

A BIBLIOMETRIC ANALYSIS OF PUBLICATIONS ON KNOWLEDGE RISKS AS A SUBFIELD OF KNOWLEDGE MANAGEMENT

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ABSTRACT

The research presented in this paper is part of a larger project concerning knowledge risks that can manifest alongside knowledge processes within organizations. The aim of this paper is to reveal the most important scientific evolutions in the field of Knowledge risks, considered as a narrow field within the bigger field of Knowledge management. The methodological approach is based on the use of the bibliometric software R-Stata Bibliometrix, specialized in Science Mapping Workflow, in order to extract meaningful results about the thematic evolution of the Knowledge risks field. The methodological approach assumes that the co-occurrence of two keywords within the same article indicates a link between those topics. Our results show that "knowledge risks" is a very specialized area, but with an important transversality. The concept of "knowledge risk" often appears as a secondary concept in research published in various fields, the publications within the field of Knowledge management being a minority in the total publications where the concept is found. The main novelty of our research consists in a mixed approach, both quantitative and qualitative, of the bibliometric analysis, using bigrams to understand the evolution of this particular scientific field. The results are important for improving the design of future scientific research on knowledge risks.

KEYWORDS: *bibliometric analysis, knowledge management, knowledge risk.*

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1. INTRODUCTION

The concept of "knowledge risk" has grown as a relevant topic in the field of Knowledge management, with many publications being focused on this subject in the last three decades (Niwa, 1989; Cooper, 2003; Scott & Walsham, 2005; Becerra et al., 2008; Massingham, 2010; Bratianu et al., 2022; Zieba et al., 2022). The thematic evolution of the publications where the concept is found is of interest to us since we are trying to clarify the semantic field of the concept, the conceptual differences that can lead to separate types of knowledge risks and the deterministic factors related to them.

Knowledge risks are abstract concepts representing types of situations where the knowledge of the organization can be affected. The concept of "knowledge risk" is a particular case of the generic concept of "risk", being observed in knowledge processes. We consider knowledge risk as a potential situation in which there could be some negative consequences of some decisions concerning knowledge processes under the influence of internal and external factors (Cameron & Raman, 2005; Massingham, 2010, 2019; Society for Risk Analysis, 2018). According to Durst and Zieba (2019, p.2), knowledge risk is "a measure of the probability and severity of adverse effects of any activities engaging or related somehow to knowledge that can affect the functioning of an organization on any level."

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The aim of this paper is to reveal the most important scientific evolutions in the field of Knowledge risks, considered as a narrow field within the bigger field of Knowledge management. The narrow field of Knowledge risks is gaining increasing importance, due to the fact that risks related to knowledge may impact the business performance in a negative way. In this sense, understanding and analyzing the thematic evolutions of publications on this subject is even more relevant. For achieving the aim of the paper, we are using a mixed method, by combining qualitative and quantitative approaches, and we are using bigrams in order to get an understanding as better as possible of the evolution of the field of knowledge risks within the larger and more general field of knowledge management. Although in the scientific literature there are papers covering bibliometric analyses on certain types of knowledge risks, for example knowledge hiding (Xia et al., 2022), we could not find papers undertaking bibliometric analyses, neither focused on the whole field of knowledge risk, nor on knowledge risks placed within the broader field of knowledge management. The bibliometric analysis in this paper covers this gap in the literature.

2. LITERATURE REVIEW

Since our focus in this paper is on undertaking a bibliometric analysis of the field of knowledge risk, within the more broader domain of knowledge management, with the scope of revealing the most significant scientific evolutions in the narrow field of knowledge risks, considered as a subfield of knowledge management, it is necessary in the first place to take a closer look into the concepts of knowledge management and, respectively, knowledge risks.

While knowledge management is a subfield of management that focuses on organizational processes that are related to knowledge, such as knowledge creation, knowledge acquisition, knowledge transfer, knowledge sharing, knowledge interpretation, knowledge use or building a memory of the organization (known as organizational memory), knowledge risk is a particular narrow field in the broader domain of knowledge management. The literature on the subject of "knowledge risks" is dominated by research published by Durst and Zieba (Durst & Wilhelm, 2013; Durst & Zieba, 2017, 2018, 2019; Zieba, 2017; Zieba & Durst, 2018; Durst, 2019; Durst et al., 2019; Bratianu et al., 2020; Durst & Henschel, 2020), with an important focus on defining and refining knowledge risks taxonomies.

