



Article

# Mixed Methods Utilisation in Innovation Management Research: A Systematic Literature Review and Meta-Summary

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**Abstract:** The main purpose of this article is to explore the application of mixed methods research in the innovation management sub-discipline utilizing a systematic literature review and meta-summary analysis. Regardless of the growing number of studies in innovation management there is still a lack of research that integrates and synthesizes this body of knowledge. Our review of 93 articles from Web of Science and Scopus databases, including content analysis, presents trends and research background in innovation management that use the mixed methods approach. This study addresses the inconsistencies in the literature and presents a holistic picture of what existing empirical studies have found to date. In addition, we have developed an innovation management model based on selected theoretical lenses to enable future researchers in a given area to choose the appropriate method. The results of the meta-summary show that 50.54% articles from our dataset are related to partially mixed dominant sequential methods, 12.90% fully mixed dominant sequential methods and 11.83% fully mixed dominant concurrent methods. We identified several research gaps and provided a future research avenue in the context of innovation management. The article analyzes empirical papers, enables identification of problems in the current research and identifies trends in the area of the studied phenomenon. The results on the topic of mixed methods in innovation management and used tools have indicated that this issue is still in a premature phase but with an upward trend of research development.

**Keywords:** mixed methods research; mixed research approaches; mixed research models; innovations; innovation management

## 1. Introduction

One of the most important and sustainable sources of long-term success of organizations is innovation (Camisón and Villar-López 2014; Iturrioz et al. 2015). Over the last 45 years the body of innovation management literature grew considerably especially in the area of innovation, innovation management or commercialization of innovation. This led to an increasing number of different models of innovation processes, especially in the field of innovation management research, from research on the impact of creative thinking on green innovations (Awan et al. 2019) and the innovative behavior of high-tech businesses (Wach 2016) to the use of managerial competencies and innovation in enterprises (Szczepańska-Woszczyzna and Dacko-Pikiewicz 2014; Okoń-Horodyńska et al. 2020; Szczepańska-Woszczyzna 2020).

Mixed research methods are one of the most important and the most effective ways of generating more accurate results in order to provide a broader and more complete vision of a problem in management research (Bazeley 2015).

The area of innovation management (Ritala et al. 2020) is studied both with the help of two groups of research methods: quantitative methods (e.g., to study expenditures on innovations or dynamics of start-up development) (Awan 2020; Faems 2020), as well as qualitative methods (Goffin et al. 2019), as innovations are complex and multidimensional processes. Many researchers indicate that only by employing mixed methods the most accurate measurements of innovation management can be achieved. Therefore, it is supposed that there is a relationship between the use of mixed research methods in the articles and obtaining results that are more accurate. Many innovation management tools are used in this discipline, the use of which has real effects. With the development of research and the deepening of knowledge on innovation management, many researchers are verifying the usefulness of existing innovation management tools and developing new ones. Nevertheless, to the best of our knowledge, there are no studies extensively exploring the application of mixed methods within the area of innovation management research, since most of them concentrate on general management (Cameron and Molina-Azorin 2011; Bazeley 2015; Molina-Azorin et al. 2017). For this reason, presenting a review of literature and meta-summary in a given field seems to be scientifically justified.

Considering these gaps in the literature, and the scholars' calls to address the absence of systematic reviews regarding innovation management (Cameron and Molina-Azorin 2011; Lopes et al. 2016), specifically in the area of application of mixed method approaches, our main goal is to explore the application of mixed methods research in the innovation management sub-discipline using a systematic literature review and meta-summary analysis. More specifically, the present study first undertakes a systematic review of the literature in order to identify drivers and outcomes of using mixed methods in the articles on innovation management. We explore the relationships between the use of mixed research methods in the innovation management sub-discipline with all drivers and outcome variables that have been empirically studied in the systematic review. Second, we conduct a meta-summary to further explore drivers and outcomes of using mixed methods in innovation management research, where adequate independent empirical studies are available.

This article contributes to the literature on innovation management research in various ways. First, it synthesizes the contributions of research published in the innovation management sub-discipline. Second, it develops a framework that covers studies on mixed methods in innovation management research. Third, it uses a meta-summary method to aggregate prior empirical studies on innovation management to identify the direction and effect of mixed methods used in the field of innovation management discipline. Fourth, through the critical analysis of the literature, this study highlights the gaps in the literature and provides suggestions for future studies to further explore the field. This is critical given that the field of innovation management sub-discipline is still in its infancy stage and, therefore, research on using mixed methods in innovation management research is strong in certain areas but weak in others.

## 2. Mixed Methods and Innovation Management Research

### 2.1. Definition of Mixed Methods Approach

Looking from the historical perspective, the mixed methods approach can be perceived as a methodology developed around the end of 1980s and beginning of 1990s, which, in its present form, stemmed from the work of researchers in various scientific fields, such as sociology, education, management, and health sciences (Creswell and Creswell 2018). Mixed methods research (the combined use of quantitative and qualitative methods in the same study) is becoming an increasingly popular approach in the discipline fields of many sciences. The main feature of mixed methods research is its methodological pluralism, which frequently results in research, which provides broader perspectives than those offered by monomethod designs.

Calls for the integration of quantitative and qualitative research methods have been announced in social sciences (Denscombe 2008) especially in the business and management discipline areas

(Cameron and Molina-Azorin 2011). On the other hand, management researchers trying to utilize a mixed methods approach may still encounter opposition from the guards of a discipline where research is heavily inculcated with a positivist ideology, an adoration of indicators, measures, and an assumption of developing statistical analyses of numeral data (Currall and Towler 2003).

The growing use of mixed methods has practical implications for research training and capacity building within business schools (Cameron 2011; Frias and Popovich 2020). Therefore, there is an increasing need to develop research capacity through the introduction of postgraduate courses in mixed methods and advanced research skills training for existing researchers.

W.E. Thurston, L. Cove, L.M. Meadows (Thurston et al. 2008) indicated that a single definition of mixed methods research does not exist, as “mixed methods studies can either combine methods from different paradigms or use multiple methods within the same paradigm, or multiple strategies within methods”. One of the most popular definitions found in *The Journal of Mixed Methods Research* (Tashakkori and Creswell 2007), in its call for papers, defines mixed methods as “research in which the investigator collects, analyses, mixes, and draws inferences from both quantitative and qualitative data in a single study or a program of inquiry”. In this paper, the following definition supplied by Greene et al. (1989) is applied, where mixed methods research designs are perceived as those that include at least one quantitative method (designed to collect numbers) and one qualitative method (designed to collect words).

