare R&D levels across countries and regions (Lindner, Edler, and Daimer 2024; Schot and Steinmueller 2018). Unlike these sub clusters, which include both regional and some national studies, the sub cluster 2002 is entirely a regional topic, with a strong centrality of the (Italian) team formed by Camagni, Capello and Lenzi. To the discussion on regional economic performance, productivity and growth, these authors add the identification of different (taxonomies of) territorial innovation patterns in Europe. Additionally, some of their publications discuss policies for smart growth or smart innovation policies, so we place the topic close to S3. This is also in line with some of the early reviews that stress the work of Capello and Camagni during the initial phase of S3 development (Janik, Ryszko, and Szafraniec 2020; Lopes, Ferreira, and Farinha 2019; Mora, Deakin, and Reid 2019).

As is well known, S3 emerged from the reflections developed by the Knowledge for Growth (K4G) Expert Group (Foray, David, and Hall 2011) on how to explain and reduce the productivity gap between the United States and the European Union. In other words, its genesis stems from non-regional or non-spatial debates (Fratesi 2023; McCann and Ortega-Argilés 2013), which 'had nothing to do with the regional policy community' (Morgan 2015, 480). According to one of the 'fathers' (or most relevant authors) of this literature, the K4G Group was composed 'only of innovation economists, macroeconomists working on endogenous growth and econometricians specializing in the measurement of R&D and productivity' (Foray 2019, 272), so initially the regional dimension was missing. As a consequence,

> very rapidly, experts on regional economies and policies improved the approach – particularly as from the practical implementation phase – and among these brave pioneers, we must of course mention McCann and Ortega-Argilés (2015), Morgan (2017), Rodríguez-Pose, Di Cataldo, and Rainoldi (2014) (…). Finally, the work carried out on related variety – notably by Boschma and Gianelle (2014) or Frenken, Van Oort, and Verburg (2007) – has led ex post to a significant theoretical basis (…). I am deliberately omitting work concerning national/regional innovation systems (from Freeman to Lundvall) – that has not radically influenced this approach, and it is useful to recall that another report from the K4G Group expressed criticism of these approaches – criticism with which to a great extent I agree. (Foray 2019, 273)

Therefore, the innovation systems approach not only had no significant influence on the origins of S3, but has also been criticized by its pioneers. In the next section, we will see that the regional researchers mentioned by Foray (2019) are not among the main referents of the RIS field (with the exception of Morgan, who has nevertheless shown a critical spirit on S3 in different publications).

In addition to these arguments (or Foray's 'confessions'), the location of S3 within the first paradigm is consistent with the views that 'the concept gets closer to neoclassical economics' (Robert and Yoguel 2022, 276) and that it remains 'dominated by a narrow competitiveness-oriented and growth-enhancing interpretation of Research and Innovation' (Molica et al. 2025, 6). In other words, S3 contains some elements of the classical S&T model (Abbott and Fitjar 2025; Benner 2020; Hassink and Gong 2019). On the other hand, it appears close to the topic of 'cluster' policies (4002), due to some continuities with it (Foray 2015; Hassink and Gong 2019), and entering in the grey zone with the third paradigm, especially because of the structural change component of S3 initiatives (Foray, David, and Hall 2011; Fratesi 2023; González-López, Asheim, and Sánchez-Carreira 2019; Isaksen, Martin, and Trippl 2018). While some authors argue that S3 can be interpreted as a case of mission-oriented policy (Foray 2018; Gianelle, Guzzo, and Polverari 2025), others are more sceptical and stress that, at best, it would be limited to the more traditional, narrow and technological conception of missions (Molica et al. 2025). Interestingly, in Robert and Yoguel's (2022) bibliometric analysis, S3 appears closer to the community of (narrow) missions than to the deeper transformative policies.

As mentioned, an important topic (sub cluster 4002), which we label 'clusters,' networks, collaboration and spillovers, is located close to S3 and within an overlap zone between the first and second paradigms. This is consistent with the long-standing tradition and influence of such policies (Lindner, Edler, and Daimer 2024; Trippl et al. 2015), as well as with the findings of other bibliometric studies (Dong and Ma 2025; López-Rubio, Roig-Tierno, and Mas-Tur 2021).

Moving into the innovation systems area in Figure 3, we place two sub clusters (4004 and 12004) in an intermediate position between the topic of 'clusters,' networks and spillovers and the historical core of RIS – obviously, sub cluster 4001, but also 4003 of knowledge bases (Bai, Chu, and Hassink 2024; Doloreux and Porto Gomez 2017). In other words, those two topics have links with each other and also with the literatures on networks, 'clusters' and RIS. The publications in sub cluster 4004 explore the role that universities can play in regional innovation and development, with many of them focusing specifically on peripheral regions. On the other hand, sub cluster 12004 addresses the more recent topic of regional innovation ecosystems, which coexists within the top cluster 12 with other related subjects such as entrepreneurial ecosystems and triple helix (as mentioned in note 7). It is thus a kind of polysemic field, where sometimes system is exchanged for ecosystem or different adjectives are attached to the latter term, with varying degrees of 'spatiality' as well. Despite this, several studies highlight the linkages between universities, (eco)systems, helix models and networks (Brekke 2021; Delbridge, Henderson, and Morgan 2025; Gu et al. 2021; Jütting 2020; Pilelienė and Jucevičius 2023; Russo-Spena, Tregua, and Bifulco 2017; Scaringella and Radziwon 2018).

