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Systematic Review

Conceptualizing the Knowledge Region: A Systematic Literature Review and a Proposed Definition

Antonio Calero-López [1], Aaron Gutiérrez [2,*] and Francesc Xavier Grau [3]

[1] Department of Geography, Universitat Rovira i Virgili, 43480 Vila-seca, Catalonia, Spain; antonio.calero@estudiants.urv.cat
[2] Department of Geography, Research Group on Territorial Analysis and Tourism Studies, Universitat Rovira i Virgili, 43480 Vila-seca, Catalonia, Spain
[3] Department of Mechanical Engineering, Universitat Rovira i Virgili, 43007 Tarragona, Catalonia, Spain; francescxavier.grau@urv.cat
* Correspondence: aaron.gutierrez@urv.cat

Abstract: Knowledge-based regional development policies have become increasingly popular in recent decades and have been widely disseminated and applied. The regional scale and regional policy have been no exception to this general trend, resulting in the coining of new terms, such as the knowledge region (KR). The use of this term has, however, suffered the consequences of a lack of consensus over its meaning. This has proven problematic and resulted in the term being applied in different ways according to the territorial context. To address this problem, the present study offers a definition of the term that identifies the main components of these different regional realities and provides examples of its appropriate use based on good practices. This new contribution has been based on the PRISMA methodology. The results highlight the existence of key components and the need for a governance framework that serves as a fundamental pillar of knowledge-based regional development. This study concludes with a proposal for a definition of the knowledge region that could be used as a model and basis for future research in this field.

Keywords: knowledge regions; regional development; knowledge-based development; definition; literature review

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1. Introduction

In recent decades, local and regional development models have had to undergo adaptation to new global trends [1]. Research, technology, and knowledge transfers are the axes that have structured a series of new regional systems in which strategic efforts are being made to foster and stimulate regional development through knowledge [2,3]. Political agendas have not been immune to these changes, and building a knowledge society has become an important public policy priority in recent decades [4,5].

This phenomenon began with the diffusion of what became known as the *knowledge society* and *knowledge economy*, which were first made popular by Drucker [6] and theorized upon by Sakaiya [7]. The former focuses on the use of knowledge in response to social needs, while the latter highlights its role in productive activities [8–11]. Within the framework of the European Union and—more specifically—under the European Regional Development Fund's (ERDF) "Thematic Objective for Research and Innovation", European regions developed Smart Specialisation Strategies (S3) during the 2014–2020 programming period. This change brought with it a more structured way of distributing EU funding [12] and allowed EU regions to outline their specific priorities and to design policies and projects addressed to meet them [13].

This extension of the use of the term *knowledge* has not only been confined to the state and global scales. Regions have also become project arenas in which strategies can be implemented [14]. This has given rise to the emergence of a growing number of new concepts and models for development strategies and policies based on knowledge. One of these terms is *knowledge regions* (KRs) [15]. These share similar features with other concepts, although they tend to be more focused on regional governance and a commitment to the pursuit of knowledge as a tool for promoting development. Some authors, including Suchacka [16], have associated them with several different domains. However, the main problem is that they lack any well-defined standards with which to identify their most typical components and scales [17].

This lack of definition has become particularly problematical within the domains of politics and public policy in which some administrations have used this designation without having a clear idea of what it implies. The term is often used when making strategic decisions that involve the use of this nomenclature as some kind of regional marketing. The result has been the progressive distortion of a concept that, from its very inception, has failed to enjoy a very wide consensus. Moreover, it has even become associated with failed attempts to implement certain development models due to a lack of understanding of what constitutes a success story and of the key actions and goals that should be transferable to other regions.

Within this context, the present study aims to clarify what KRs are, identify their main components, and examine their role in knowledge-based regional development. Two basic objectives were established: (1) to revise the main references to the concept, identifying its use, typologies, origin, and the most relevant examples of good practices identified in the literature, and (2) to produce our own definition of KRs, thereby addressing the current lack of consensus and seeking to provide a useful tool for policymaking and devising regional development strategies.

2. Theoretical Framework

Although it has gained prominence in recent decades, the use of knowledge as a driver of development is a growing trend that is rooted in two earlier concepts: the knowledge society and the knowledge economy. The former traces its origins to Schumpeter's [18] theories on economics and production systems. This initial groundwork was further developed by authors such as Masuda [19], who contextualized the concept in Japan, and Drucker [20], who associated the rise of the knowledge society with the post-World War II era. As a result, the knowledge society has become a key element of contemporary life [21]. However, despite extensive academic attention, its meaning remains somewhat ambiguous [22].

Similarly, the application of knowledge as an economic engine has followed a parallel trajectory, giving rise to global frameworks rooted in the *knowledge economy* [23,24]. In this context, scholars have focused on how knowledge contributes to economic growth and productivity [25–27]. Nonetheless, this concept also suffers from a lack of consensus. While it has been widely studied [28], the challenge of arriving at a globally accepted definition persists [29], largely because the role of knowledge in development extends beyond mere economic metrics [30].

The knowledge economy presents a historic opportunity to promote growth and territorial transformation. One of the most comprehensive strategies in this regard is knowledge-based territorial development [31], which diverges from traditional models in that it emphasizes the central role of knowledge and innovation in public policy [32]. Second, it underscores the critical importance of collaboration among social and economic actors to achieve shared objectives [33]. The practical deployment of these types of ter-

ritorial models generates the adaptation of the concept at two specific scales: local and regional. The first is based on the need to incorporate the knowledge perspective into urban planning [34], and the second on the capacity to respond to regional challenges represented by knowledge [35]. The urban area generates so-called knowledge-based urban development (KBUD), a concept that encompasses those realities where strategies are applied to transform local resources linked to knowledge into economic prosperity for their cities [36]. The concept is the basis that gives rise to elements such as strategic planning [37], the knowledge-based vision [38,39], and a new form of city, the *knowledge city* [40].