A monomethod study uses only one type of method, one qualitative or one quantitative. In general, in a qualitative study, the information, which is mainly in textual form, is analyzed employing qualitative data analysis techniques. In a quantitative study, the data is in numerical form and this information is analyzed using quantitative data analysis techniques. Drawing an initial distinction between monomethod research and multiple methods research may be helpful to determine what is understood as “mixed methods”. A multiple methods study uses more than one method. Moreover, a differentiation can be made within multiple method designs between multimethod research (multiple qualitative or quantitative methods) and mixed methods research (integration of quantitative and qualitative methods) (Creswell and Clark 2017).

The need to combine methods is due to the complexity of the object research, the need to enrich the results with different research perspectives and obtain a more complete and comprehensive picture of the reality being examined.

## 2.2. The Application of Mixed Methods Research

For researchers, two factors are most important: priority and implementation of data collection to design and conduct a mixed methods study (Morse 1991; Tashakkori and Teddlie 1998; Creswell and Clark 2017). Priority means that, depending on the researcher’s preferences, research questions, and limitations in the possibilities of data collection, researchers can give equal priority to both quantitative and qualitative research or place more emphasis on qualitative or quantitative parts. Mixed methods designs can therefore be divided into the following categories: equivalent status designs and dominant-less dominant studies, or nested designs. Using the first model the researcher conducts the study using both the quantitative and qualitative approaches equally to understand the phenomenon under study. Using the other model, the researcher conducts the study within a single dominant paradigm with a small component of the overall study drawn from an alternative design.

Implementation of data collection refers to the sequence that the researcher uses to collect all data. If the research problem is solved by applying both qualitative methods as well as quantitative ones, the researcher uses a simultaneous, also referred to as concurrent, or parallel design. The relationship between methods can be equivalent (equal status of qualitative and quantitative paradigm) or leading for one of the methods (e.g., dominance of qualitative or quantitative method). In a sequential design, results obtained using one approach are the basis for research using the second approach. The third type of approach is transformational design. The transformational approach is characteristic of mixed methods used in evaluation studies being the basis for conducting economic research. In these studies,

the test results are the basis for shaping social change that comes from the adopted theory. When the researcher has quantitative data, the goal is to test the variables on a large sample. To confirm the results obtained from a large sample, it is worth conducting a more in-depth analysis of several cases using qualitative methods. However, if qualitative data were collected, the intention is to first investigate the problem under study using qualitative methods, and then to continue this study using quantitative data that can be tested on a large sample so that the results can be deduced from the population.

Morse (Morse 1991) and Johnson and Onwuegbuzie (Johnson and Onwuegbuzie 2004) proposed four groups and nine types of mixed method projects with a combination of two dimensions. The dominant method is marked with capital letters (QUAN, QUAL), while the complementary method is represented by lowercase letters (quan, qual). The notation “+” means simultaneous design, and the arrow “→” is used to indicate a sequential design.

Equivalent status/simultaneous design: QUAL + QUAN.

Equivalent status/sequential designs: QUAL→QUAN; QUAN→QUAL.

Dominant/simultaneous designs: QUAL + quan; QUAN + qual.

Dominant/sequential designs: qual→QUAN; QUAL→quan; quan→QUAL; QUAN→qual.

### 2.3. The Advantages and Limitations of Mixed Methods

In the field of management research, a significant reflection prior to designing and conducting a mixed methods study is whether mixed methods, as compared to monomethod designs, best address the research questions and the research problems. Malan et al. (2019) described in detail that conducting a mixed methods study requires more work, time and financial resources. Additionally, increased demands on time depend on how long it takes to implement both aspects of the study.

In the field of management research, Jick (1979), Tashakkori and Teddlie (1998) and Creswell and Clark (2017) have been strong advocates for pluralism or multimethodology. Jick (1979) discussed triangulation in terms of the weaknesses of one method being offset by the strengths of another. It is often stressed that different methods have different weaknesses and strengths, and therefore the main effect that triangulation can offer is to overcome the weaknesses of any single method. Tashakkori and Teddlie have advised that better understanding and increasing the validity of inference can be obtained, for example, by triangulating one set of results with another. Additionally, “the use of quantitative and qualitative approaches in combination provides a better understanding of research problems than either approach alone” (Creswell and Clark 2017). Other advantages of using mixed methods in research include complementarity understood as complementing one method by another, initiation (the ability to exclude paradoxes and changing inappropriate research questions), extension by extending the scope of questions and answers and development (by using both methods in a given research area) Greene et al. (1989).

Other advantages presented by Bryman (2007) are: triangulation and analysis of processes and statistical features. Qualitative research can facilitate the interpretation of relationships between variables, because qualitative research facilitates quantitative research and quantitative research facilitates qualitative research.

Similar to the arguments above, Creswell and Creswell (2018, p. 281) have argued in favor of the advantages of using this type of approach by means of comparing various viewpoints obtained from quantitative and qualitative data, clarifying quantitative results with a qualitative complementary data collection and analysis, designing better contextualized measurement tools, augmenting experiments by including the perspectives of individuals, creating cases (i.e., organizations, units, or programs) for comparisons and obtaining a more complete perception of changes required for a marginalized group.

Despite the mentioned advantages of this sophisticated approach of conducting research, it is important to mention some challenges that may occur before starting a new research project

(Creswell and Creswell 2018, p. 281): the need for large-scale data gathering, the time-consuming character of analyzing both qualitative and quantitative data and the necessity for the researcher to be acquainted with both quantitative and qualitative types of research. Moreover, due to the complexity of the research design it is important to develop clear, visual models to comprehend the specifics and the course of research activities within this approach. Bryman (2007) and Bryman (2007) mapped a brief division of barriers to using mixed methods research, pointing out that researchers need to develop a wider set of skills that span both the quantitative and qualitative research approaches. Another barrier is connected to the challenges of publishing mixed methods studies, such as word and page limits in journals (Wipulanusat et al. 2020).

