Development of regional foresight studies between 2000 and 2019: an overview and co-citation analysis

Hamed Amini 1, Mohammad Saeed Jabalameli 2* and Mohammad Hosein Ramesht 3

Abstract
Regional foresight is one of the regional planning approaches that increase the ability to deal with uncertainty and changes. This study aims to provide an overview of regional foresight studies and domain map to evaluate their merits and defects and direct future studies in this field. For this purpose, 111 papers related to regional foresight were identified at the “Web of Science” in the period 2000 to 2019 and used as the basis for further analysis. These papers have been reviewed in various aspects. In addition, the domain map of regional foresight and its intellectual bases was drawn based on co-citation analysis of these papers and their 4194 references. The domain map includes five main clusters of research areas or intellectual bases for regional foresight: normative forecasting, participation, foresight in policy and strategy, innovation systems, and multi-level governance. Finally, the merits and defects of regional foresight studies are evaluated based on research results and some suggestions are provided for future studies.

Keywords: Regional foresight, Regional planning, Domain map, Co-citation analysis, Foresight

Introduction
To account for the increasing complexity and speed of changes in the current century in terms of urban and regional policy-making, it is necessary to come up with the approaches that provide the grounds for anticipating and becoming ready to face changes. Great changes in political, social, cultural, and economic issues and their interactions, as well as inherent uncertainty involved in some of these factors, have made it difficult to anticipate the future of such changes. Although environment changes have profound effects in some regions, they still lack strong well-developed policy institutions that can cope with such changes [1]. These challenges have led to future-oriented approaches, most commonly known as “regional foresight,” to enter territorial issues. Regional foresight is, in fact, the result of the introduction of foresight and its capabilities in territorial issues.

Various studies have been conducted on regional foresight. These studies deal with how to implement or present the achievements of regional foresight in their cases. After about 20 years from the advent of the concept of regional foresight in scientific papers, it may be the time to evaluate the course. In this regard, it is necessary to conduct an evaluation that has a comprehensive look at past research, highlights the strengths and achievements of studies of these years, and underlines shortcomings in future studies while demonstrating the orientations and roots of regional foresight studies.

The remainder of this study is organized as follows: The “Conceptual background” section is allocated to define the conceptual backgrounds. The “Methodology” section addresses the methodology of the study, especially the co-citation analysis method used in the research. The “Overview of papers” section represents an overview of key information from selected papers, briefs...
about publications, active authors, countries, keywords, journals, and most popular methods and issues. The “Results of co-citation analysis” section presents the result of co-citation analysis. In this section, also, domain map of regional foresight and the description of clusters or intellectual bases are provided. Eventually, the “Conclusions” section provides the concluding remarks, based on the results of the analysis, the strengths and weaknesses of regional foresight studies, and recommendations for further studies.

**Conceptual background**

Foresight is one of the various names used for referring to the field of studying future. Most commonly used names in this field are futures studies, and foresight. The concepts of futures studies (also called futures research) and foresight are close to each other. Both of these concepts use the same theories and methodology. The main difference is that foresight is doing, using, and interacting, while futures studies are more science-dependent [2]. As shown in Fig. 1, the Futures approaches have shifted over time from positivist to pluralist approaches [3].

FOREN\(^1\) has described “Foresight is a systematic, participatory process that involves gathering intelligence, building visions for a medium/long-term future, informing present-day decisions, mobilizing joint actions” (p. 311) [4]. As outlined in the definition, it can be used at various levels and topics. For example, the subject of foresight can be individuals, organizations, societies, regions, countries, continents, planets, and even issues such as technology, environmental challenges, and humanity.

Regional planning issues are to be well suited to the participative and vision-building foresight approaches. Stronger links between regional-based actors, the immediacy, and sensitivity of people to variations in their region, and a heightened level of awareness and commitment to the community should all make such approaches valuable in regional settings [4]. The name that has been used for foresight in territorial level over the past 20 years is “regional foresight.”

Regional foresight means applying foresight methods for anticipation, participation, networking, vision, and action at smaller territorial scales where proximity factors become more critical. This process has five main components [5]:

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\(^1\)FOREN: Future Oriented Regional Planning and Economics Network
(1) Organized anticipation and projection of long-term social, economic, and technological developments and needs
(2) Interactive and participative methods of exploratory debate, analysis, and study that involve a wide variety of stakeholders
(3) Interactive approaches that involve new social networks
(4) A guiding strategic vision to which a sense of commitment can be shared
(5) The shared vision is not to be a utopia; there has to be explicit recognition and explication of the implications for the present-day decisions and actions.