It should be noted that we position topic 4004 a little higher in Figure 3, in the grey zone with the third paradigm, due to the consideration of peripheral conditions and regional inequalities as challenges to be addressed. This literature tends to agree that universities can act as pipelines for accessing, absorbing and anchoring external knowledge, thus contributing to catch-up and innovation processes in peripheral regions. However, for this to happen, there must be a 'match' between the resources demanded or needed by the companies in the region and those provided by the universities, something that may

not occur under academicist, 'laissez-faire' or science-push logics (Bonaccorsi 2017; Eder 2019; Peer and Penker 2016; Vale et al. 2024). For this reason, the topic is also placed slightly closer to the centre, in the grey zone with the first paradigm.

Although we will delve into several of the remaining topics in the next section, given their role in RIS evolution, it is worth making a few clarifications here. First, sub cluster 4005 on new path development is located in an overlap area with the third paradigm due to its structural change component (Grillitsch, Hansen, and Madsen 2021; Isaksen, Martin, and Trippl 2018). On the other hand, the position of sub cluster 5000 (transformative policies and challenge-oriented RIS) is consistent with the recent 'transition phase' of this literature (Bai, Chu, and Hassink 2024, 6), beginning to address grand societal challenges such as sustainable development or to shed light on the geography of sustainability transitions (Coenen et al. 2025; Kruse 2025; Tödtling, Trippl, and Desch 2022; Vale et al. 2024).

5. Evolution of RIP research: topics, authors and journals

Instead of analysing keywords and their evolution, as in studies we partly question (Bai, Chu, and Hassink 2024; López-Rubio, Roig-Tierno, and Mas-Verdú 2022), we propose a new way to examine the evolution of (and across) the RIP topics previously identified through bibliographic coupling. This approach consists of reviewing the list of the most prominent authors in each sub cluster and highlighting those who connect two or more topics (Figure 4), excluding authors who only stand out in one sub cluster. This is somewhat similar to Robert and Yoguel (2022), who identify some authors as 'gatekeepers' between thematic communities, as they contribute to more than one of them. In addition, Figure 5 shows the temporal evolution of publications in each topic (with the most significant years highlighted in dark blue), together with the connections between topics derived from the analysis of authors in Figure 4.

One initial observation from both representations is that RIP research encompasses several more topics than those within the RIS tradition or the recent S3 literature (long-term RIP topics and emerging topic in Figure 5), which revalues the comprehensive analysis proposed in this article. Secondly, we distinguish four topics and phases through which the RIS literature has evolved. The first three belong to top cluster 4 (the core of RIP) and the systems paradigm, while the last one 'jumps' to top cluster 5 and the third paradigm, providing 'spatially sensitive variants' of transformative and mission-oriented innovation policies (Karlsen, Rypestøl, and Trippl 2025, 3). This is quite evident in the publication dynamics over time (left side of Figure 5), as well as in the movement of key authors from one topic to another (top of Figure 4). Coenen, Isaksen and Trippl stand out for crossing the four RIS phases, followed by Asheim and Tödtling, who are prominent in three. Some authors are particularly influential in the early phases (e.g. Cooke), others in the later ones (e.g. Bugge) and some connect both extremes (e.g. Uyarra). Coenen and Uyarra also stand out for contributing to sub cluster 5000 and other non-regional topics within top cluster 5 on transformative and mission-oriented policies (the latter is indicated with an asterisk on the right side). In contrast and beyond their trajectory in regional studies, authors such as Grillitsch, Hansen and Moodyson only appear in non-strictly regional sub clusters within the transformative policy literature.