#### 2.4. Innovation Management Research

Innovation management is essentially perceived as inter-disciplinary research, where various theoretical and methodological concepts developed in business and management are applied, resulting in a separate sub-discipline of management (Tidd and Bessant 2018b). Within the literature, innovation management is referred to in many ways, routed in different theories that include new product development (Cooper 1990; Wheelwright and Clark 1992), technological innovation (Dosi 1982; Shea 2005; Nambisan and Nambisan 2008), process innovation (Tidd and Bessant 2018a), and open innovation (Sawhney and Prandelli 2000; Chesbrough et al. 2006).

The lack of a common definition of innovation is partly explained by referring to its multidisciplinary origin that influences the theory of innovation management. Two trends in innovation management influenced the basic idea of this paper. (Pereira and Leitão 2016)

Selection of the correct research method is one of the main fundamentals for success in the field of solving innovation problems. We were encouraged by the ideas of publications having methodological character that pay attention to methods, their development and applications, since comprehension and utilization of several different methods may cause some difficulties to researchers (Blumberg et al. 2011; Gupta and Trusko 2014). Moreover, notion innovation is very often connected with the questions of creativity, invention and intuition as expressions associated with newness. This fact was acknowledged, and the final method selection includes those methods that focus on gathering real data, data processing, analysis, etc. (so-called empirical or experiential methods) and the distinction between qualitative and quantitative methods. Study of innovation processes showed that it is necessary to apply a set of methods according to the way the innovative solution progresses. These so-called theoretical methods should be included in solving problems in the area of innovations, as those are usually verified by the internal logic reflection and relationship to business and commercial practice. There is a lack of comprehensive studies on utilizing the mixed methods approach in the innovation management subdiscipline. This research problem will be solved by applying an appropriate research methodology provided in the next section of the paper.

### 3. Research Methodology

A systematic literature review is the method that explores and sorts publications in order to identify the essential attributes of the studied materials. Moreover, the systematic literature review makes a special contribution in distinguishing past trends and forecasting future models, using a set of concepts, interpretative reflections, and analyzing all the evidence on a specific question (Rousseau et al. 2008). The advantage of this method is that it focuses on individual journal researches and chooses small samples or characteristics of cases according to the subject requirements and the interests of researchers (Aliaga-Isla and Rialp 2013).

According to the method applied, steps suggested by Tranfield et al. (2003), Aliaga-Isla and Rialp (2013) and Kitchenham (2004) are followed. In the planning stage, we prepared a study plan for review and developed a review protocol based on the objectives of the study. In the execution stage, we developed search keywords, identified the data sources, defined study selection criteria and

extracted and synthesized data from selected studies. In the reporting stage, we reported our findings and explained the relationships between mixed methods and innovation management research.

Before the actual search for the articles, several initial searches of Scopus, Google Scholar and Web of Science were undertaken in order to determine keywords and appropriate search terms. All relevant keywords were searched in November 2019 as the next step. Electronic databases searched were Scopus and Web of Science.

For the literature search in the Web of Science and Scopus databases, we have applied a set of alternative keywords including such combinations as: “innovation management AND mixed methods”, “mixed models AND innovation management”, “quantitative and qualitative methods AND innovation management”, “quantitative and qualitative research AND innovation management”. Additionally, we made a manual search to find studies not included in the search of the databases.

We have only included the journals written in the English language. Nevertheless, all results should be treated with some reservation due to delays in publishing. In order to recognize the interest in the subject of mixed methods in innovation management research, we decided to search for articles from the Web of Science and Scopus databases. This is a typical procedure in this type of research order so as to increase reliability of results.

Based on the search criteria, we identified 1414 initial papers. It is common to retrieve a very large number of hits from the searches in databases. Therefore, once all studies had been retrieved from the databases, the inclusion and exclusion criteria were used to identify relevant studies. Initially, after applying two criteria: type—“article” and language—“English”, 104 articles were found. The following documents were excluded: (1) in languages other than English, (2) book chapters, conference proceedings.

Firstly, we removed the duplicate publications (11) and this process brought down the number of studies to 93. The first author then read the full text of the 93 articles and data from the 93 studies were extracted and synthesized for the purpose of systematic review (see Appendix A).

In the next stage, data from the 93 studies were extracted and synthesized for the purpose of systematic review. Data synthesis was achieved using content analysis. Content analysis is an established method of research and is used to condense a text into fewer content-related categories (Cavanagh 1997). Following Ritchie et al. (2013) method, a series of steps were undertaken in order to analyze the papers in our final pool. First, the literature was read and textually studied to derive a set of suitable categories. This led to identifying recurring themes and methods used in the papers from the collected literature. The extracted data was organized and examined based on method used in two main groups: non-empirical and empirical articles. Additionally, the group of empirical studies were divided into three types: quantitative, qualitative and mixed methods approach articles.

To lead the meta-summary, we used the Sandelowski and Barroso (2003) analytic guideline in this study. The approach includes the extraction, grouping, and formatting of findings, and the calculation of frequency and intensity effect sizes, which can be used to produce mixed research syntheses and to conduct analyses of the relationship between reports and findings. Additionally, meta-summaries can serve as a basis for a further synthesis.

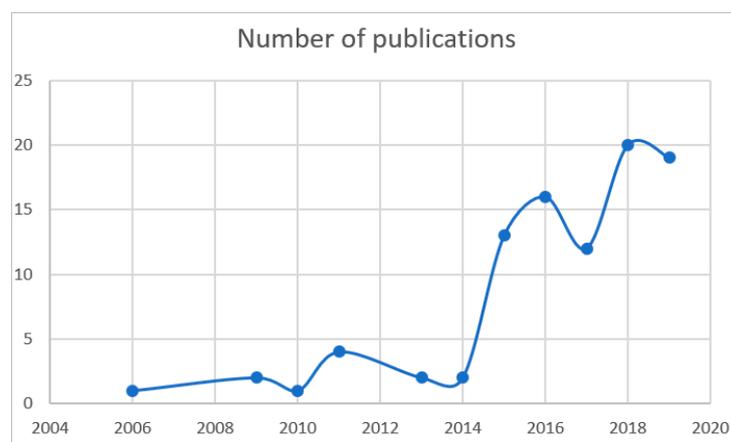
The following studies were excluded from our meta-analysis: all articles in languages other than English and book chapters, conceptual studies, conference papers, and review papers, as we are interested in empirical evidence of mixed methods in innovation management research. We excluded studies that used the same dataset and stated the same correlations as in previously published papers.