Further, knowledge management is a domain with a strategic dimension, considering that knowledge is a strategic resource in order to achieve competitive advantages (Bolisani & Bratianu, 2018). In this context, knowledge risks may be considered as a subfield that it should be paid attention to. Another name found in the literature is that of "knowledge management risk"; for this latter mentioned term, another concept that was used was "(Intellectual) Capital Management Risk", and it started to decline as knowledge was shared more widely; thus, for companies that manage their knowledge better than others, the risk of being outperformed by competitors goes down (Erikson & Rothberg, 2008). Durst (2019, p. 21) states that knowledge risk "describes a likelihood of any loss resulting from the identification, storage or protection of knowledge that may decrease the operational or strategic benefit of a company". According to Bratianu (2018, p. 594), the term "risk" "is always associated with uncertainty, which reflects a state of incomplete knowledge about an event or about the future".

Based on the ideas previously presented, it can be concluded that knowledge risks can have negative outcomes both at a strategic level and at an operational level within organizations. However, they are especially relevant within the broader field of knowledge management in cases when the impact on an organization's competitive advantages becomes unacceptable; this is when organizations start looking for knowledge risks (Bratianu et al., 2022).

Furthermore, the relationship between knowledge management and knowledge risk appears in the context in which "knowledge represents the objects of specific processings, such actions taking

place in contexts or modes favouring the appearance of knowledge risks that generate specific vulnerabilities in each knowledge process" (Neșțian & Guță, 2023, p. 960). In this context, the concept of "knowledge vulnerabilities" is also relevant. A vulnerability is a measure of likelihood for an asset to be attacked successfully by a given threat (Avcı & Ozbulut, 2018). Referring to knowledge, vulnerabilities refer to weak points of knowledge systems or knowledge management routines (Bratianu et al., 2022).

Analyzing the literature (Durst & Wilhelm, 2013; Durst & Zieba, 2017, 2018, 2019; Zieba, 2017; Zieba & Durst, 2018; Durst, 2019; Durst et al., 2019; Bratianu et al., 2020; Durst & Henschel, 2020; Bratianu et al., 2022), it can be seen that the taxonomies regarding knowledge risks state different types: knowledge loss, knowledge leakage, knowledge spillover, knowledge attrition, knowledge hiding, knowledge hoarding, knowledge waste, emotional risks and spiritual risks. Also, knowledge risks can be approached through the perspective according to which they can manifest themselves along knowledge processes, such as knowledge creating, knowledge acquiring, knowledge capturing, knowledge storage or knowledge use (Bratianu et al., 2022).

Within this complex context of knowledge risks related to knowledge processes, it is useful to take into consideration a perspective of organizational knowledge dynamics, considering that knowledge may reduce its value in the cases when knowledge risks manifest (Bratianu et al., 2022). From this knowledge dynamics perspective, a type of knowledge risk called knowledge loss may lead to the most significant decreases of the value of an organization's knowledge, along its knowledge processes (Bratianu et al., 2022). It is considered that knowledge loss is a type of knowledge risk that can not be avoided, since employee turnover and retirements are increasing (Durst & Zieba, 2017). Knowledge loss can become a problem at a strategic level for organizations, in the case when knowledge loss is never regained and that knowledge would be needed in the future.

Other relevant types of knowledge risks, from a strategic point of view, are knowledge leakage and knowledge spillover. Knowledge leakage is linked with the process of knowledge sharing or with knowledge exchange, that involves the organization's actors and parties from outside of the organization (Durst & Zieba, 2017). It is a case of knowledge risk where knowledge that is critical for an organization is used in its disadvantage (Durst & Zieba, 2017). This type of knowledge risk makes sense in the context in which knowledge sharing means to disseminate the right content, at an appropriate time, to the right people (Paloti, 2010). Similar with knowledge leakage, knowledge spillover is a type of knowledge risk that appears in relation to an organization's competitors. Thus, to spillover knowledge refers to situations when knowledge that is of high value to an organization spills out of it and reaches its competitors, which will use it to obtain competitive advantages (Durst & Zieba, 2017).