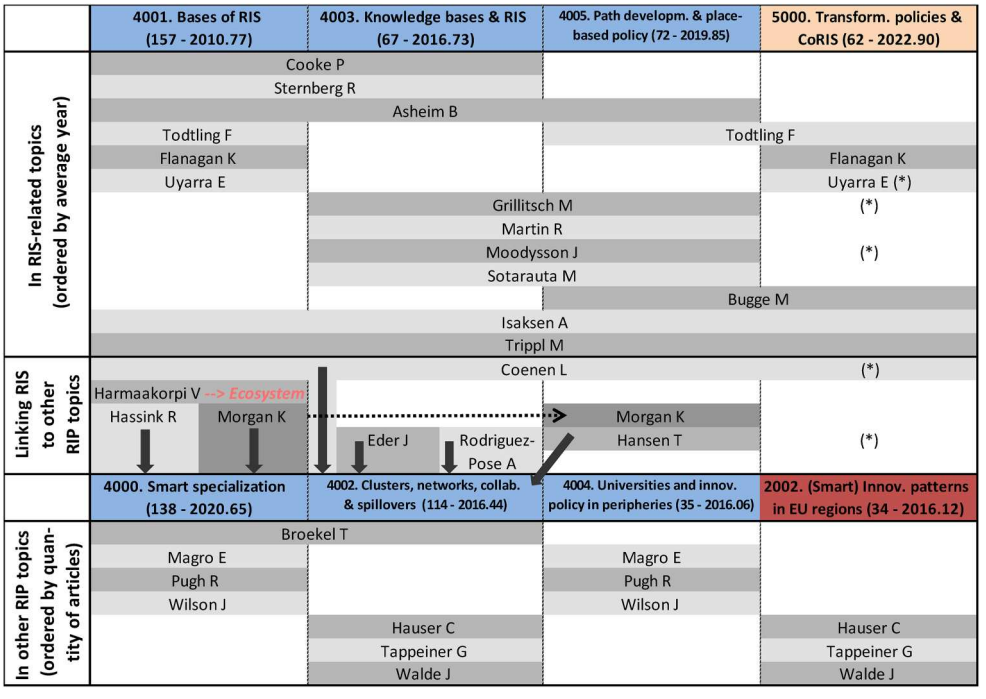


Figure 4. Principal authors connecting two or more RIP topics (total number of publications and average year of publication in parentheses). Source: own elaboration.

Notes: We identify those authors who appear in two or more sub clusters among the top 20 most cited (according to SCOPUS) or the top 20 most representative (in terms of total in-degree, which measures the number of cluster publications they are linked to). An asterisk (*) indicates authors who also stand out in other non-regional topics within top cluster 5 on transformative and mission-oriented policies. The arrows indicate authors who connect RIS-related topics with other RIP topics. For example, Morgan connects sub clusters 4001 and 4000, and he also stands out in 4005 (arrow with dotted line). Harmaakorpi is the only author connecting sub clusters 4001 and 12004 (ecosystems), which is not included for simplicity.

One aspect that differentiates our approach from previous studies on RIS evolution (Bai, Chu, and Hassink 2024; Doloreux and Porto Gomez 2017; López-Rubio, Roig-Tierno, and Mas-Verdú 2022) is that we do not impose predefined cut-off years to divide the analysis into phases. Instead, the topics that emerge through bibliographic coupling exhibit and reveal their specific temporal dynamics (Figure 5). On the other hand, the fact that we start from a broader search strategy (not from 'regional innovation systems'), that the BC technique helps to identify topics with high thematic coherence, and that we can examine and compare the most relevant authors in each topic, allow us to question and clarify some of the findings of these studies, such as (but not limited to) the connection with S3 (Bai, Chu, and Hassink 2024; López-Rubio, Roig-Tierno, and Mas-Verdú 2022). It is likely that, due to the search and analytical strategies used, these reviews include articles by prominent RIS authors who, usually from this expertise, sought to address and discuss a 'hot topic' such as S3 (e.g. Asheim 2019; Trippl, Zukauskaite, and Healy 2020), but who are not prominent authors in the S3 literature. In this case, keyword analysis may lead to the conclusion, erroneous for us, that S3 is part of RIS evolution. Something similar applies to other keywords identified by López-Rubio, Roig-Tierno, and Mas-Verdú (2022) and Bai, Chu, and Hassink (2024),

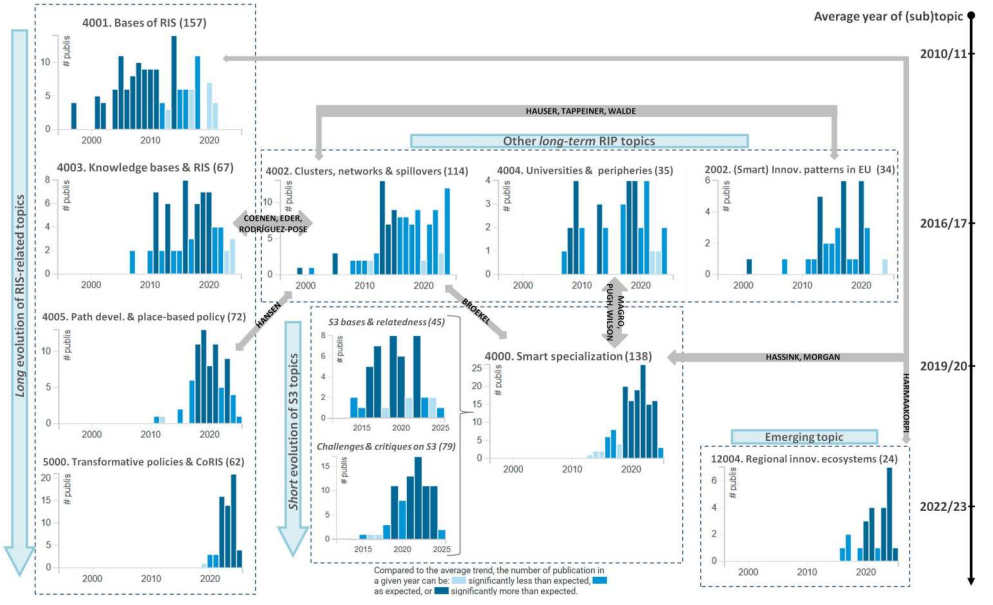


Figure 5. Temporal dynamics of publications in each RIP topic. Source: own elaboration.