The meta-summary examined relationships between the application and the characteristics of mixed methods in innovation management research. In the included studies, a sequential mixed methods study with two stages was undertaken to identify mixed methods articles and determine their main characteristics. In the first phase, a qualitative stage was used in the manual search strategy for the purpose of determining whether each article represented a non-empirical, quantitative, qualitative or mixed methods study. This deep analysis involved using all information presented in each article starting from the title, which is followed by keywords, abstract, introduction, literature review, methods,

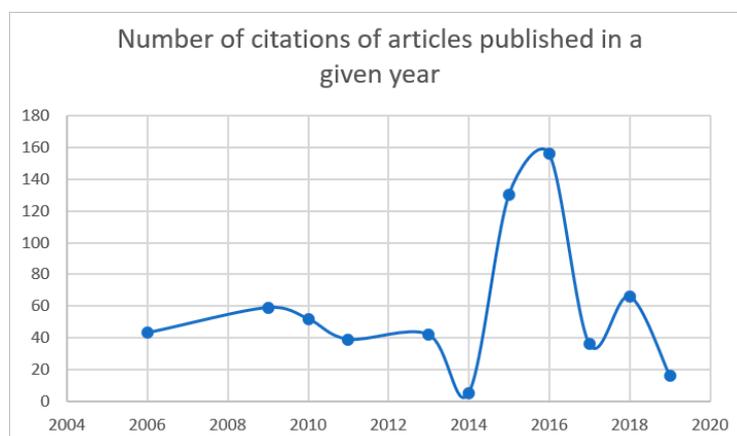
results, and finally discussion and conclusions. After a precise investigation of their content, including analysis of individual tables by journal and by year, listing the journal title, year, number of total articles, number of non-empirical articles, number of quantitative articles, number of qualitative articles and number of mixed methods articles. A database was created to compare different types of papers, techniques, methods, objects of analysis and a summary of findings. Once the mixed methods articles were identified, they were re-examined through a content analysis and coded according to two main dimensions: implementation of data collection (simultaneous or sequential) and priority (equal or dominant status of the quantitative and qualitative parts). In another phase, descriptive statistics were used for the quantitative analysis of prevalence, for providing sums and percentages depending on the type of article (non-empirical, quantitative, qualitative and mixed methods articles). Furthermore, regarding the mixed methods articles, numbers and percentages by type of priority (equal or dominant status), type of implementation (simultaneous or sequential) and purpose were also provided.

**4. Characteristics of the Included Studies**

As Figure 1 shows, the number of studies investigating the use of mixed methods approach in innovation management research has increased rapidly in recent years. There is a notable growth in publications from 2014, which suggests that mixed methods in innovation management research have grabbed the attention of academics as well as practitioners. Another purpose of the large number of publications in 2014 was raising the number of citations in the same year (see Figure 2). The observed number of citations shows small randomness in relation to the number of publications (see Figures 1 and 2), even considering the publishing cycle.



**Figure 1.** Number of publications of the studied literature collection (source: own study).



**Figure 2.** Number of citations of the studied literature collection (source: own study).

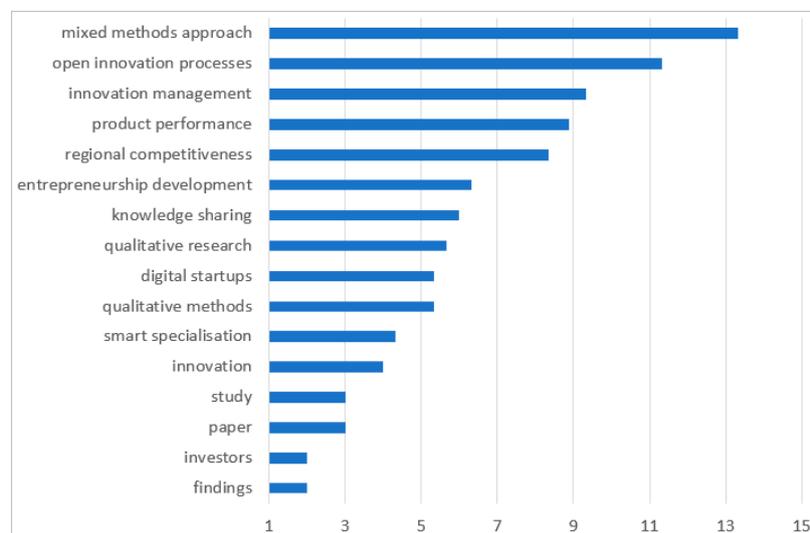
This is due to two phenomena: the first is the high homogeneity of the publications, expressed by many citations (International Journal of Production Research and Journal of Product Innovation Management are the most appropriate journals for targeting texts related to this issue as those have the largest number of citations).

Only “Technological Forecasting and Social Change” has published five articles; they appear in stable time intervals (2006, 2015, 2018, 2019). The next are “R & D Management”, “Journal of Business Research”, with four and three publications, respectively. “Technological Forecasting and Social Change” has (according to the average: 2006, 2015, 2018, 2019) the most recent articles of them all and is in an upward trend.

The second reason is the large number of publications in general, which is noticeable in the form of small fluctuations in the number of publications. During bibliometric analysis of 4185 references we noticed that 13 authors out of 314 worked on five publications from the collection. This indicates the lack of chances of specialization in the topic.

Compared with Lotka’s schedule (Lotka 1926) in de Solla Price’s interpretation (Price 1986), this is the number of publications above the elite borderline (i.e., 10 publications), since there is a theoretical capacity for the author who would be responsible for 13 publications (with  $c = 314$   $n = 2$  for Lotka’s distribution should be 1.858 author with 13 publications). It is also an argument demonstrating that this topic started to be a part of knowledge on innovation management research.