3. METHODOLOGY

The research presented in this paper is part of a larger project concerning knowledge risks that can manifest alongside knowledge processes within organizations. Two authors of this paper were coauthors of an article published in 2022, presenting a taxonomy of knowledge risks (Bratianu et al., 2022) created based on the correspondence of knowledge risks with the knowledge processes in which they occur, and of another paper presented in 2023 at an international conference, proposing a measuring scale for the concepts of knowledge vulnerabilities and knowledge risks (Neșțian & Guță, 2023).

We extracted a database from Clarivate – Web of Science Core Collection, in a format suitable for the R-Stata Bibliometrix software. The extraction was made from a search on the keywords "Knowledge Risk", in the section called "Topic". According to Clarivate, a search in topic will produce a search in the title, abstract and keyword fields of Web of Science records. Other methodological choices would

have been to search in the "Title", "Abstract" or "Key words". We decided to search the "Topic" in order to cover all articles that include references to the concept of knowledge risk.

The search was refined by adding two supplementary criteria: only Articles and Proceedings Papers, from the field of Business Economics. The search produced a list of 8889 articles. Out of them we downloaded a database of the first 1000 articles, sorted based on Relevance, including all data records about the articles in the database.

According to Clarivate Analytics (2023), relevance ordering for source records takes into account the following fields: Title, Abstract, Keywords, Keywords Plus® (Web of Science Core Collection and Current Contents Connect only). The Title and Keywords fields are weighted slightly more than the Abstract and Keywords Plus fields. This paper includes processing made with data from this database.

In order to achieve our goal, to reveal the most important scientific evolutions in the field of Knowledge risks, we decided to use an instrument called "thematic map", that has been used in many publications for similar purposes. A thematic map is a bibliometric map that describes how research fields are structured and connected through a network representation. According to Small (1997, pp. 275-276), "constructing a map of relationships of the contemporaneous branches of knowledge could show us areas that are proximate and facilitate the making of new connections between them, and can aid us in tracking how these relationships change as new discoveries are made".

From a technical point of view, we used the software R-Stata Bibliometrix (Aria & Cuccurullo, 2017), specialized in Science Mapping Workflow, a software that is able to produce graphical and numerical analysis based on bibliographic information from a database. The software is using the concept of N-grams for creating graphic representations of the appearance and connections between concepts. N-grams are developed and used in the field of NLP (Natural Language Processing). An N-gram refers to sequences of words (or characters) containing "N" elements as found in a sentence. An N-gram of size 1 is referred to as a "unigram", size 2 is a "bigram", size 3 is a "trigram". For example, the bigrams in the text "a company at risk" are: {"a company", "company at", "at risk"}. An N-gram graph is a graph which connects N-grams, initially proposed in by Giannakopoulos et al. (2008) as a method of summarizing (Birmingham & Muscat, 2022). The meaning that can be deduced from the results offered by these instruments, for the analysis of the thematic evolution of a scientific field, is regarding the thematic concentration. Compared to a simple analysis of descriptive statistics (the frequency of occurrence of a word), the N-grams (e.g. bigrams or trigrams) have the advantage of using the relationship between several words, managing to create thematic concentrations by associating the respective words. The N-gram graph highlights both the frequency of a single word and its network of conceptual connections, with the frequencies of each connection.

The software is able to produce thematic maps as the ones proposed by Callon et al. (1991), in order to use co-word analysis as a tool for describing the network of interactions. These authors are proposing a thematic map separating in a matrix with 4 quadrants the themes found in a scientific field. The matrix is designed based on two dimensions: density and centrality. The X-axis represents the Centrality, considered as the degree of interaction of a network cluster in comparison with other clusters appearing in the same graph. It is interpreted as a measure of the importance of a theme in the development of the research field. The Y-axis symbolizes the Density, which measures the internal strength of a cluster network, and it can be assumed as a measure of the theme's development (Cahlik, 2000; Cobo et al., 2011). Figure 1 below presents the general structure of a thematic map.