Regions are increasingly being recognized as engines of economic growth and innovation, capable of fostering robust networks among economic and knowledge-based actors [41]. Knowledge-based regional development rests on the premise that a region's economic success is contingent upon its capacity to mobilize knowledge resources [42,43] and on the collaboration between knowledge-generating organizations, knowledge users, and policymakers [44]. As with the broader concepts from which it derives, this model of development gained prominence in the early 2000s, coinciding with the global consensus regarding the link between knowledge and regional competitiveness [45,46]. More broadly, regional development can be significantly shaped by systemic innovations [47], with knowledge functioning as a critical absorptive capacity to stimulate growth [48].

The implementation of regional projects grounded in these principles has given rise to new referential models, which have been examined by scholars seeking to clarify their distinctive features and establish a suitable conceptual framework. It is within this context that the notion of KR emerges. Although the concept has gained attention in recent years, there is still no broad consensus regarding its precise definition [49]. Much of the academic debate has focused on identifying components and characteristics associated with both the knowledge economy and the knowledge society. For instance, the World Bank highlights that the pillars of a knowledge economy include an institutional and incentive framework that facilitates effective communication and the dissemination and utilization of information and knowledge. Based on this perspective, it is possible to identify some of the key dimensions underpinning knowledge-based development at the regional level.

Despite the progress achieved, a unified and widely accepted model for conceptualizing KRs is lacking. Although various frameworks share common elements, they also diverge in significant respects, reflecting the plurality of perspectives and methodological approaches adopted by different scholars [49]. According to Mian, Corona, and Doutriaux [50], KRs can be understood as regional systems characterized by highly skilled populations, the presence of significant economic clusters, and the development of new or innovative products and processes. Similarly, North " [51] identifies common denominators across definitions—such as the existence of qualified human capital, effective regional governance, and a strong presence of educational institutions—while noting that these definitions often differ in the emphasis placed on specific components depending on the analytical lens employed.

An additional contribution is offered by Reichert [52], who outlined the key components of a KR, emphasizing factors such as leadership, a shared and enabling collective mindset, a coherent strategic vision, and the presence of key institutions and industries, with the university playing a central role. In contrast, Sanz [53] defined a KR as "a territorial unit with abundant human and social capital, containing structures, organizations and people actively engaged in generating development through science, technology and innovation, and whose interactions achieve a high concentration of technology-based firms and highly skilled knowledge workers and entrepreneurs".

In sum, while academic literature has produced a wide range of conceptualizations regarding what constitutes a KR, it has thus far failed to generate a widely accepted or standardized definition capable of resolving the current conceptual fragmentation. The diversity of approaches—each emphasizing different dimensions such as institutional arrangements, human capital, innovation ecosystems, or governance structures—reflects the complexity and multi-dimensional nature of knowledge-based regional development. This lack of consensus, however, is not merely a theoretical issue; it has practical implications for both policy design and implementation. Without a clear and cohesive framework, efforts to replicate or benchmark successful KRs risk being inconsistent or ineffective as they may overlook critical contextual variables or misinterpret core mechanisms. Therefore, advancing towards a more integrative and operationalizable definition of KRs is essential—not only to enhance academic understanding but also to guide public policies and regional strategies aiming to foster innovation, competitiveness, and sustainable territorial development in the knowledge economy.

3. Research Methodology

The research presented was based on a systematic literature review of articles published in the academic databases *Scopus* and *Web of Science* and referenced via *Google Scholar*, which is a broader, more inclusive, and less selective database. The aim was to make the search for academic and technical documentation as wide and inclusive as possible. The study included a targeted search of published research and technical reports that contained the term "*knowledge region*" in their titles and/or abstracts, working with the three previously cited databases. The extensive coverage of *Google Scholar* generated an initial sample of 1308 documents. To make the task more manageable, the authors decided to focus on the 150 most relevant references (see Figure 1), as they provided a representative volume of content that could be processed in the study. Before screening, all duplicated records (38) were removed, leaving 213 records for revision.