We also examined the superficial content of the articles using the RAKE method (Berry and Kogan 2010) to identify keywords. The udpipe package (Straka and Straková 2017) for the language R (R Core Team 2018) was used for this purpose; the method was carried out on lemmas (basic forms of expression), so as not to multiply variations of the same phrases. The set of keywords identified from the abstracts is quite extensive (see Figure 3). The mixed methods approach shows the greatest link here as well as open innovation processes and innovation management and regional competitiveness. These are all concepts identified as essential for mixed methods in the innovation management topic, whose relationship with the examined subject is sometimes not obvious.



**Figure 3.** Identification of keywords by the Rapid Automatic Keyword Extraction method (RAKE) (source: own study).

We examine the recent information visualization phenomenon known as tag clouds, which are an interesting combination of data visualizations (Hearst and Rosner 2008). We used this method to compare the results using two different techniques. Figure 4 demonstrates that most keywords are repeated in both figures, which means two tests were carried out correctly.



of methods and results were made only at the last stage, when the data were collected and analyzed adequately using individual methods (qualitative and quantitative).

Partially mixed dominant concurrent methods occur when the plan research provides for two phases of research—quantitative and qualitative—implemented at the same time, the results of which are assigned different weights. An example is [Hofmann \(2015\)](#) research focusing on the question of who the companies should address in order to be able to make complex long-term decisions, come up with a vision and develop products and services that will appear on the market in a few years. A quantitative study to review existing concepts in this case had a smaller role than the qualitative study (questionnaire and interviews). Data collection and analysis were made prior to comparison and drew conclusions from the entire study.

Partially mixed complementary sequential methods occur when test phases using different methods follow one another and have the same weight in assessing test results. Based on the results of exploring the selected articles database (see Appendix A), seven authors used a given type of method ([Yström et al. 2015](#); [Jafarnejad et al. 2014](#); [Siripongdee and Fongsuwan 2015](#); [Barak and Usher 2019](#); [Korneta 2019](#); [Cortimiglia et al. 2016](#); [Hoffmann 2011](#)). An example of this variation of the mixed method is the article ([Yström et al. 2015](#)), which explored the creative climate in the open arena of innovation called SAFER, where 26 partner organizations meet to innovate together. First, a quantitative randomized study, i.e., a quantitative creative climate questionnaire, was conducted. The second phase of the study took place towards the end of the program and covered it and supplemented the data through interviews; the interviews were to reflect the perspective of the experience of group members related to the program. The analysis of the results of individual stages was made separately, and the combination was conducted only at the stage of data interpretation.

Partially mixed dominant sequential methods occur when one of the methods used in the sequential system is treated as more important in determining the results of the entire study. This type of method is very popular in our article database because it was used in 47 articles ([Hankammer et al. 2019](#); [Teixeira et al. 2019](#); [Jensen 2011](#); [Blindenbach-Driessen et al. 2010](#); [Lagos and Kutsikos 2011](#); [Radovanović et al. 2017](#); [Al and Wu 2016a, 2016b](#); [Bouette and Magee 2015](#); [Teirlinck and Spithoven 2013](#); [Walwyn et al. 2019](#); [Almeida et al. 2019](#); [Ghezzi 2019](#); [Duarte and Pinho 2019](#); [Burlison et al. 2019](#); [van de Burgwal et al. 2019](#); [Olsson et al. 2019](#); [Harrison et al. 2018](#); [Chasanidou et al. 2018](#); [Reinhardt and Gurtner 2018](#); [Ilonen et al. 2018](#); [Al-edenat 2018](#); [Holis et al. 2018](#); [Geyskens et al. 2009](#); [Cowell et al. 2018](#); [Al-Husseini and Elbeltagi 2018](#); [Tu 2018](#); [Perenyi et al. 2018](#); [Grimpe et al. 2017](#); [Kılıç 2017](#); [Bala and Venkatesh 2017](#); [Lucas et al. 2016](#); [Kopcha et al. 2016](#); [Boerchers et al. 2016](#); [Klingebiel and Joseph 2016](#); [McCarthy et al. 2016](#); [Swartz et al. 2016](#); [Bakhshi et al. 2015](#); [Udawatta et al. 2015](#); [Tikka et al. 2015](#); [Owusu-Manu et al. 2015](#); ([Maurice Khosa and Kalitanyi 2015](#); [Flores Ituarte et al. 2018](#); [Saunila 2017](#); [Walravens 2015](#); [Abubakar 2015](#); [Dadfar et al. 2013](#); [de Miranda Santo et al. 2006](#)). Most often, the dominant method was the quantitative method used at the beginning of the study (in 25 articles), while in 22 the dominant method was the qualitative one. For example, authors ([de Miranda Santo et al. 2006](#)) in their study concentrated on analysis conducted by the Center for Management and Strategic Studies related to the research and development in nanotechnology to provide recommendations to the Brazilian government agencies on improving the competitiveness of selected sectors of the country's economy. The first stage—which was the dominant phase—involved data monitoring using text mining techniques. The second stage involved the use of quantitative methods to support the decision-making process related to establishing policies and activities. The next article concerned exploring utilization of the mobile city applications by citizens of Brussels, where the use of the iTunes App Store and Google Play applications was analyzed ([Walravens 2015](#)). Quantitative data was supplemented by qualitative interviews by experts with individuals in this field, such as city councilors, representatives of interest groups and developers.

Fully mixed complementary concurrent methods occur when a combination of different approaches—treated as equally important in assessing the result—is made on at least one of the elements of a single research process: determining the purpose of the study, choosing the type of data

and activities performed, choosing the type of analysis or the type of inference. Different approaches are used in parallel at one or more stages of the research process. An example of this type of approach is the analysis of the nonscientific achievements of traditional disciplines and their reference citations in various disciplines (Corsi and Prencipe 2018). The study was based on the analysis of quantitative and qualitative results, which should already be considered a combination of these two types of approaches at the stage of determining the purpose of the study. This combination was also made at the data analysis and inference stage. The authors of two subsequent articles (Islam and Miyazaki 2009); (Crammond et al. 2018) also used this approach, using in their methods questionnaires with closed and open questions.