"Region” is an important term in the definition of regional foresight. Region means territories that have the following two features: geographical proximity and limited spatial range. Rural communities, town/city/historical regions, regions with specific economic activity/cultural identity, and political regions (autonomies, counties, and provinces), as well, can be covered by the term region.

**Methodology**

In order to achieve the goals of evaluating past research and leading future research in the field of regional foresight, four preliminary steps are considered for this research: (1) sampling and reviewing the related studies, (2) thematic analysis of basic attributes of studies to discover an overview of them, (3) co-citation analysis for discovering the domain map of regional foresight and its intellectual bases, and (4) assessing the past studies and giving recommendations for future research.

Due to the emergence of foresight and regional foresight studies, the sampling of studies was performed using the director of Web of Science without any time limitations. After reviewing 200 cases and removing items that appeared merely because of verbal similarity in the results, 111 valid papers were selected for the subsequent analysis.

The basic attributes of the articles were identified through the study of selected articles and thematic analysis in various dimensions. Results are presented as an overview of regional foresight studies in the “Overview of papers” section.

Then, an attempt was made to implement co-citation analysis in the field of regional foresight with CiteSpace Software. The general approach for detecting and visualizing the emerging trends and transient patterns in scientific literature is the basis for the design of this software.

In the field of “Information Science,” a specialty is conceptualized and visualized as a time-variant duality between two fundamental concepts. These concepts are “research fronts” and “intellectual bases.” The former is defined as an emergent and transient grouping of concepts and underlying research issues and the latter—the intellectual bases of a research front—is its citation and co-citation footprints in the scientific literature, which is an evolving network of scientific publications cited by research-front concepts (Fig. 2) [6].

The co-citation analysis performed using CiteSpace software can greatly enhance the speed and precision of the literature review. Moreover, information from the intellectual bases of the subject under review by the references of all articles is presented in an illustrative way, another achievement that will work with this method.

However, despite these benefits, there are some issues that make it hard to work with this methodology. Co-citation analysis is largely the function of the initial articles as an input, and sometimes with the choice of some wrong articles in the input section, the results are subject to many changes and deviations.
Overview of papers
Since the objective of this paper is to present a comprehensive literature review on “Regional foresight,” which is an emerging knowledge, no time limits have been considered in collecting the relevant papers. While searching in the “Web of Science,” 111 related papers were found from 2000 to 2019. Software studies showed that the selected papers had 4194 references, which were used for analyzing and studying the status of “Regional foresight.”

Number of papers published and cited on regional foresight
Next, the status of regional foresight is studied and analyzed considering different criteria. The number of regional foresight papers published between 2000 and 2019 is shown in Fig. 3 and the annual number of citations to regional foresight papers is presented in Fig. 4. Statistics of this part are indicative of regional foresight studies with a growing trend during 2000–2019.

The growing number of citations to regional foresight articles also indicates that this area is transforming from an emerging knowledge front into a referenced domain.

Regional foresight authors
In this section, well-known regional foresight authors are introduced. Authors’ names and the number of their papers are shown in Table 1. Also, Fig. 5 shows authors’ names and collaborations they have had with other authors. In this figure, thicker connecting lines mean more cooperation among the authors and bigger fonts mean the author has more papers in this field.

Table 1 Regional foresight authors active between 2000 and 2019

| Author                  | No-papers |
|-------------------------|-----------|
| Ropuszynska-Surma E     | 5         |
| Kononiuk A              | 4         |
| Uotila T                | 4         |
| Weglarz M               | 4         |
| Eames M                 | 3         |
| Koninola T              | 3         |
| Rinaudo JD              | 3         |
| Stormer E               | 3         |
| Truffer B               | 3         |
| Wylomanska A            | 3         |
| Ahlqvist T              | 2         |
| Capello R               | 2         |
| Roveda C                | 2         |
| Vecchiato R             | 2         |
| Canaglu A               | 2         |
| Dixon T                 | 2         |
| Ejdys J                 | 2         |
| Graveline N             | 2         |
| Harmaakorpi V           | 2         |
| Hunt M                  | 2         |
| Kalvo-Oja J             | 2         |
| Leclerc G               | 2         |
| Maurer M                | 2         |
| Melkas H                | 2         |
| Miles I                 | 2         |
| Stratigea A             | 2         |
| Sacio-Szymanska A       | 2         |
| Rudskaja I              | 2         |
| Hunt M                  | 2         |
| Saitas O                | 2         |
In this section, countries with the highest number of regional foresight researches are introduced in the order of their contributions. The country name and its number of papers published during 2000–2019 are presented in Table 2. As can be seen, Finland, England, Poland, France, Russia, Italy, Spain, Switzerland, and the USA are the leading countries in this regard, in the order of their appurtenance. Figure 6 presents the share of countries in published papers.