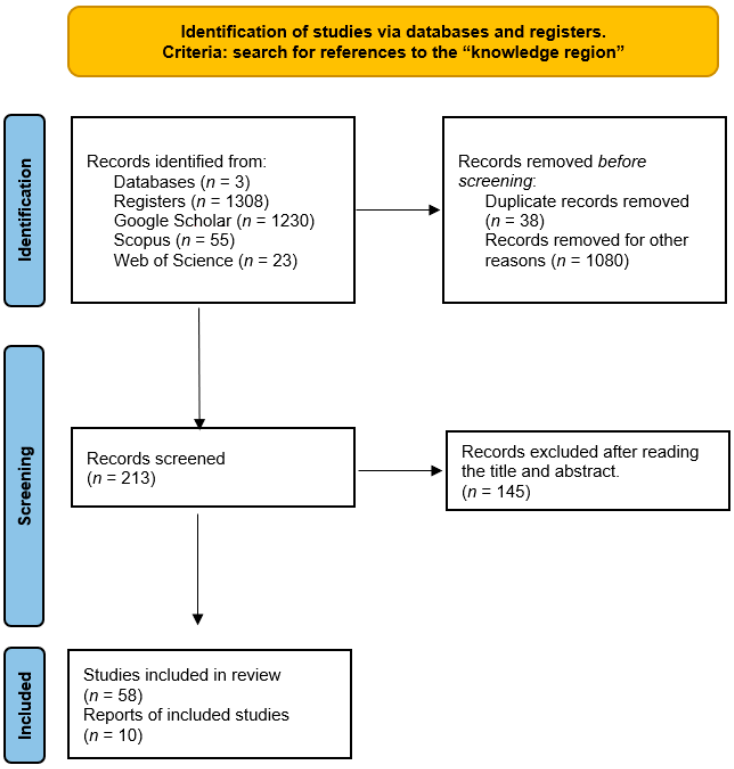

Figure 1. Prisma diagram.

After combining this reduced number of sources with the other studies that had been found, the sample was refined by reviewing the titles and abstracts and only including references that specifically referred to the target concept. The result was a working sample of 68 references, 58 studies, and 10 reports (15 from *Scopus*, 9 from the *Web of Science*, and 44 from *Google Scholar*). These were subjected to a systematic literature review that followed the PRISMA guidelines developed by Page et al. [54]. A complete list of the selected references can be found in a table included in the Supplementary Material.

4. Sample Characteristics

4.1. Publications

Filtering the 68 references that were analyzed by their respective years of publication revealed that the earliest work dated back to 2002 (see Figure 2) and that the publications continued until 2023, with there being two references for that year. Academic interest in this subject may have dwindled over time, as most of the articles were published in the 2006–2015 period. Although it was possible to observe a general downward trend, with a resurgence of interest in later years, the evolution may reflect a decrease in interest in this line of research within the scientific community.

Figure 2. Number of references to knowledge regions.

As can be seen from Table 1, the subject of KRs has mainly been addressed in scientific papers, which accounted for 63.24% of the references analyzed. Published studies on non-indexed platforms were also important, with these mainly taking the form of reports (14.71%). References included in books, chapters of books, papers presented at conferences, and other formats accounted for 36.76% of the publications reviewed.

Table 1. Types of references analyzed.

Paper	Book	Book Chapter	Conference Paper	Report	Master's Degree Thesis	Total
43	4	5	5	10	1	68
63.24%	5.88%	7.35%	7.35%	14.71%	1.47%	100%

The heterogeneity of the sample, in terms of the typologies referred to, was significantly reduced when it came to the geographic origins of the different publications. As can be appreciated from Figure 3, Europe was responsible for most of the publications (72.6% of the total), with its most productive countries being the Netherlands (9), Estonia (8), and the United Kingdom (6). North America was the second largest contributor, accounting for 19.18% of the total, with Canada (5), Mexico (5), and the USA (4) as the main sources. The study also contained three references from Asia, namely Indonesia, Israel, and Singapore, and another referring to Australia, Colombia, and South Africa. This distribution also reflected that the use of the English version of the concept "knowledge region" effectively limited the geographical scope of the sample. In fact, there was a noticeable lack of publications and references from South America, which is an area that is certainly not devoid of development models and has several examples of good practices.

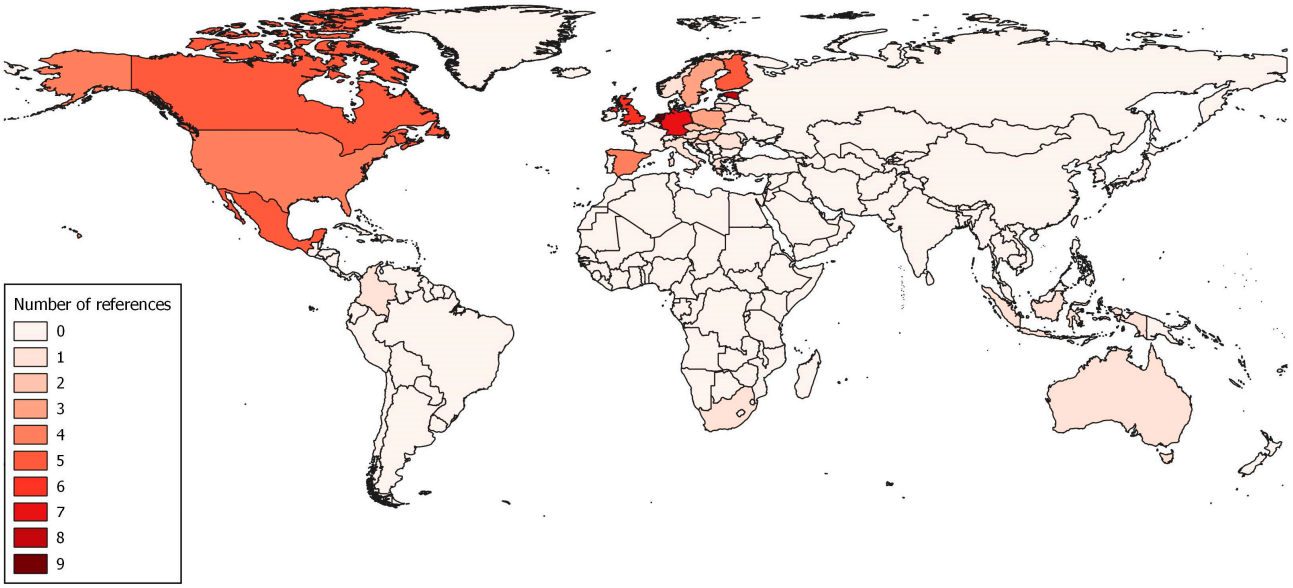

Figure 3. The origins of the references.