Note: 2025 is only partially covered, as the database download took place on March 21. Each of the graphs compiled is a byproduct of our programming scripts.

such as 'cluster' policies, universities or helix, which in our analysis represent RIP topics but outside the core RIS tradition.

The middle and lower parts of Figure 4 show these weaker or more isolated connections between topics, which are not enough to suggest a thematic evolution between them. Only two authors connect the original RIS topic (sub cluster 4001) with S3, while four other authors stand out in S3 and another RIP topic but outside of RIS. Although some of them (e.g. Morgan) contributed to the conceptual and practical foundations of S3, all six (including Morgan) have raised different critiques and challenges to this approach, which is, in fact, the main element in common. This reflection arises from a division of the S3 field based on a second stage of BC (see Figure 5).[10] There, we observe a certain evolution in the short history of S3 (or at least shorter than the trajectory of RIS), where the first phase focuses on establishing its conceptual bases. To Foray's words above, we can add the 'discrepancy between what was at this time an incomplete concept and a massive and immediate implementation of the prescriptions formulated by this concept' (Foray 2019, 2066). Hassink and Gong (2019) question the conceptual confusion and fuzziness under the umbrella of S3, with terms like diversified specialization, smart diversification, branching, variety or relatedness, although the concepts of related variety and relatedness become increasingly central over time.[11] This leads us to the second phase (or 'subtopic') of S3, which brings together publications with different critiques and challenges faced by these policies, a relatively more intense issue in recent years. These two major fields within the S3 literature have also been identified by Rosas Rodríguez and Demmler (2023).

Some interesting, though more subtle, differences between RIS and S3 emerge when analysing the main journals where these topics have been published (Figure 6).

In RIS-related topics (ordered by average year)											
4001. Bases of RIS (157 - 2010.77)	f(%)	σ	4003. Knowledge bases & RIS (67 - 2016.73)	f(%)	σ	4005. Path devel. & place-based policy (72 - 2019.85)	f(%)	σ	5000. Transform. policies & CoRIS (62 - 2022.90)	f(%)	σ
European Planning Studies	**17.83**	13.90	European Planning Studies	**17.91**	9.13	European Planning Studies	**12.50**	6.23	European Planning Studies	**17.74**	8.69
Regional Studies	4.46	4.35	Journal of the Knowledge Economy	8.96	7.32	Regional Studies	6.94	5.07	**Environmental Innovation and Societal Transitions**	**16.13**	16.05
Research Policy	4.46	0.95	Environment and Planning C: Government and Policy	4.48	7.52	Competitiveness Review	5.56	14.09	Journal of Cleaner Production	3.23	3.14
Environment and Planning C: Government and Policy	3.82	9.74	European Urban and Regional Studies	4.48	8.18	Environment and Planning C: Politics and Space	5.56	10.61	Journal of Human Development and Capabilities	3.23	10.04
Journal of the Knowledge Economy	2.55	2.37	Science and Public Policy	4.48	0.74	Innovation: The European Journal of Social Science Research	4.17	3.92	Research Policy	3.23	0.04
Journal of Technology Transfer	1.91	1.49	AJSTID-African Journal of Science, Technology, Innovation...	2.99	3.35	Revista Galega de Economia - Galician Journal of Economics	4.17	8.25	Sustainability	3.23	1.02
Science and Public Policy	1.91	-0.77	Policy Studies	2.99	5.91	Economic Geography	2.78	6.91			
Technological Forecasting and Social Change	1.91	-0.41	Regional Studies	2.99	1.63	Norsk Geografisk Tidsskrift - Norwegian Journal of Geography	2.78	8.26			
Economic Geography	1.27	4.45	Research Policy	2.99	-0.07						

In other topics of RIP research (top and sub clusters with +100 publications)											
4000. Smart specialization (138 - 2020.65)	f(%)	σ	4002. Clusters, networks, collab. & spillovers (114 - 2016.44)	f(%)	σ	2. Regional innov. patterns, growth & efficiency (146 - 2016.30)	f(%)	σ	12. Regional innov./entrepren. ecosystems (118 - 2017.74)	f(%)	σ
Regional Studies	**13.04**	14.22	Technological Forecasting and Social Change	6.14	2.59	Research Policy	5.48	1.62	Research Policy	6.78	2.27
European Planning Studies	**12.32**	8.48	European Planning Studies	5.26	2.40	Regional Studies	4.79	4.61	Sustainability	5.93	3.75
Journal of the Knowledge Economy	5.80	6.43	Research Policy	5.26	1.30	Growth and Change	2.74	7.55	Technological Forecasting and Social Change	5.08	1.89
Science and Public Policy	5.07	1.47	Regional Studies	3.51	2.69	Technological Forecasting and Social Change	2.74	0.25	Asian Journal of Technology Innovation	3.39	6.04
Innovation: The European Journal of Social Science Research	3.62	4.60	Journal of Technology Transfer	2.63	2.12	Scientometrics	2.05	3.17	Industry and Higher Education	3.39	5.87
Annals of Regional Science	2.90	9.99	Science and Public Policy	2.63	-0.20	Sustainability	2.05	0.44	Science and Public Policy	3.39	0.28
Sustainability	2.90	1.21	Cities	1.75	6.46	European Planning Studies	1.37	-0.59	Innovation: The European Journal of Social Science Research	2.54	2.73
Cambridge Journal of Regions, Economy and Society	2.17	6.43	Growth and Change	1.75	4.12	Foresight	1.37	2.74	Journal of Technology Transfer	2.54	2.05
Industry and Innovation	2.17	3.04	IJTLID-International Journal of Technological Learning...	1.75	2.36	Innovation: Management, Policy and Practice	1.37	1.47	Social Studies of Science	2.54	9.66
Scienze Regionali - Italian Journal of Regional Science	2.17	10.00							Technology Analysis and Strategic Management	2.54	2.12

Figure 6. Top journals in each RIP topic (with % of total publications and significance σ). Source: own elaboration.