Fully mixed dominant concurrent methods occur when methods are combined in the scope of the elements of the research process—qualitative and quantitative, with one of them being treated as more important when determining the test result. Examples of such method combinations may be found in the following studies: (Hwang and Katayama 2009); (Kruger et al. 2018); (Kraus et al. 2018); (JosephNg 2018); (Kapasi and Grekova 2018) (Fu et al. 2018); (Ho et al. 2016); (Vicente-Oliva et al. 2016); (Hayter 2016); (Monsson and Jørgensen 2016). One of the mentioned articles was about examining students' perceptions and perspectives in relation to self-determination of learning in the context of entrepreneurial education (Kapasi and Grekova 2018). Data—both quantitative and qualitative—was obtained by means of a questionnaire and the combination of methods was made at the stage of determining the purpose of research, data analysis and conducted conclusions.

Similar research was performed in the study by Monsson and Jørgensen (2016). The authors presented differences in the characteristics of entrepreneurs, which influenced the benefits that resulted from various elements of the regional incubator program.

Fully mixed complementary sequential methods occur when a combination of different approaches is made on at least one element of the research process. Different approaches are used sequentially—one after another—at one or more stages of the research process, with both approaches given the same weight in determining the result of the study. Examples of this combination could be observed in the research conducted by Hu and McGrath (2011) and Hu and McGrath (2011). In the former, the potential utility of Maslow's theory in understanding technology adoption was examined. Initially, quantitative measures were considered, then these results were compared with the results obtained using a qualitative study. The second article describes a teacher development study related to the expansion of information and communication technologies (ICT) in the context of the national reform of English language teaching. Four groups of teachers were distinguished, considering quantitative measures of pedagogical effectiveness and sources of student success (external vs. internal). These groups were then compared with the received qualitative teacher study data.

Fully mixed dominant sequential methods and fully mixed complementary sequential methods occur in similar cases, but one approach is given greater weight in determining the final test result. An example of such a combination is research in 12 articles from the database (Imran and Gregor 2019; Lütjen et al. 2019; Shen 2019; Grimsby and Kure 2019; Yetis Larsson et al. 2019; Malan et al. 2019; Bican et al. 2017; Fellnhofner 2017a, 2017b; Thomas 2017; Berker and Throndsen. Throndsen 2017; O'Dwyer and Cormican 2017). One article (Bican et al. 2017) examined the way in which companies best manage knowledge through intellectual property rights in open innovation processes.

In the first phase of the study, qualitative methods (focus groups and interviews) were used, which provided information on the activities of the organizations studied. In the second, quantitative phase, a questionnaire was used which contained narrowed and more specifically targeted questions. In the last qualitative phase, focus groups were reused and the research focused on one topic—sources of customer satisfaction of this organization. The next phases of the study were planned based on data and results obtained in the preceding phase, and qualitative research was decisive in determining the results of the entire study.

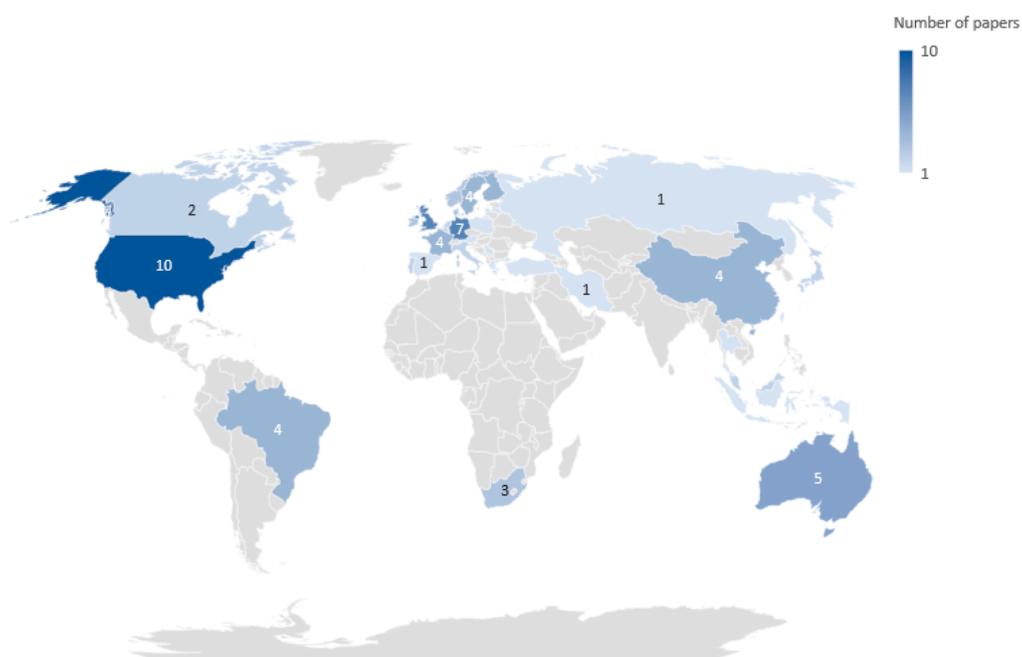
Theoretical papers (Lecossier et al. 2019a, 2019b; Edling and Danks 2018; (McAdam and Debackere 2018; Guidice et al. 2016; Spiegel and Marxt 2015; Titarenko et al. 2014) were not included in our analysis.

Regarding the conclusions derived from our study, several aspects may be emphasized. First, regarding the characteristics of identified articles with mixed methods, 92% of the entire database were empirical articles, and the most common purpose for using mixed methods in research on innovation management was development; the most common priority type was priority of quantity and quality. Additionally, sequential implementation of data collection was the most common implementation pattern used in the studied field.

The description of our dataset (out of 93 articles analyzed), shows that around a half of the analyzed articles (50.54%) use partially mixed dominant sequential methods, 12.90% fully mixed dominant sequential methods and 11.83% fully mixed dominant concurrent methods. As shown, partially mixed dominant sequential methods were common, as data were collected sequentially, initially with quantitative data gathering. The researchers believe that mixed methods have allowed the expansion of the statistical data interpretation because qualitative findings have helped to elaborate on the quantitative results in order to fully address the research questions and have profoundly elucidated the “real” phenomenon. Moreover, mixing the methods has also allowed a deeper examination of the research problem because qualitative methods were used to re-examine research questions, research objectives and the assumptions underlying each component proposed in the study. Mixed methods achieved two major goals related to theory verification and theory generation.