4.2. Regions Studied

In total, 163 examples of KRs were obtained from the references analyzed. Figures 4 and 5 show that the geographic distribution of each of the examples identified was heavily concentrated in Europe (89.39%), followed by North America (8.94%), Asia (1.12%), and Oceania (0.56%). There was not, however, any clear correlation between the provenance of the references and the examples analyzed. As far as individual countries were concerned, the United Kingdom contained 27 cited cases, followed by Germany (24), the Netherlands (13), Spain (9), and Sweden (8). In total, there were 144 cases in Europe. Examples cited in other continents included the following:

- North America: Baltimore; Boston; Calgary; Chicago; Cuernava-Ensenada; Jalisco, Mexico City; Monterrey-Guadalajara; New York; Ottawa; Philadelphia; Quebec; Queretaro; Saskatoon; Tabasco; and Washington, D.C. [55–58]).

- Asia: Kobe [59] and Israel [60].
- Oceania: Sydney [61].

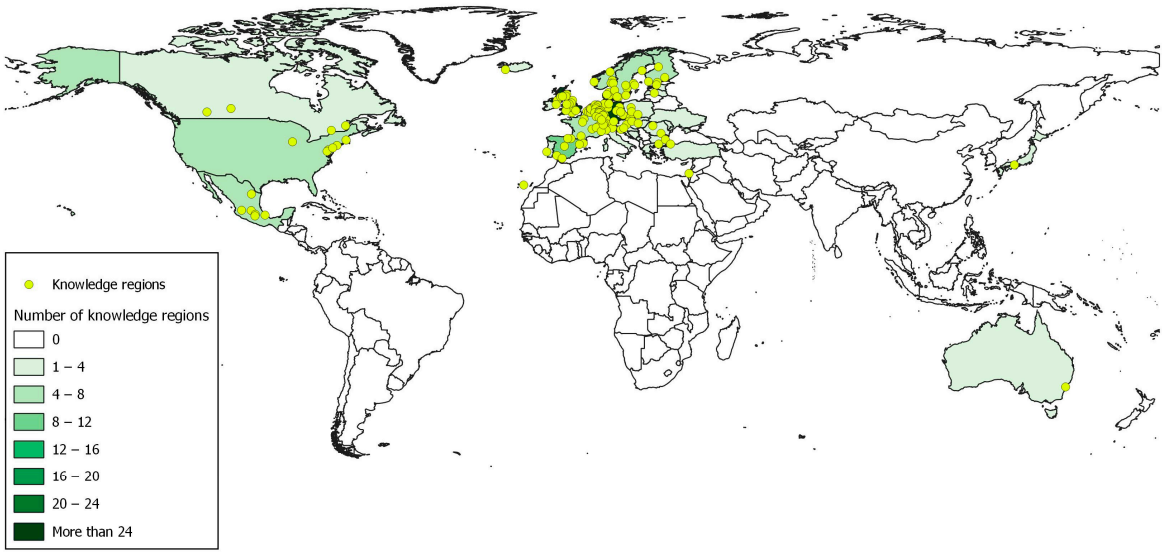

Figure 4. Distribution of knowledge regions by country.