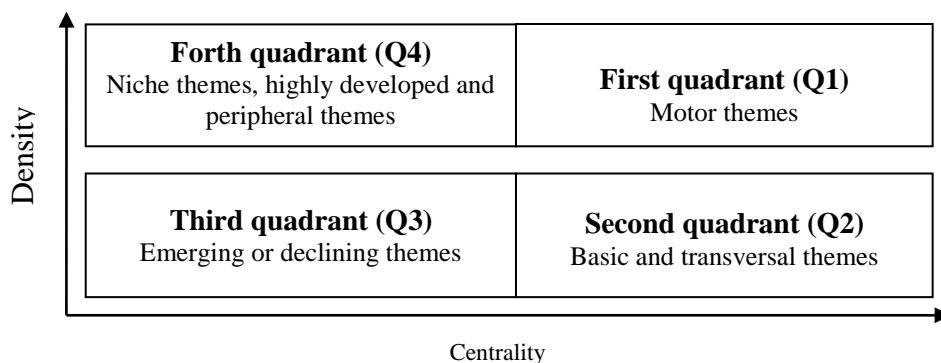


Figure 1. Thematic map (strategic diagram and characterization of clusters)

Source: Adapted after Callon et al. (1991, p. 166)

The meaning of the 4 quadrants in Figure 1, according to these authors (Callon et al., 1991, Aria et al., 2021), are:

- **First quadrant (Q1) / Motor themes:** the cluster network is characterized by high centrality and high density, meaning that they are well developed and important for the structuring of a research field.
- **Second quadrant (Q2) / Basic and transversal themes:** they are characterized by high centrality and low density, namely, they are important concerning general topics that are transversal to different research areas of the field.
- **Third quadrant (Q3) / Emerging or declining themes:** they have low centrality and low density, meaning that they are weakly developed and marginal.
- **Forth quadrant (Q4) / Niche themes, highly developed and peripheral themes:** they are characterized by high density and low centrality, meaning that they are of limited importance for the field since they do not share important external links with other themes.

4. RESULTS AND DISCUSSION

4.1 Evolution of number of articles, citations and published authors

Below, in Figures 2, 3 and 4, we are presenting the first results concerning the evolution of the thematic “knowledge risks”, focusing on an evolution concerning the number of published articles, the number of citations and most published authors. The timeframe taken into consideration is from the year of 1979 towards the year 2023.

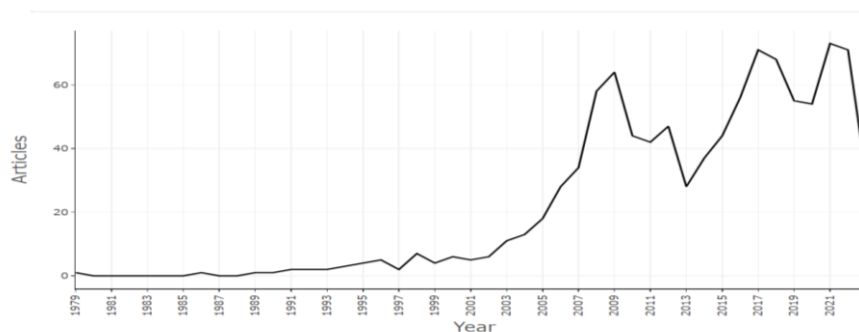


Figure 2. Evolution of articles

Source: authors' own processings in R-Stata Bibliometrix

Starting from Figure 2 above, we made a time segmentation of the evolution in three periods: emergence and development (from 1979 to 2009), crisis and recovery (from 2010 to 2017), fluctuation (from 2018 to 2023).