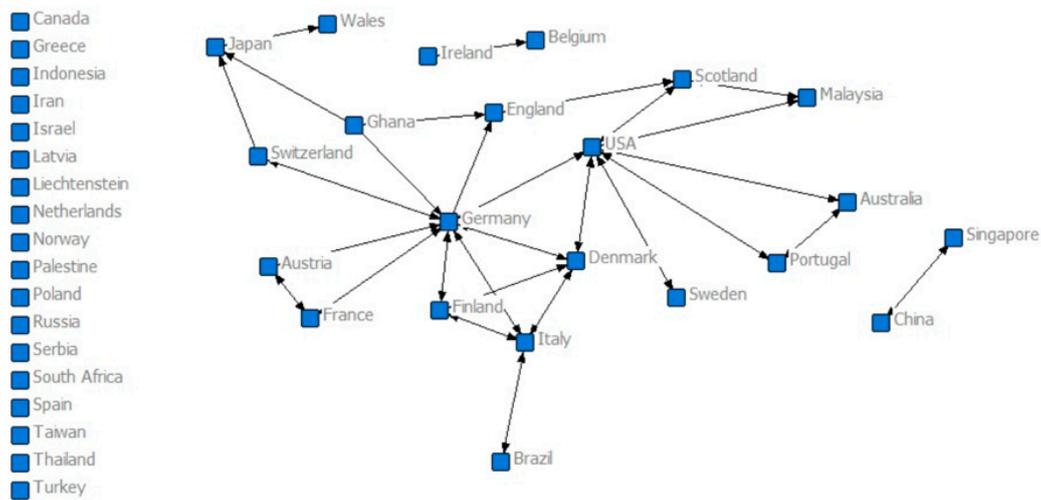
Second, the analysis of the number of studies of mixed methods in innovation management shows great variation year to year, and journal to journal. There is a clear growing trend in the publication of mixed methods research in innovation management in the case of the studied journals. Third, it can be indicated that it is very difficult to classify a given article into one area because various aspects are being described in many articles. The increase in publication from year to year may indicate that the topic is constantly being updated.

In the presentation of the meta-summary results, we begin with showing geographical coverage patterns of the articles analyzed in our study (Figure 5). Since authors from different countries cooperate with each other in order to obtain unambiguous results, we applied the lead author’s affiliation as a determinant for the articles being discussed. Most of the studies included in our analysis have been conducted in the USA (10 papers), United Kingdom (7 papers), Germany (7 papers) and Australia (5 papers).



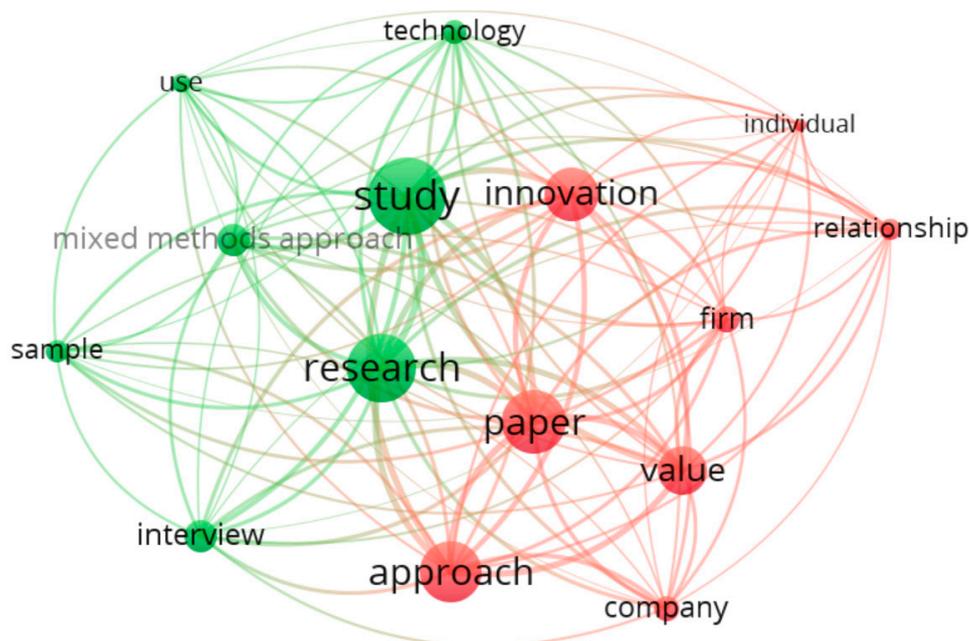
**Figure 5.** Frequency of the publication per country—by the lead author’s affiliation (source: own study).

The analysis of cooperation networks (Figure 6) between authors from different countries shows a high rate of cooperation of countries such as the USA, Germany, Denmark, Italy and the UK. Still, many researchers decide only to research with authors from their own country. It is evident that the network of connections of such clusters as Singapore and China does exist, and connections are paradoxically not obvious between Ireland and Belgium, despite obvious economic, cultural or geographic relations.



**Figure 6.** Network analysis of collaboration between authors (source: own study).

The bibliographic data from Scopus with an ris extension was converted to the .txt extension of plain-text format used by Web of Science with the Cite Space converter utility (Chen 2006). Then, based on these two files, a keywords co-occurrence network was created and analyzed with VOS viewer (van Eck and Waltman 2010). There were 871 unique keywords, 29 appeared at least 5 times, and this was chosen as a threshold for the research, to eliminate purely accidental and unrelated keywords. Three thematic clusters (see Figure 7) were formed.



**Figure 7.** Keywords co-occurrence network with colored clusters, node size by number of occurrences (source: own study).

Modularity of thematic network means that, apart from the central concepts that are obvious given the query types (mixed methods and innovation management), there are other research areas highly related to the scope of the query, like business, knowledge management, or countries such as the UK and USA. This outcome brings two additional conclusions. Firstly, it means that these identified areas should be subjected to additional, deepened literature analysis leading to better categorization of the related areas (clusters) of knowledge. Secondly, further analysis that would enhance understanding of this division's nature and explore social aspect of links is required to fully understand the leading authors, countries (USA and UK) and possible knowledge gaps.

## 6. Conclusions

Analysis using a mixed methods approach in innovation management research seems to be an interesting topic for academicians and practitioners because of its positive effects on organizational performance as well as growing interest in the subject of innovation and thus implementation in the culture of the organization. Companies seek to gain a competitive advantage by using innovation more effectively in enterprises.