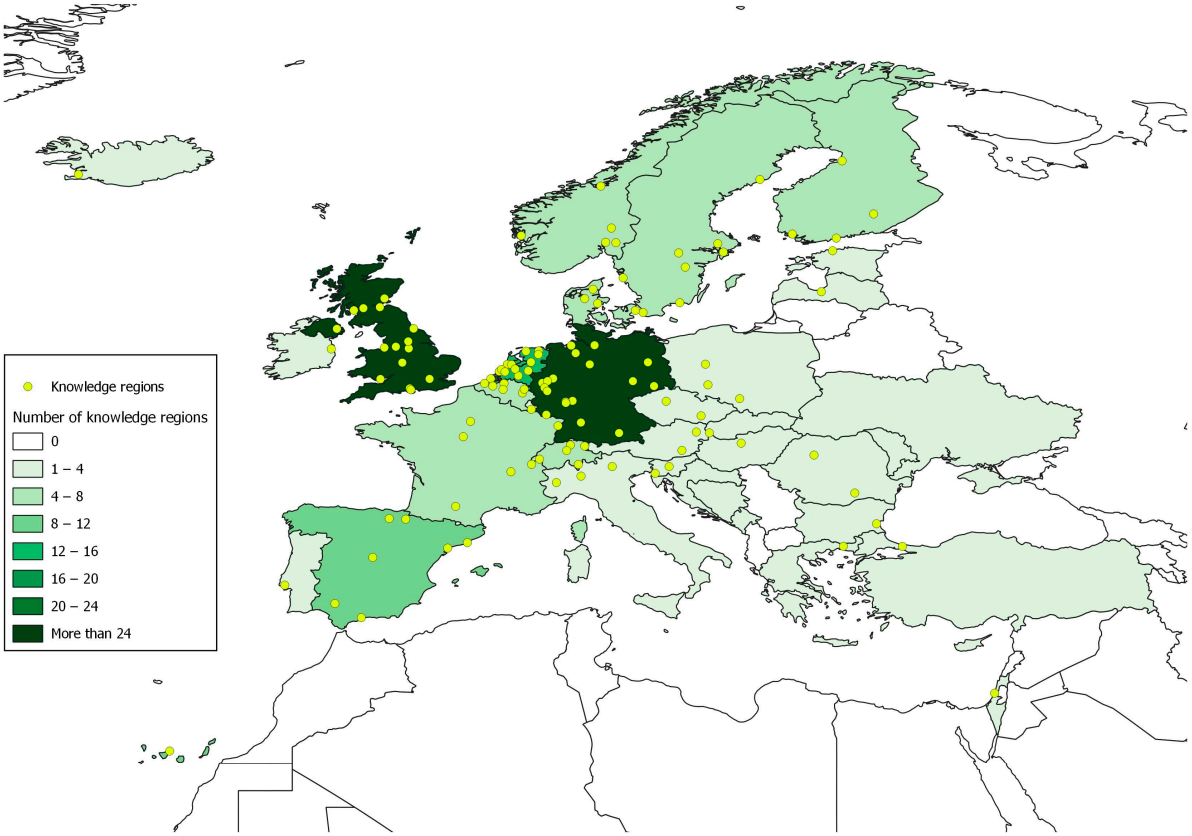

Figure 5. Distribution of knowledge regions in Europe.

Given the previous lack of consensus on KRs and the dearth of research on their demographic size, the authors decided to analyze the number of inhabitants in the different regions included in the sample. The obtained results provide a good reflection of the current lack of precision in the use of the term KR and the differences between the territories in which this concept has been applied to provide a framework for analysis and

planning. It was observed that 13.04% of the cities cited in the sample had fewer than 500,000 inhabitants, 15.53% had between 500,000 and 1 million, 47.83% had between 1 and 5 million, 17.39% had between 5 and 10 million, and 6.21% formed part of megacities with over 10 million inhabitants (see Figure 6). On a comparative level, this predominance presented similar results to those obtained for what were identified as the world's most innovative regions according to the Regional Innovation Scoreboard. In that case, the highest levels of innovation were reported to occur in cities with between 2 and 2.5 million inhabitants, while what were recognized as emerging areas tended to have fewer than 1.5 million inhabitants.

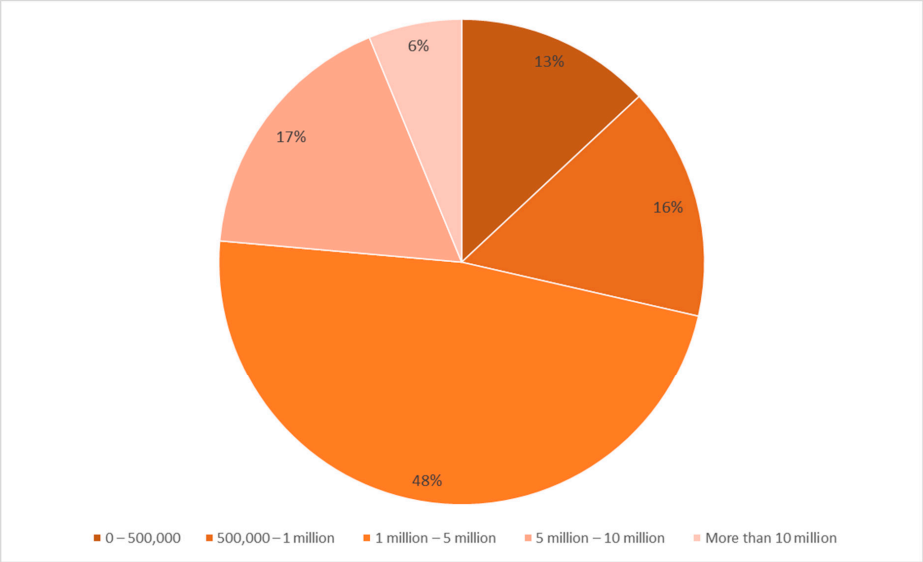

Figure 6. Population of each example of knowledge regions.

The case with the greatest number of inhabitants was the Danube Region, analyzed by Koch [62], which included 115 million people in Austria, Bulgaria, Croatia, the Czech Republic, Germany, Hungary, Romania, Slovakia, Slovenia, Bosnia and Herzegovina, Montenegro, Serbia, Moldova, and Ukraine. This case represents a considerable outlier within the sample. It was excluded from the study to provide a more accurate approximation and was one that adjusted better to the dimensions that were initially expected. The smallest KR, Tübingen, was analyzed by Colombelli, Foddi and Paci [63] and had only 89,447 inhabitants.

5. Findings and Analysis

The analyzed references offer a particular vision of what the characteristic and required components of KRs should be. The level of diversity is great, as is the number of components identified by different authors. This makes it necessary to seek a series of common and unifying components, which could include human capital, higher education institutions, an innovative economic sector, regional governance, and quality of life.

5.1. Human Capital

The implementation of strategies for promoting knowledge-based regional development requires a critical mass [64] that must meet the needs of the innovating activities that are to be undertaken at the local level [65]. We observed a series of educational strategies that cover the whole educational spectrum at the regional level [66], nourish productive activities [67], and provide responses to the training requirements of the local population [68].

This need for a diverse range of training calls for the provision of quality education at all levels [69], which must be readily accessible to the local population [70].

Various authors have underlined the importance of implementing strategies and policies to promote the training and skills of the local population as key components of KRs. For example, several authors give importance to the presence of a young, well-educated population [71], including a certain percentage of society with at least university-level studies [63], and to the skills of local populations being a characteristic feature of these regions [55,72]. Ideas such as possessing tacit knowledge appear in a much more testimonial way [49]), with references to skills that are more difficult to pass on, such as leadership [73], and to *lifelong learning* [74].