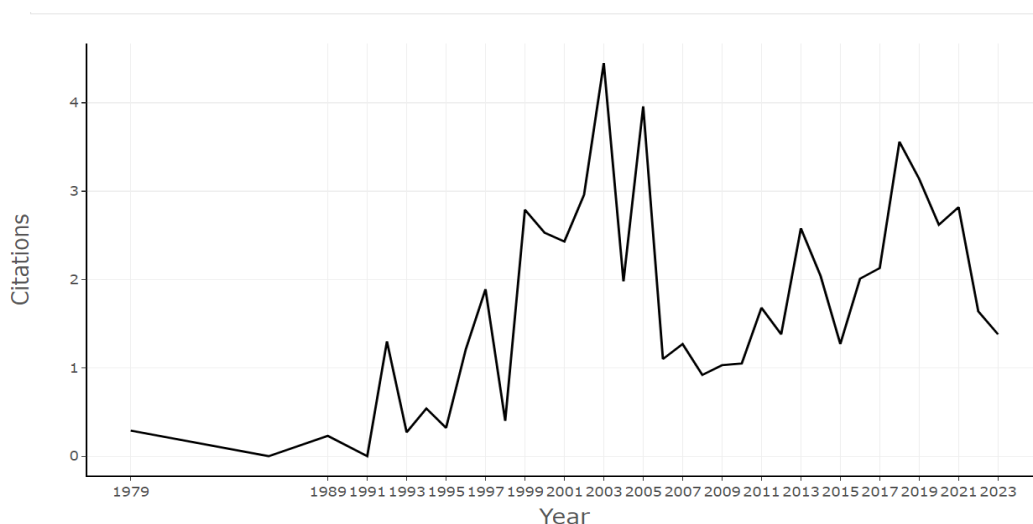


Figure 3. Evolution of citations
 Source: authors' own processings in R-Stata Bibliometrix

The low number of citations between 2006 and 2010 (Figure 3) might be a potential cause of the falling number of publications from 2009 to 2013, as the attractiveness of the topic seems reduced. Figure 3 presents the average citations per year.

In Figure 4 below we can see that the most relevant researchers in the field of Knowledge risks have between three and seven papers published. There is only one exception, that of Susanne Durst, with a number of 17 papers, being the most prominent author in the field. This result shows that – with one exception – there aren't authors that have focused their research interests on this subject. A potential explanation for this may be the low number of citations, especially between 2006 and 2010 (Figure 3).

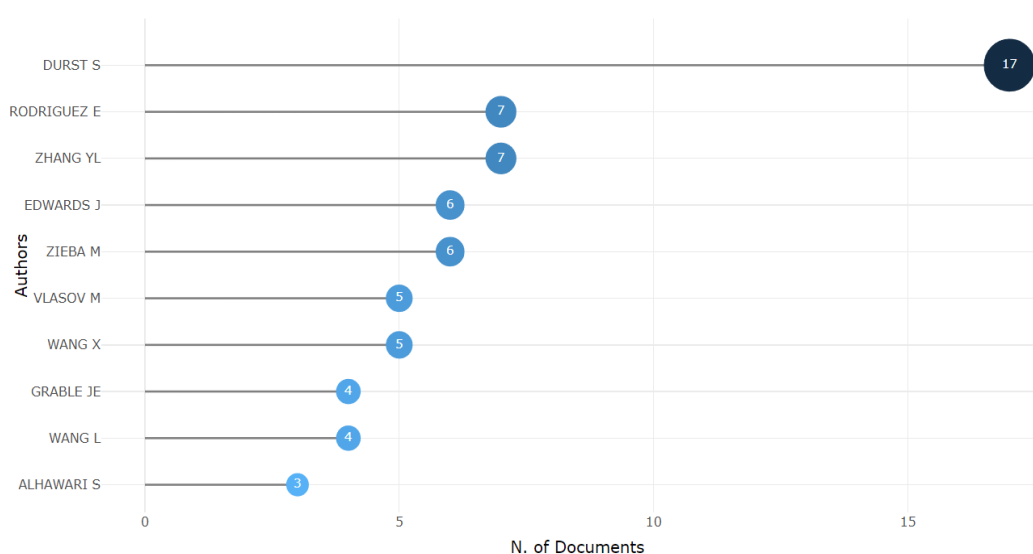


Figure 4. Most published authors
 Source: authors' own processings in R-Stata Bibliometrix

4.2 Evolution of the knowledge risks field. Analysis of abstracts using bigrams

In order to undertake our bibliometric analysis, we are using a mixed approach – both quantitative and qualitative – using bigrams for understanding the evolution of a particular scientific field, “knowledge risks”, within the larger field of knowledge management.

As we already mentioned, when analyzing the number of publications and the number of citations from 1979 until the current year of 2023, we were able to highlight three different periods in time: emergence and development (from 1979 to 2009), crisis and recovery (from 2010 to 2017) and fluctuation (from 2018 to 2023).

Because in the downloaded Clarivate Database the biggest size text for each article was the Abstract, we decided to create the thematic maps based on them, considering that the number of N-grams identified will make the analysis more substantial. Also, by learning to use the software, we noticed that bigrams based on abstracts are the most helpful for creating maps revealing the conceptual developments and the consistent appearance of some ideas from knowledge management and knowledge risk.