Notes: We show the journals with at least two articles per topic and excluded from the lists some compiled books and conference proceedings (however, they do not occupy top positions). Journals appearing in two or more topics are coloured according to the following logic: regional journals in blue scale; S&T journals in greyscale; and 'Sustainability' in orange, being a journal with a broad thematic scope. Given the low number of publications in sub clusters 2002 and 12004, we present the results for top clusters 2 and 12, which contain more than 100 records. Cluster 4004 is not included due to its low number of publications.

Throughout the different RIS phases, there is a clear predominance of 'European Planning Studies,' which only in the recent sub cluster 5000 is also shared with a non-strictly regional journal: 'Environmental Innovation and Societal Transitions'. Another well-known regional journal, 'Regional Studies', appears further behind among RIS topics (especially in percentages), which is consistent with other reviews (Doloreux and Porto Gomez 2017; Fernandes et al. 2021), and does not figure in the ranking of sub cluster 5000. The situation is quite different in the S3 field, where both 'Regional Studies' and 'European Planning Studies' lead in terms of publications, as also shown by Rosas Rodríguez and Demmler (2023). 'Research Policy' and 'Technological Forecasting and Social Change', two S&T journals that are not strictly regional, gain relevance in the latest RIP topics in Figure 6, while 'Sustainability' also appears in some cases (Gu et al. 2021; Jütting 2020; Lopes et al. 2020).

In terms of origin and scope, although European journals clearly dominate and European scholars also play an important role in many other leading journals, there are also some journals from other continents (e.g. Asia and Africa) and other non-mainstream journals in which authors from developing countries have more participation (e.g. 'IJTLID', 'Foresight', 'Social Studies of Science'). Something similar can be seen in

Figure A2 in the Annex, based on BC labelled by country of authors of the 753 RIP publications. Although the centrality of Europe is undeniable, several Asian countries have joined the discussion in recent years and are gradually gaining more central positions within the network, such as China. On the other hand, while there are also contributions from most Latin American countries, they still appear on the margins of the network.[12]

6. Conclusions and future agenda

Building on several limitations and research gaps identified in previous studies, this article aimed to conduct a comprehensive bibliometric analysis of the evolution and framing of RIP research within the three innovation policy paradigms. In addition, the article showed the usefulness of some methodological advances, such as the use of BC with a higher threshold of shared references, the analysis of clusters at multiple levels, the mapping of topics into a new analytical model of policy paradigms or the tracking of the most influential authors (and journals) across the different topics. All of this has allowed us to answer different questions that guided the analysis.

In the first place, it is hard to continue suggesting, as some reviews have done (Martin 2012; Meneses 2023; Uriona-Maldonado, dos Santos, and Varvakis 2012), that RIP research is merely an appendix, subset or extension of the general (or national) innovation policy literature. On the contrary, we have shown that the RIP literature has a volume and internal coherence that distinguish it from other national, sectoral or technological (systems) approaches. The main caveat, for the moment, lies in regional studies on transformative and mission-oriented innovation policies. In this case, these publications share the same top cluster with five other topics, in which the geographical dimensions of sustainability transitions and other grand challenges are still largely overlooked (we will return to this point below).

In the second place, despite the undeniable historical relevance of RIS and, more recently, S3 (which have been the focus of most regional reviews), our comprehensive analysis has shown that the RIP field extends well beyond these two issues. Based on the evidence presented, it is necessary to acknowledge the existence of other long-term RIP topics (such as 'cluster' policies, regional universities, regional performance and innovation patterns) and some emerging topics (around different notions of ecosystems), which have generally been little explored.

In the third place, although the centrality of the RIS approach has led to framing the RIP literature mainly within the innovation systems paradigm, we have discussed that several RIP topics are placed within the classical science and R&D policies for growth, that is, in a narrow view of innovation policy rationales, objectives and instruments. At this point, we especially argued and justified the location of S3 within this (first) framework, given its political and academic prominence over the past decade. Furthermore, we claim that only one RIP topic or sub cluster can be fully located within the third paradigm of transformative and mission-oriented innovation policies.