In conclusion, the literature agrees in identifying human capital as one of the basic axes upon which a model for knowledge-based regional development should be structured. Several authors concur in underlining this as a key component of KRs, with references to various related resources such as a *trained workforce* [50], an *innovative workforce* [52], and *knowledge workers* [75–79].

Structuring productive systems on research [14], knowledge, and innovation [51] requires this essential raw material and several other components. This leads to policies and strategies that promote the creation, retention, and capturing of talent and the ongoing acquisition of knowledge by the local population to converge [66]. However, not all regions can become KRs [80], as the competition for talent tends to be intense [81]"; therefore, only a few regions are able to fully achieve this final goal [82]".

5.2. The University and Research System

KRs should have at least one university with regional coverage [83], capable of enabling them to establish a system within which the university can take advantage of the region's economic and social structures, and at the same time, the region can take advantage of the university's ability to generate and transfer knowledge [84].

Today, universities face the new challenges posed by the knowledge economy [85] and must adapt and meet emerging requirements to generate and transfer knowledge and new skills to the wider local society [86,87].

Universities are one of the main pillars of models for knowledge-based regional development [88,89] and seem destined to play leadership roles that will reach beyond just academic training, although their exact role may vary from case to case [90]. They have become institutions for responding to the socioeconomic needs of their territories, for providing skills aligned with regional needs [91], for playing a key role in transfers of knowledge and technology [92], for promoting *knowledge engagement*, and, finally, for helping to produce an authentic *knowledge environment* [52].

One of the most important references relating to the roles of universities in KRs is that established by Reichert [52], who identified four roles. The first, the *sober view*, understands them as institutions that produce knowledge. The second, the *social view*, identifies them as entities that create knowledge by responding to the challenges and needs of society. The third, the *creative view*, perceives them as ideal environments in which ideas can be freely developed without the need to find answers to any specific questions. Finally, the fourth perspective, the *purist view*, sees them as entities that must distance themselves from society, politics, and the economy to remain truly innovative in the long run.

Research centers could play a similar role to universities. Several authors, including Gutiérrez et al. [71], identified them as axes that can dynamize research by generating knowledge and transferring it to society and local companies. The strategic role that researchers play in these environments is repeatedly recognized in the literature. Various studies, including the Regional Innovation Scoreboard, have therefore aimed to monitor

the dynamism of the regional network of researchers, using as indicators such factors as the number of international co-authorships in scientific publications. In conclusion, a KR must have ties with at least one powerful researching university and/or research center, although not all regions with powerful and innovative universities necessarily constitute KRs [82].

5.3. Productive Model

Entrepreneurial activity is one of the most important axes in any regional development system. In the case of strategies linked to knowledge, this sector must play an important role in the productive process of transforming an industrial region into a globally operative KR [58]. Competitiveness is one of the characteristic features of this model [69]. Others include an industry's commitment to its region, cooperation between the local public and private sectors [93], and establishing business clusters [64,70]. In KRs, productive activities and services with relevant knowledge components are actively promoted by both the public and private sectors [66]. Within this process, industries specialize in competitive niches [84] or in activities that require a highly qualified workforce [94].

New investment is attracted and entrepreneurship is actively promoted [95,96]; also, new products and innovative processes are developed [50] that have a direct and positive impact on R&D&I [52,97] and increase the percentage of innovative activities within the region as a whole [98]. The result is a region that facilitates the development of companies, in which different actors work in close collaboration and innovate together [99].

Finally, numerous authors analyzed how innovative profiles and business activities can affect regional development, with perhaps the best known of these being the Regional Innovation Scoreboard organized by the European Commission [100]. This report shows that the least innovative regions tend to stand out in indicators such as education, training, applications for trademarks, and design. By contrast, the most innovative regions stand out in indicators related to industrial activities that are close to the market and make a greater direct contribution to industry in the form of added value. The latter includes concepts such as expenditure on R&D in the business sector and requests for patents [101].

5.4. Governance Structure

The literature presents different examples of good practices in governance applied to KRs. It is important to highlight a basic principle that focuses on their capacity to design, agree upon, implement, monitor, and re-formulate strategies and action plans, leading to and driving forward development through knowledge [102]. According to the literature, KRs characteristically have forms of governance that are well adapted to responding to meet their challenges and needs [103]. Within this framework, "*good governance*" [94] implies incorporating knowledge and innovation into regional strategies [104,105];.

New and less hierarchical forms of governance [49]), typically with greater civic participation [106], and the implication of future generations [107] can help to develop quadruple helix structures that serve as stimuli for increasing the role of local society within the regional system [83]. These configurations tend to be based on a public sector that carries out its tasks in what the local population perceives as a clear, effective, and positive way [103] and which focuses on promoting strategies that seek to ensure that this development favors the whole of society [84].

The different ways in which the previously mentioned functions can be implemented fundamentally depend on whether or not regions have the necessary competences. Some regions can develop these competences directly and on their own, while others, as is the case with Twente in the Netherlands, have a *board* that defends their interests within the organs of the region's provincial government [108]. In other cases, universities have taken

on a prominent role in decision-making because of their regional influence, and their leadership can be observed in some medium-sized cities ([83,109]). There are many varied options in terms of KR governance, but there is one idea that is clear: it is necessary to have a group of institutions that are committed to the cause and actively involved in promoting knowledge-based regional development strategies [53]. In the end, there is a need for a regional body capable of allocating resources to develop common strategies and actively involving all agents that form part of the quadruple helix.