The results suggest that most regional foresight studies are conducted in Europe, probably due to the limited size of most countries in this continent and the need for joint planning of neighboring territories for development. Furthermore, countries with large terrestrial zones, such as the USA and Russia, have been pursuing regional foresight because of their territorial diversity within their country.

### Active countries in regional foresight research

In this section, countries with the highest number of regional foresight researches are introduced in the order of their contributions. The country name and its number of papers published during 2000–2019 are presented in Table 2. As can be seen, Finland, England, Poland, France, Russia, Italy, Spain, Switzerland, and the USA are the leading countries in this regard, in the order of their appurtenance. Figure 6 presents the share of countries in published papers.

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### Active universities and institutes in regional foresight

Universities and institutes active in regional foresight are presented in Table 3. The results of this section also demonstrate the dominance of European institutions and universities in regional foresight studies.

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**Table 2** Number of regional foresight papers of different countries published during 2000–2019

| No. | Country  |
|-----|----------|
| 15  | Finland  |
| 12  | Poland   |
| 12  | England  |
| 10  | Russia   |
| 9   | France   |
| 9   | Italy    |
| 7   | Spain    |
| 7   | Switzerland |
| 6   | USA      |
| 5   | Germany  |
| 5   | Australia|
| 4   | Austria  |
| 4   | Wales    |
| 3   | Denmark  |
| 3   | Norway   |
| 3   | Canada   |
| 2   | Sweden   |
| 2   | Belgium  |
| 2   | Brazil   |
| 2   | Greece   |
| 2   | Hungary  |
| 2   | Netherlands |
| 2   | Thailand |
Keywords

Keywords/phrases are important tools in every research area that help researchers to have access to papers, books, and research works related to their field of expertise. Figure 7 shows the most frequent keywords in this area. Words such as foresight, management, policy, future, and scenario are the main items in Table 4.

Active journals in regional foresight

Relevant journals, as well, are an important issue for researchers by showing which journal has published most of the related papers. Table 5 presents the number of papers published in each journal. As can be seen, Futures, Technological Forecast and Social Changes, and European Journal of Futures Research have the highest frequency in the table.

This list is a good reference for finding similar studies and subsequent publications by researchers in the field of regional foresight.

The categories of regional foresight

Another issue studied in the selected papers is the category of their case studies. The results are shown in Table 6 and Fig. 8. As can be noticed, most of these papers have addressed subject such as “urban planning,”

Table 3 Number of universities and institutes papers in regional foresight

| No. | Universities and institutes                                      |
|-----|-----------------------------------------------------------------|
| 6   | Białystok University of Technology                             |
| 5   | Lappeenranta University of Technology                           |
| 5   | University of Manchester                                       |
| 4   | Institut National de la Recherche Agronomique Inra             |
| 4   | CIRAD Agricultural Research for Development                    |
| 4   | Polytechnic University of Milan                                 |

Keywords present the proximity of futures studies concepts policy-making and sustainable development in regional foresight studies.
“science and technology,” “Economic development,” and “industry.”

The multiplicity of articles with topics in the city, village, and region, compared to articles focusing on specific subject, indicates that researchers prefer to focus on multiple subjects in the regions rather than concentrating on a topic. However, this variety of subjects also points to prioritizing issues with respect to the characteristics of the land under consideration.

**High-frequency tools and methods**

Studying the selected papers through well-known foresight methods provided a basis for the identification of high-frequency methods used in the related studies. These studies are illustrated in Fig. 9.

In addition to modeling, which outlines how regional foresight is implemented, scenario planning has been the most commonly used tool for studies. This tool takes regional planning out of certainty and recognizes future uncertainty in the regions.

**Results of co-citation analysis**

This section examines two issues by analyzing the co-citation of regional foresight papers: (1) the status of journals is analyzed by the co-citation analysis of their articles and (2) the intellectual bases of regional foresight.

**Co-citation analysis of journals**

In this section, co-citation analysis of the Journals is performed based on regional foresight papers and their references. Table 7 and Fig. 10 present the number of citations and centrality of each journal in the field of regional foresight, respectively. As shown in Table 7, *Futures* and *Technological Forecasting and Social Change* have been cited most frequently. *Research Policy* and *Regional Studies Journal* have the most centrality in the co-citation map of journals.