The thematic evolution map in Figure 5 shows a clear thematic concentration for the 2010-2018 period in the area of risk management, and a distributed focus between 2019 and 2023, as if the field is losing the focal point. Several subjects are consistently found throughout all three periods: risk management, risk evaluation / assessment, financial knowledge, structural equation. Many subjects related to risk management are found in all three periods. Some typical knowledge management subjects are also found: knowledge sharing, knowledge workers, organizational knowledge.

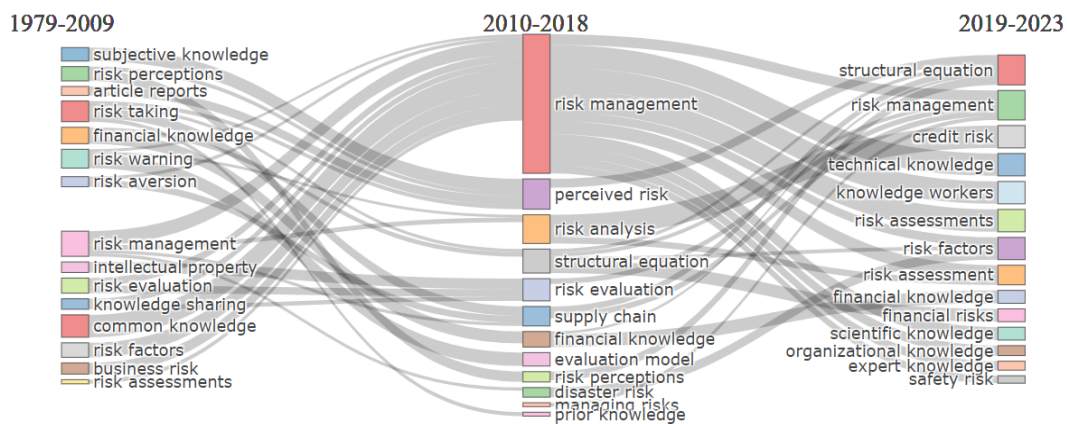


Figure 5. Thematic evolution of abstracts – bigram
 Source: authors’ own processings in R-Stata Bibliometrix

For each of the three time-slices we also created the thematic map proposed by Callon et al. (1991). Therefore, Figures 6, 8 and 10 present the thematic evolution of abstracts, for three different time slices: time slice 1: from 1979 to 2009, time slice 2: from 2010 to 2017 and time slice 3: from 2018 to 2023. Figures 7, 9 and 11 are similar to Figures 6, 8 and 10, but present a detailed view where it is needed.