5.5. Living Conditions

The analyzed literature coincided in highlighting that KRs tend to stand out, amongst other reasons, providing their populations with socioeconomic conditions that offer prospects for a better quality of life [64]. KRs are regions with a strong identity [94], with a great propensity for social cohesion [66,105], and with a tendency towards multiculturalism thanks to their historical attractiveness [49].

Strakova [55] and Sleutjes [105] identified access to culture as a characteristic aspect of these settings. Growth strategies driven by culture and creative enterprises have been extensively identified as tools with which to develop KRs [110]. However, no academic reference explains which elements stimulate this cultural character, although they could potentially be adapted to those that are currently being analyzed by the European Commission, such as *the cultural and creative monitor.* A group of 24 indicators was gathered for 196 European cities with the aim of assessing their cultural character [111].

Table 2 presents the five main components of KRs that were identified in the literature and are presented in this section. The table also highlights the key variables considered and the main studies in which they were identified.

Table 2. Main components of knowledge regions.

Human Capital	University and Research System	Productive Model	Governance Structure	Living Conditions
Critical mass [64] Study cases: Helsinki and Tallin **Meeting the needs of productive activities** [67] **Global education strategies** [68] Study cases: South Finland and Wallonia **Young people with academic training** [63] Study cases: Basque Country, Berlin and Flemish Brabant **Knowledge workers** [79] Study cases: Amsterdam, Birmingham and Budapest	**One regional university** [83] Study cases: Lyon, Newcastle and Tallin **The university as a pillar of regional development** [88] Study cases: Amsterdam, Eindhoven and Lyon **Roles beyond academic training** [90] Study cases: Cambridge, Oxford and Leeds **System in which the university takes advantage of the region and the region takes advantage of the university** [84] Study cases: London, Manchester and Bristol **Not all regions with powerful universities are knowledge regions** [82]	**Productive transformation into a knowledge region** [58] Study cases: Boston and Washington **Collaboration between public and private sectors** [66] Study cases: Andalusia, Oresund and Styria **Business competitiveness** [69] Study case: Tabasco **Industrial commitment to the region** [93] Study cases: Helsinki and Tallin **Encouraging new knowledge activities and services** [6] Study cases: Andalusia, Oresund and Île-de-France	**Incorporation of knowledge and innovation into regional strategies** [105] Study case: Northwest Romania **Governance adapted to challenges** [104] Study case: Vienna **New forms of less hierarchical governance** [49] Study cases: Baden-Württemberg, Catalonia and Scania **Structure of the quadruple helix system** [83] Study cases: Tampere, Umbria and Leuven **Committed and actively involved institutions** [53]	**Options that favour quality of life** [64] Study cases: Helskini and Tallin **Strong identity** [94] Study cases: Barcelona, Dublin and Munich **High levels of social cohesion** [106] Study cases: Amsterdam, Eindhoven and Helskini **Multiculturalism and historical attractiveness** [49] Study cases: Catalonia, Hamburg and Île-de-France **Culture as a driver of development** [55]. Study cases: Sofia, Istanbul and Yorkshire

6. Discussion

The results of this study make it possible to identify the main components and variables that recurrently appear in studies of KRs. Firstly, it is possible to detect a series of elements that are common to approaches which examine innovative regional environments: human capital, university and research systems, a productive model, a governance structure, and quality of life. Secondly, the demographic dimensions and surface areas of the territorial units studied tend to exhibit an important degree of variability. Thirdly, as a result of previously cited components, there is an evident lack of consensus concerning the KR concept and its implications.

6.1. Characteristic Components of KRs

The most relevant feature identified in the sample was the existence of a good system of regional governance, which was well adapted to respond to the challenges and needs of this type of region. In line with other authors, such as Neves [49], the present study confirms that the organizational structures found in KRs tend to be less hierarchical than those in more traditional regions. They also tend to have institutional contexts that favor their development [94,105]. Evidence also shows that KRs tend to develop their own regional strategies with which to frame the processes used to promote knowledge and innovation within their own regional contexts [71,104]. Within this framework, some authors associated KR governance systems with triple or quadruple helix structures to incorporate key agents from the economic, educational, public, and social sectors into their respective projects [83]. It is also considered important to incorporate, while guaranteeing the support and commitment of, key public and private stakeholders and policymakers into the project [112] and to guarantee that they can implement and formulate actions at the regional level [102]. Some authors highlighted sharing a common path as a key milestone. It is also important to have a clear understanding of and agreement on which institution or institutions should lead each project [64]. As Piñol [83] pointed out, this project-driving role does not necessarily have to belong to a specific type of entity; it can be assumed by universities, regional governments, companies, business associations, and local administrations.

Lepik and Krigul [93] observed that the existence of a critical mass of human capital was a key variable for providing the innovative environment associated with a KR. Other factors that have been associated with KRs include a young, well-trained population [71]"; a regional university network for study and research [63]; and the provision of quality education at all levels [69]. All of these are components required to supply companies with a highly qualified workforce [94]. Although some authors have not included professional training as a key factor in KRs, Román del Río [66] pointed out that developing KRs requires promoting educational strategies that cover the whole educational spectrum.

Most of the studies included in the sample identified universities as key components in the promotion of a knowledge-based strategy and as important instruments for generating and stimulating regional talent. As Reichert [51,52] underlined, universities create knowledge by providing responses to the challenges facing society and meeting its needs, but they should also play a role in dynamizing a region's socioeconomic environment. Moreover, as Jones et al. [84] noted, it is important for KRs to establish systems in which the region and its university can take advantage of each other.