The centrality of a node is a graph-theoretical property that quantifies the importance of the node’s position in a network. It measures the percentage of the number of shortest paths in a network to which a given node
Nodes with high-betweenness centrality tend to be found in paths connecting different clusters.

**Clustering the intellectual bases of regional foresight**

In this section, co-citation analysis of the relevant researches is carried out based on a review of the references (4181 papers) of the 111 selected papers. The analysis results are depicted under 5 clusters (Fig. 11) and named (Table 8) considering high-cited papers in each cluster and are explained briefly in the following subdivisions.

Five clusters identified in the intellectual base of regional foresight studies show that the foundations of this emerging field of knowledge are based on these concepts: visioning, participation, innovation systems, foresight applications in policy-making and management, and multi-level governance.

**Cluster 1: normative forecasting**

This cluster, compiled during 2006–2012, focuses on the importance of drawing a vision for addressing regional and environmental issues, as well as on the need for active participation of people in this process. For instance, visions of “development of hydrogen energy” [109], “urban development” [110], and “carbon pollutants” [111] have been outlined thematically. Some other papers in this cluster have addressed the potential and importance of visioning and backcasting methodologies in solving issues such as urban planning [112, 113] and sustainable development [114].

**Cluster 2: participation**

This cluster of papers that started from the year 2000 has addressed critical elements in the foresight process. Some papers consider participation as a necessity for new foresight and strategic planning models [115, 116]. Some articles also point to the vital importance of “participation” in regional development and regional innovation systems [70, 117].

**Cluster 3: foresight in policy and strategy**

This cluster focuses on the advantages of using foresight in strategic management and policy-making. A better understanding of changes, improving response to changes, influencing other actors, enhancing organizational learning, understanding new businesses [118], developing innovative options, and improving the quality of innovation projects [119] are foresight capabilities for firm-level management. Moreover, on a sectoral and national level, foresight is a tool for policy-making [120–122]. This tool can help understand discontinuities, increase participation, address long-term issues [120], avoid lock-in of business clusters by networking [52], and enhance innovation and learning [123]. Moreover, it also helps the process of formulation and implementation of policies by generating insights regarding the dynamics of change and building a common awareness [122].

**Cluster 4: innovation systems**

This cluster of studies (being published since 2011) focuses on interactions between regional foresight and innovation systems; some of them focuses on how innovation affects foresight [124] while others emphasize the effects of foresight on innovation systems [125]. At last, some of these cluster papers discuss the co-evolution of these two knowledge areas [126].

**Cluster 5: multi-level governance**

The fifth and last cluster of regional foresight papers is related to studies on the role of foresight in multi-actor and multi-level governance at the regional level. Some of

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**Table 5** Shares of journals from regional foresight papers

| Papers | Journals | References |
|--------|----------|------------|
| 16 | 1.1. Futures | |
| 12 | 1.2. Technological Forecasting and Social Change | |
| 5 | 1.3. European Journal of Futures Research | |
| 4 | 1.4. European Planning Studies | |
| 4 | 1.5. Foresight | |
| 3 | 1.6. Rynek Energli | |
| 4 | 1.7. Technology Analysis Strategic Management | |
| 2 | 1.8. Geoforum | |
| 2 | 1.9. International Journal of Technology Management | |
| 2 | 1.10. Procedia Engineering | |
| 2 | 1.11. Regional Environmental Change | |

**Table 6** Number and paper references devoted to various subjects in the selected papers

| Number | Papers | Subject | No. |
|--------|--------|---------|-----|
| 24 | [5, 7–29] | Region, city, village | 1 |
| 22 | [30–50] | Science and technology | 2 |
| 12 | [51–62] | Industry | 3 |
| 11 | [63–73] | Economic development | 4 |
| 9 | [74–82] | Energy | 5 |
| 8 | [83–91] | Environment and climate change | 6 |
| 4 | [92–95] | Water | 7 |
| 4 | [96–99] | Terrorism | 8 |
| 3 | [100–102] | Food | 9 |
| 3 | [103–106] | Land use | 10 |
| 2 | [107, 108] | Crisis management | 11 |
| 9 | ... | Others | 12 |
Fig. 8 Number of papers devoted to different subjects in the selected papers.

Fig. 9 Number of methods frequently used in the selected papers.