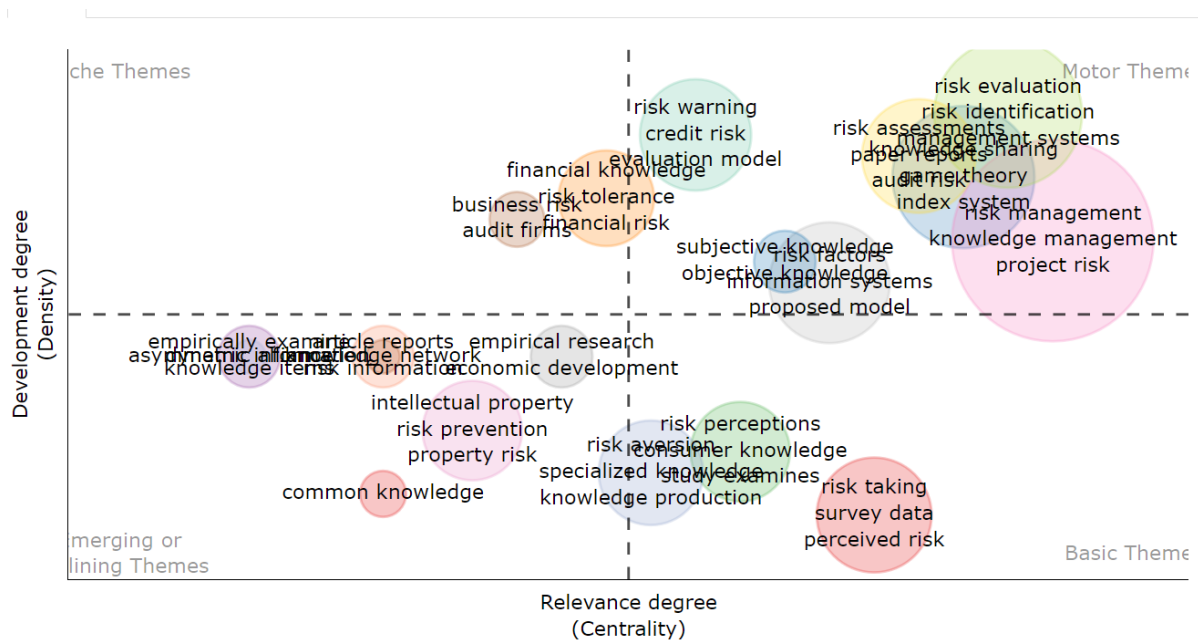


Figure 6. Thematic evolution of abstracts – bigram (time slice 1)

Source: authors' own processings in R-Stata Bibliometrix

The thematic evolution map in Figure 6, for the emergence and development period of the field (1979-2009), shows a clear thematic concentration of motor themes, with concepts typical for the field of risk management (e.g. risk management, risk evaluation, risk identification, risk audit, risk warning), showing the emergence of the knowledge risks field as a field deriving from the field of risk management, by bonding knowledge management perspectives to the original risk management concepts. In the motor themes (Q1 quadrant) we find references to knowledge management, objective and subjective knowledge. The Q4 quadrant is almost blank, while there is only a minimal presence of subjects typical for knowledge management, in Q2 and Q3 quadrants: knowledge production (in Q2 quadrant), intellectual property (in Q3 quadrant).

The biggest cluster identified in Q1 (in pink color) is focused on risk management (58 appearances, Figure 7), knowledge management (54) and project risk (15). We can see in that cluster that only knowledge creation (11 appearances) and knowledge transfer (10 appearances) are knowledge management related concepts.

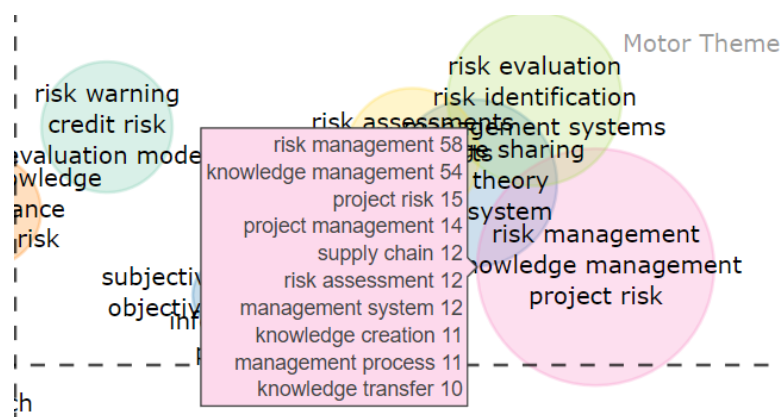


Figure 7. Biggest cluster analysis – Thematic evolution of abstracts – bigram (time slice 1)