The business sector is also expected to play a relevant role in KR strategy, which should not be exclusively limited to promoting its own profits; instead, it should be an active participant in developing the regional project [66]. Various authors agree in underlining the key role that businesses can play and support in competitive environments [65,69], including forming important business clusters [64] and specializing in competitive niches [84] to

promote the development of KRs. Most authors also stressed the distinctive role that the business sector can play in KRs and its potential implications in shared knowledge-based regional projects. It is through this involvement with regional strategy that businesses can achieve the indirect results mentioned by several authors and thereby contribute to creating what could be considered functional KRs [60]. These direct benefits include the appearance of new products [50], new investment [94], and an increase in innovation and competitiveness [52,97].

The creation of a distinctive own brand was a core action in most of the KRs mentioned in the review [84,94,105]. Developing a regional brand was identified as a necessary output and part of a recommended path towards implementing a KR strategy. Pursuing policies focused on promoting a model for knowledge-based regional development must be synonymous with the existence of a personalized profile with which all regional actors can identify, and which can give new value to the strategic singularity of the KR territory.

6.2. Components Excluded from Consideration as Characteristics of KRs

Some authors, including Jones et al. [84], Strakova [55], Sleutjes [105], and Piñol [83], identified infrastructure as one of the characteristic components of KRs. The provision of basic infrastructure is generally considered an indispensable requirement for regional development. However, an adequate provision of infrastructure is not in itself a key component for the development of a knowledge-based strategy; instead, it is a prerequisite. The same is true of many of the other components that were classified as prerequisites for KRs, such as an established level of social cohesion [105] and having a society with an important degree of multiculturality [49].

With respect to the topics mentioned at the end of the Results Section, referring to other components, they could be interpreted as largely being the result of applying policies and of the correct development of knowledge region models rather than as being prerequisites. In this sense, having an appreciation of knowledge culture [97]; dedicating an important percentage of spending to Research, Development, and Innovation (R + D + I) [52,113]; having a reputed international profile [94]; and offering favorable conditions for investment [52] could all be seen as the fruits of positive KR dynamics.

7. Conclusions

This systematic literature review revealed the diversity of the different conceptualizations of KRs and approaches to using knowledge-based strategies for regional development. It also highlighted the diversity of the explanatory variables cited in the many and varied areas studied. It was possible to detect the heterogeneity of the regions that have applied models conceptualized as KRs, exemplifying the tremendous diversity that this concept encompasses. The review permitted the identification and clarification of the main components of KRs: skilled human capital, universities with roles that go beyond those that they have traditionally played, innovative companies committed to regional development strategies, and a system of regional governance that uses knowledge to give structure to a common development project.

The results of this study may have important practical implications. The evidence collected in the different studies analyzed recurrently shows that KRS are instruments that decision-making organs use to define their development strategies. This, combined with the detected lack of consensus over what KRs are, highlights the need to offer a response to the current conceptual vacuum. Analyzing the realities of the KRs reviewed in this article helped identify issues arising from the direct extrapolation of good practice models used in many regional policies and strategies. In many cases, models are applied without a clear understanding of what KRS are or the key elements to be found in the regions analyzed. To

be effective, policy transfer practices based on good practice experiences must be adapted to the specific realities of the regions in which they are to be implemented.

This study proposes a definition of the KR that could be useful for future studies. This definition stems from the results of this study, combining them with ideas from the proposal originally put forward by Sanz [53]. A knowledge region should be understood as "*a regional unit that, whether formally recognized or not, serves as an administrative entity and bases regional development on knowledge developed through a form of adapted governance. It actively involves major local agents, with a strong emphasis on human capital formation, universities and research systems. In addition, it has the ability to allocate resources to promote strategies that exploit their potential and align the productive model with knowledge and innovation, thereby stimulating economic growth and improving living conditions*".

Future research should focus on three main objectives: expanding the review to encompass other concepts related to knowledge regions (KRs); studying cases from other territories and experiences not captured in the present literature review—particularly examples from the Global South; and critically examining practical applications of the KR model through different case studies. Their potential content is briefly explained below.

Firstly, it should be noted that the existing literature includes other concepts that were recently used to address the role of knowledge and innovation in regional development strategies. This includes references to learning regions, innovative, innovating regions, and smart regions. This shows the extent to which subjects linked to knowledge have fascinated academia and society as a whole in recent decades [112]. The implications of and differences between each concept should be addressed in future studies by comparing them with the main KR framework. The existence of other concepts that may refer to the same realities as KRs should also be examined, particularly if the term is regarded as being independent and significant for the development of modern regional science.

Secondly, the present study shows how the KR concept has primarily been used and reviewed within the context of the Global North, especially in Europe. Exploring other concepts and models should allow a broader coverage of territories from the Global South, which are not represented in the present review. This would permit a shift from a conceptual review towards a wider understanding of the different ways in which the model has been applied in regional planning and development across a range of different territorial contexts.

Thirdly, the approach used in this study is purely theoretical; it focuses on the identification of the components of KRs and the territorial context in which the concept has been applied and studied. In future studies, it will be necessary to apply all of this in practical empirical cases. This will make it possible to critically analyze the application of the KR concept and to verify whether the structure of the components presented here is used in real-world contexts.

Finally, it will be necessary to determine which instruments and processes are used in each area to adapt existing models for knowledge-based development to cover their singularities.

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