Table 7 Citation and centrality of journals in co-citation map of journals

| Citation | Centrality | Journal name |
|----------|------------|--------------|
| 69       | 0.01       | 1.12. Futures |
| 53       | 0.03       | 1.13. Technological Forecasting and Social Change |
| 29       | 0.02       | 1.14. Foresight |
| 28       | 0.46       | 1.15. Research Policy |
| 21       | 0.02       | 1.16. Technology Analysis and Strategic Management |
| 16       | 0.00       | 1.17. Thesis |
| 15       | 0.06       | 1.18. Harvard Business Review |
| 14       | 0.04       | 1.19. HDB Technology Foresight |
| 13       | 0.09       | 1.20. Land Use Policy |
| 13       | 0.01       | 1.21. Journal of Forecasting |
| 13       | 0.35       | 1.22. Energy Policy |
| 13       | 0.01       | 1.23. European Planning Studies |
| 12       | 0.07       | 1.24. Regional Studies Journal |
| 12       | 0.00       | 1.25. Ecological Economics Journal |
| 12       | 0.07       | 1.26. Global Environmental Change Journal |
| 12       | 0.00       | 1.27. Long Range Planning Journal |
| 12       | 0.11       | 1.28. Strategic Management Journal |
Fig. 10 Citation and co-citation map of journals
the papers focus on the actors’ roles at different levels in regional foresight processes [5, 127]. Some papers discuss the importance of coordination between regional policies and upper hierarchical levels [128], while some others show the results of regional foresight studies in different countries [129].

**Conclusions**

The present research is based on the analysis of 111 regional foresight papers from 2000 to 2109 and their references. The obtained results show that regional foresight is still an emerging field, despite the increased publication and citations over the past years. The keywords used in the articles indicate the close proximity of the field of regional foresight with the futures studies concepts, policy-making, and sustainable development.

Most of these studies are conducted within continental Europe. This seems to be due to the relative smallness of European countries and the division of a geographic

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**Table 8** Regional foresight intellectual bases based on co-citation analysis

| Cluster No. | Cluster name                          |
|-------------|---------------------------------------|
| 1           | Normative forecasting                  |
| 2           | Participation                          |
| 3           | Foresight in policy and strategy       |
| 4           | Innovation systems                     |
| 5           | Multi-level governance                 |
region between several countries. In the same vein, active institutes and journals in this area are mainly located in Europe. Besides, regional foresight has been used in vast countries such as the USA. Such vastness and diversity have encouraged conducting regional foresight studies in these countries.

The multiplicity of articles with topics in the city, village, and region indicates that researchers prefer to focus on multiple subjects in the regions. Consequently, in each region, the focus of the issues should be determined according to the priorities of the region. Of the available tools, the scenario planning that represents the uncertainty in the future of the land has been most used.

As stated in the text of the article, five intellectual bases of regional foresight researches are normative forecasting and visioning, participation, foresight in policy and strategy, innovation, and multi-level governance. These categories point to a number of aspects that regional models and studies of regional prospecting should focus on, regional stakeholder participation, the creation of a shared stakeholder perspective, innovation, and a long-term perspective on planning and policy-making while paying attention to different levels of planning at different levels.

Regional foresight studies have had significant merits to date. Attention to the topic of innovation in various formats such as open innovation, social innovation or regional innovation, attention to the need for cross-level translation of programs and scenarios at different geographical/governance levels, emphasis on stakeholder participation, and the application of different approaches for analyzing their views, and the high number of cases in these studies are all promising points for conducting a set of studies on regional foresight.

However, despite these merits, there are some defects in this study that may be considered in future works. The lack of paradigmatic discussions and the focus on tools and methods are one of these defects. Moreover, these studies often do not use deeper analysis tools such as layer analysis of causes. Another shortcoming that appears in regional foresight studies is the lack of attention to the historical analysis of regional issues. Ultimately, the lack of proper assessment models in developed models for regional foresight is another issue that must be further addressed in the future.

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Authors’ contributions
HA and MSJ conceived of the research idea. HA conducts the research methods and performed the computations. MSJ and MHR verified the analytical methods and encouraged HA to investigate and supervised the findings of this work. All authors discussed the results and contributed to the final manuscript. The authors read and approved the final manuscript.

Authors’ information
Hamed Amini is a Ph.D. candidate in the field of regional foresight, Mohammad Saeed Jabalameli is Full Professor with a specialized field of land use planning, and Hosein Ramesht is Full Professor with a specialized field of Natural Geography and Geomorphology.

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Author details
1 School of management, economics and progress engineering, Iran University of Science and Technology, Tehran, Iran. 2 School of Industrial Engineering, Iran University of Science & Technology, Tehran 1684613114, Iran. Faculty of Geographical Sciences and Planning, Isfahan University, Isfahan, Iran.

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