Source: authors' own processings in R-Stata Bibliometrix

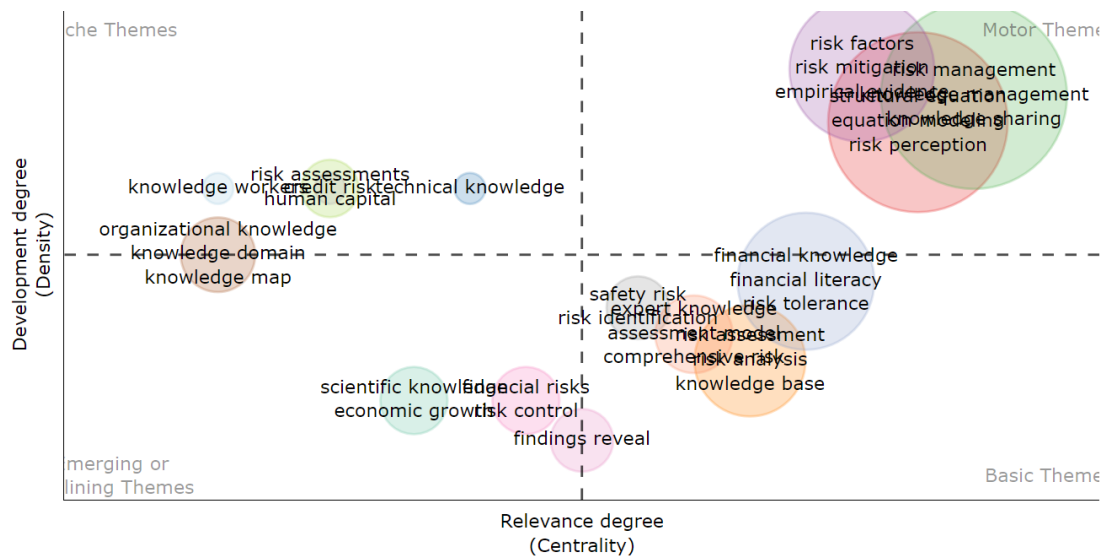


Figure 10. Thematic evolution of abstracts – bigram (time slice 3)

Source: authors' own processings in R-Stata Bibliometrix

The thematic evolution map in Figure 10 and Figure 11, for the fluctuation period of the field (from 2018 to 2023), shows a movement of the themes with the biggest load toward the first quadrant of motor themes (Q1).



Figure 11. Biggest cluster analysis – Thematic evolution of abstracts – bigram (time slice 3)

Source: authors' own processings in R-Stata Bibliometrix

The biggest cluster identified in Q1 (in green color) is focused on risk management (54 times found, Figure 11), knowledge management (44) and knowledge sharing (18). If we go deeper with the analysis (Figure 11), we can see that knowledge risk/risks is found 28 times, knowledge transfer 14 times and knowledge creation 11 times. Overall, in the diagram the subjects that we can attribute to risk management are now around half of the subjects, but typical knowledge management subjects are present in all quadrants: technical knowledge, knowledge workers and human capital (in Q4), organizational knowledge, knowledge domain and knowledge map (at the border of Q2 and Q3), expert knowledge and knowledge base (Q2).

5. CONCLUSIONS

One first conclusion that we can draw is that the knowledge risk literature in the latest period of time has clearly taken a separate scientific evolving direction, and the thematic focus of the most prominent publications in the field are clearly in the area of knowledge management and not anymore in the area of risk management, in an attempt to avoid the transversal themes, as we could also see from the low number of knowledge management themes in Q2 quadrant in one of the latest figures (Figure 10).

Another conclusion we can put forward, based on the bigrams representations, is that the field is still young, and still searching for its position and focus. Despite the large number of articles approaching the concept of „knowledge risk” (8889 articles indexed in Clarivate WOS), our analysis on the most relevant 1000 shows that the concept is not central in the case of the vast majority of these 1000 papers. Finding specific topics, in order to define a clear new field about knowledge risks is a difficult endeavour since the field has emerged rather as a transversal field.

A general conclusion is that some types of knowledge risks appear in our analysis: for example, knowledge leakage is a basic theme in the crisis and recovery period (2010-2017) and knowledge spillover is an emerging theme during the same period. Thus, slightly but apparently surely, the field of knowledge risks takes its own scientific direction of evolution.

In this paper, we intended to use a mixed approach, both qualitative and quantitative, for undertaking a bibliometric analysis, in order to understand the evolution of the particular scientific field of “knowledge risks”, through discussions based on the use of bigrams.

Also, the paper covers a gap in the literature, by focusing on the field of knowledge risk, within the broader field of knowledge management.

Regarding the limits of the present research, we need to mention that many of the 1000 articles that we analyzed contain both words (“knowledge” and “risk”) in the abstract, yet not really associated at the level of a conceptual approach. They might be found in phrases or enumerations that brings them together, but without representing contributions to the knowledge risks field. Hence, we found it difficult to identify this lack of conceptual connection through bibliometric analysis. We consider that it would be necessary to read all the articles and exclude those that do not actually fit the field. However, the bibliometric analysis showed us this fact, namely that the concept of knowledge risks is found many times as a secondary concept in articles, rather than as a main concept.

Future research should focus on undertaking bibliometric analyses that is being focused strictly in the field of knowledge risks, narrowing the area of analyses and discussions, and thus potentially offer a clearer picture of the evolution of this field within the scientific literature.

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