In the fourth place, and beyond the evidence provided in the previous points, we presented different ways of analysing the evolution of the literature that allowed us to highlight a couple of key issues. With new arguments, we again challenged the interpretation that S3 is an extension or derivation of the regional systems approach (Bai, Chu, and Hassink 2024; González-López, Asheim, and Sánchez-Carreira 2019; Kruse 2025;

Lopes, Ferreira, and Farinha 2019; López-Rubio, Roig-Tierno, and Mas-Verdú 2022). On the other hand, we showed that the field of challenge-oriented regional policies and systems represents one of the latest phases of RIS evolution, entering into the debates of the most recent paradigm of innovation policy. Lastly, we briefly stated that, despite the strong dominance of European journals and authors, there is evidence in both dimensions of a gradual increase in the participation of developing countries, not only driven by China and other parts of Asia but also by Latin America.

Quite evidently, and not only at the regional level, the research agenda on innovation policies has been shifting in recent years towards the third paradigm, paying increasing attention to issues such as climate change, environmental sustainability and other grand societal challenges. In this context, several authors highlight the existence of various research gaps, many of which are related to our findings. First, it must be recognized that partially different concepts and perspectives, such as transformative, mission-oriented or challenge-driven policies, are often placed under a common umbrella (Haddad et al. 2022) or used interchangeably, but 'one cannot find in literature a systematic discussion of their differences' (Molica et al. 2025, 6). While this article did not delve into this issue (which certainly deserves to be addressed in future reviews), our analysis showed that, despite their conceptual differences, these topics tend to coexist relatively closely within top cluster 5.

Part of this connection between topics can be explained by the need to overcome the second limitation or gap of the third paradigm: the mismatch between academic (theoretical) discussions and concrete policy-making or, in other words, between policy recommendations and the instrumentation and governance level (Edler et al. 2025; Grillitsch, Hansen, and Madsen 2021; Lindner, Edler, and Daimer 2024; Molica et al. 2025). In this context, the mission-oriented policy approach has often served as a practical means to manage, translate and implement transformative and challenge-oriented objectives (Hekkert et al. 2020; Jütting 2020; Lindner, Edler, and Daimer 2024; Schot and Steinmueller 2018), although several authors recognize 'that addressing grand challenges is much more complex than the next generation of mission-oriented policy' (Haddad et al. 2022, 18). As the theory and practice around the third generation of innovation policies continue to develop and mature over time, the differences between approaches may become more apparent and this may be reflected in future reviews (for example, in possible divisions of top cluster 5).

Third, we have mentioned in several places, and our results have validated to some extent, 'the gap in how geography, i.e. space, place and scale, is understood and can be integrated in current debates on mission-oriented [and transformative] innovation policies' (Uyarra et al. 2025a, 8). In addition to the academic or theoretical interest in this issue, this gap also entails a series of limitations or problems related to the implementation of innovation policies inspired by the third paradigm. Numerous authors have criticized the little place sensitivity, insufficient attention to contextual and multi-scalar factors and national bias in mission debates, warning that such shortcomings can lead to top-down, place-blind policies that may exacerbate regional disparities (Cappellano, Molica, and Makkonen 2024; Isaksen, Trippl, and Mayer 2022; Uyarra et al. 2025a; Uyarra, Wanzenböck, and Flanagan 2025b). All of this brings us to a fourth gap related to the previous two: the need for more studies that explicitly focus on the characteristics, conditions and needs of peripheral regions within the third innovation policy

paradigm and that, in particular, delve into 'how to devise, coordinate and implement sustainability-related policy in peripheral regions' (Vale et al. 2024, 127).

Going strictly to the regional policy field, according to different authors and in part to the evidence provided in this article (for example, the location on the spectrum of innovation policy paradigms), the modern S3 approach seems to face several limitations or challenges in order to respond to some of the above gaps. Despite its more place-based nature and the combination of top-down and bottom-up elements, there is broad consensus that implementing S3 in peripheral regions remains highly difficult or challenging (Benner 2020; Foray 2019; Hassink and Gong 2019; Marques and Morgan 2018; Wibisono 2022), unfortunately contributing to the persistence of the regional innovation paradox (Oughton, Landabaso, and Morgan 2002). On the other hand, 'existing policy instruments contemplated by the S3s do not yet fully align with the requirements of a transformative, challenge-oriented approach' (Molica et al. 2025, 5). In this sense, some authors raise doubts about whether sustainability transitions and other grand societal challenges can truly be addressed through S3, or whether this policy instrument risks being overcharged and diverted from its original techno-economic objectives (Hassink and Gong 2019; Kruse 2025).

For various reasons, the long-standing RIS tradition seems to be better equipped to include or address several of the aforementioned gaps in its future research agenda. Since its origins, the RIS approach has had the merits of becoming a kind of synthesis of other territorial innovation models and of questioning 'one-size-fits-all' interventions (Tödtling and Trippl 2005), thereby promoting place-based innovation policies that take into account the diversity of regional contexts and, in particular, the conditions of peripheral regions (Coenen and Morgan 2020; Eder 2019). In these respects, it has some advantages over the ecosystems literature, which has been fragmented among several adjectives and subtopics with varying degrees of attention to the regional policy scale (as mentioned in several places, especially in note 7). Furthermore, as noted by Grillitsch, Hansen, and Madsen (2021, 287), the 'geographical sensitivity in transformative innovation policy (…) remains considerably under-developed compared to innovation systems policy', which has incorporated the concern for sustainability transitions (reflected in top cluster 3), grand societal challenges and regional transformation in the last phase of its evolution (Bai, Chu, and Hassink 2024; Vale et al. 2024). However, there is still a need to further develop and harmonize the multiple concepts and frameworks that coexist within sub cluster 5000, such as challenge-oriented regional innovation systems (Trippl, Baumgartinger-Seiringer, and Kastrup 2024), geography of sustainability transitions (Coenen et al. 2025), geography of mission-oriented innovation policy (Uyarra et al. 2025a) or sustainable regional restructuring (Karlsen, Rypestøl, and Trippl 2025). Likewise, it is necessary to advance in the practice and implementation of these emerging RIP approaches. Paraphrasing Uyarra et al. (2025a), what does a place-based, third-generation innovation policy design look like?

Notes

1. SCOPUS yielded more records than WoS in preliminary searches, probably because it includes more social science journals. Despite including some records in Spanish, OpenAlex did not necessarily show a higher total volume. In terms of volume and also data quality, SCOPUS was the best choice.

2. We evaluated smaller definitions for top clusters (with a minimum of 50 records) and sub clusters (with a minimum of 10), but these specifications made the analysis more complex and the additional clusters did not add much analytical richness (except for a few comments in note 7). In their BC analysis, Vale et al. (2024) also set the minimum cluster size at 20. Based on Figure 2, the reader may explore the implications of raising that threshold. For example, a minimum of 30 would result in the exclusion of three regional sub clusters from the analysis.
3. For the complete list, see the online supplemental material.
4. From now on, the term 'topic' will refer specifically to the level of sub clusters (which constitute the main focus of this article), while any further division of a sub cluster through the iterative process mentioned will be considered a 'subtopic'.
5. In addition to the consistency and robustness checks outlined in this section, the comparison with previous reviews reinforces the reliability of our findings. For this article, we carried out a thorough examination of review studies in the (regional) innovation policy field and related subfields. Most of these reviews work with substantially smaller samples than ours (usually a few hundred) as a result of complex search strategies, sometimes restricted to unjustified time periods. These smaller samples are often a prerequisite for using automated (or 'black-box') clustering and network tools, which typically do not allow researchers to control specific thresholds or parameters.
6. Although it did not always rank first in the other configurations tested, it should be noted that the core of RIP (top cluster 4) was consistently among the first three positions. It is worth mentioning that the system randomly assigns identifying numbers to the top and sub clusters.
7. Top cluster 12 contains several small sub clusters, with less than 20 publications and therefore not visible in Figure 2. However, they are partially represented in the top cluster label, such as entrepreneurial ecosystems and helix models, among others. This may reflect different but related issues, such as the use of various adjectives (and approaches) for ecosystems, with differing degrees of 'spatiality' or territorial focus (not always regional) and with emphasis on different dimensions or policies (not always related to innovation) (Scaringella and Radziwon 2018; Gu et al. 2021; Cobben et al. 2022).
8. A deeper analysis of the non-regional top clusters and sub clusters, while certainly of interest, is beyond the scope (and word limit) of this article and will be left for future studies.
9. Although it is not a RIP topic, we note a significant presence of authors from Argentina, Brazil, Mexico and South Africa among the top 10 countries contributing to a (general) sub cluster on barriers and obstacles to innovation, reflecting some of the challenges faced in the Global South.
10. As mentioned above, this second stage of BC was applied to the set of 753 publications that make up the 11 regional sub clusters identified in the first stage. This iterative exercise also produced divisions within other original sub clusters, although they did not provide much information for the objectives pursued. For example, the distinction between an initial stage of differentiated knowledge bases and a later one of combinatorial knowledge bases –KB 1.0 and 2.0, according to Boschma (2018)– or the separation of new path development studies from the literature on agency and regional development.
11. Boschma stands out within this first field or 'subtopic' of S3, but does not appear in Figure 4 based on the whole cluster. He is also one of the coauthors of the highly cited 'ABC Paper' on constructing regional advantage (Asheim, Boschma, and Cooke 2011), which integrates the sub cluster 4003.
12. Examining the top ten countries by authors, China and Russia stand out in top cluster 2 (China only in sub cluster 2005 and Russia across all of them). China also ranks high in top cluster 12, particularly in sub cluster 12004 (together with Brazil), and in sub cluster 4002. Russia and Colombia also appear in sub cluster 4005.

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Data availability statement

The complete list of 753 RIP papers is published as online supplemental material. Further details on datasets, calculations and results are available upon request from the authors.

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Appendix

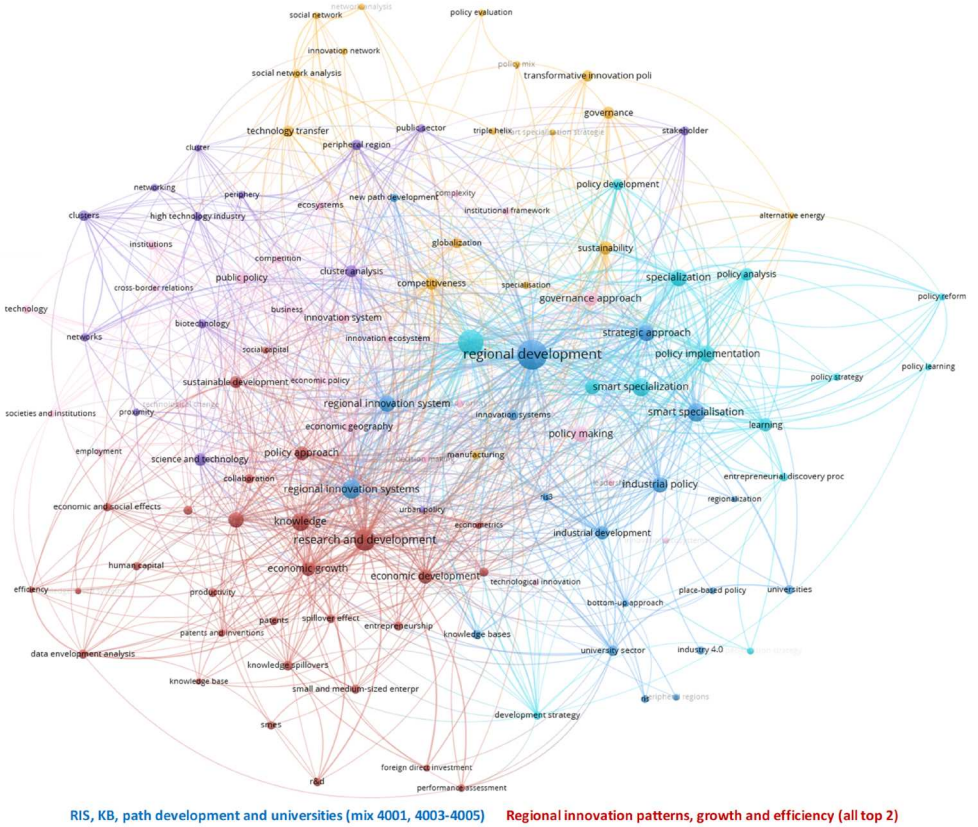

Figure A1. Keyword co-occurrence groups from the 753 RIP publications. Source: own elaboration based on VosViewer.

Note: We use author's and index keywords, as Foglia (2023).

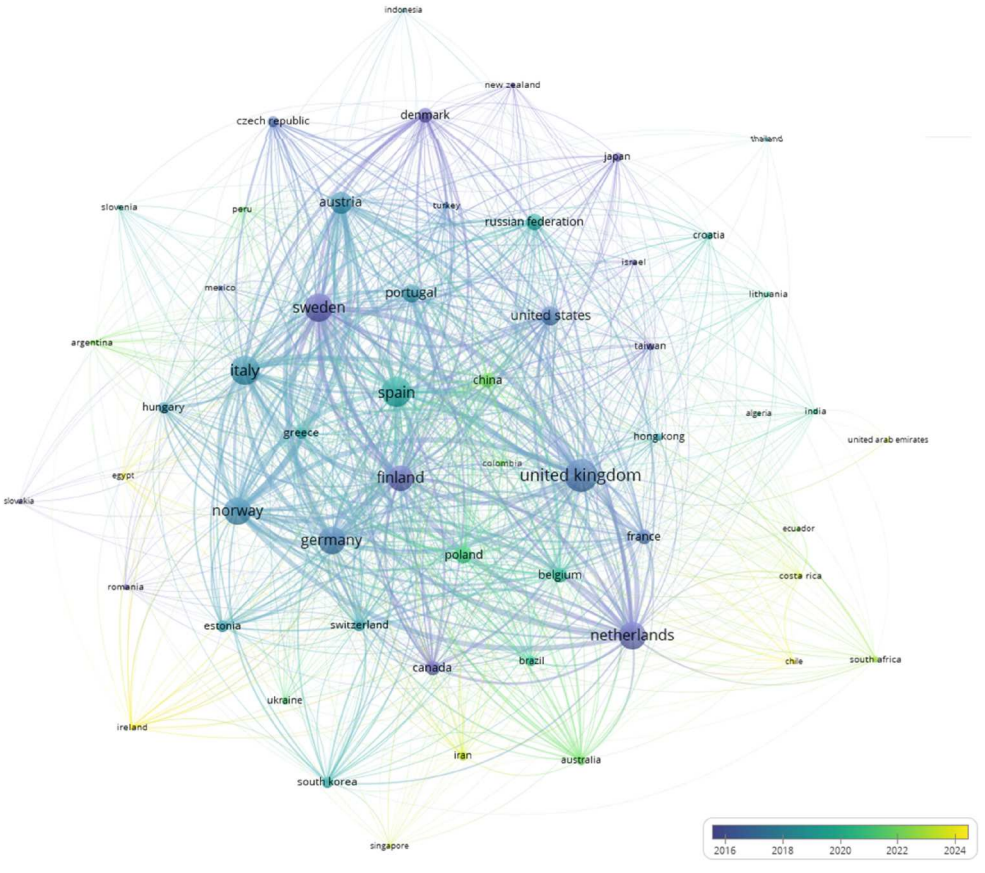

Figure A2. BC labelled by country of authors of the 753 RIP publications. Source: own elaboration based on VosViewer.