Regardless of the increasing number of studies referring to mixed methods in innovation management research, there is a lack of studies that integrate and synthesize this body of knowledge. To advance our understanding of the various methods of innovation management, we carried out analyses of mixed methods in innovation management and we presented the results using figures. The results contained will be useful to scientists interested in using individual methods in research and using them in research. Additionally, this study offers a good starting point for future research to do more thorough research into the given method.

This study reported on the characteristic of mixed methods in innovation management research present in the existing literature. Regardless of the increased number of studies referring to this topic, there is a lack of review of this body of knowledge. This study answers a call by [Cameron and Molina-Azorin \(2011\)](#) and [Cameron and Molina-Azorin \(2011\)](#) for a systematic literature review. In addition, consistent with recent recommendations to develop an advanced standard of methodological rigor of reviews of the management literature ([Newbert 2007](#)), we analyzed 93 articles published in seventy-one academic journals using a systematic literature review approach. Our paper is a compendium of knowledge in the field of mixed methods in innovation management that analyzes the most important publications in a given field published in the Web of Science and Scopus databases.

Based on the literature review, it can be concluded that some studies reveal conflicting findings regarding the use of mismatched methods in the innovation management literature, which makes it difficult to draw general conclusions. Some authors believe that it is worth starting their research by conducting partially mixed dominant sequential methods.

As [Mason \(2006\)](#) indicated, mixing methods offers enormous potential for exploring new dimensions. The predominance of more quantitative-based methodological tools in innovation management research does not mean that these tools are applicable to all research questions. The research question and context should dictate the choice of the appropriate research methods. We would like to indicate that the knowledge about mixed methods research can stimulate a researcher to better define and analyze innovative problems and research questions in innovation management research. Hopefully, this review of management empirical studies which have used mixed methods designs along with the ideas offered for the application of mixed methods studies may favor progress on innovation management research.

Some limitations of our research should be explicated. One limitation of this study to mention is the selection of the articles, since some papers may have not been included due to missing keywords or owing to the fact that articles have not been included in the search in the two chosen databases. We only included peer reviewed journal articles in our study and excluded books and conference proceedings. Moreover, excluding unpublished articles may introduce a bias into the effect size of our result. While such an issue is common in most meta-summaries ([Sandelowski and Barroso 2003](#)) our

result should be interpreted with caution. In our view, extensive searches into two databases illustrate the current state of research into mixed methods in innovation management. Nevertheless, future research on a given topic may show the phenomenon in a different way due to the inclusion of other databases and the inclusion of unpublished research.

Finally, regarding future research, although the current study attempts to extend the knowledge of the application of mixed methods research in management research, much remains to be learned. For example, it would be interesting to analyze the yield from mixed methods studies regarding the added value of these articles, or the contribution to the improvement of several methodological aspects such as validity or construct measurement. Moreover, an analysis of the use and application of mixed methods research in other organizational and management fields would also be interesting and could expand upon the research reported here. Further research is also required to develop a deeper understanding of the relationship between the element of commitment and innovation performance improvement. For this purpose, it is worth exploring the management of relationships between enterprises for sustainable social development and examining the impact of the buyer-supplier relationship in terms of innovation (Awan 2019; Awan et al. 2018).

Additionally, thanks to future application of bibliometric analysis and cluster analysis of the co-citation analysis, studies could offer a comprehensive and up-to-date identification and assessment of trends in mixed methods utilization in innovation management research.

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## Appendix A

List of articles included for literature review by year (source: own study)

Source Title	Authors	Year	Cited by
International Journal of Business Innovation and Research	Ahmadi M., Osman M.H.M.	2020	0
INTERNATIONAL JOURNAL OF INNOVATION SCIENCE	Almeida, Fernando; Kennedy, Andrew John; Lin, Brook; Nowak, Irina V.	2019	0
COMPUTERS & EDUCATION	Barak, Miri; Usher, Maya	2019	3
ENERGY RESEARCH & SOCIAL SCIENCE	Burleson, Grace; Tilt, Bryan; Sharp, Kendra; MacCarty, Nordica	2019	0
JOURNAL OF BUSINESS RESEARCH	Duarte, Paulo; Pinho, Jose Carlos	2019	3
TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE	Ghezzi, Antonio	2019	3
BRITISH FOOD JOURNAL	Grimsby, Sveinung; Kure, Cathrine Finne	2019	0
Journal of Cleaner Production	Hankammer S., Brenk S., Fabry H., Nordemann A., Piller F.T.	2019	3

Source Title	Authors	Year	Cited by
INFORMATION TECHNOLOGY & PEOPLE	Imran, Ahmed; Gregor, Shirley	2019	0
BRITISH FOOD JOURNAL	Korneta, Piotr	2019	0
INFORMATION AND ORGANIZATION	Larsson, Zeynep Yetis; Di Gangi, Paul M.; Teigland, Robin	2019	1
International Journal of Services Operations and Informatics	Lecossier A., Pallot M., Crubleau P., Richir S.	2019	2
AI EDAM-ARTIFICIAL INTELLIGENCE FOR ENGINEERING DESIGN ANALYSIS AND MANUFACTURING	Lecossier, Adrien; Pallot, Marc; Crubleau, Pascal; Richir, Simon	2019	0
JOURNAL OF BUSINESS RESEARCH	Luetjen, Heiner; Schultz, Carsten; Tietze, Frank; Urmetzer, Florian	2019	0
INTERNATIONAL REVIEW OF RETAIL DISTRIBUTION AND CONSUMER RESEARCH	Olsson, Annika; Paredes, Karla Marie B.; Johansson, Ulf; Roese, Malin Olander; Ritzen, Sofia	2019	0
JOURNAL OF THE ASSOCIATION FOR INFORMATION SCIENCE AND TECHNOLOGY	Shen, Yi	2019	0
Management Research Review	Teixeira E.K., Oliveira M., Curado C.	2019	0
JOURNAL OF TECHNOLOGY TRANSFER	van de Burgwal, Linda H. M.; Dias, Ana; Claassen, Eric	2019	0
INTERNATIONAL JOURNAL OF TECHNOLOGY MANAGEMENT	Vlok, Awie; Ungerer, Marius; Malan, Johan	2019	0
JOURNAL OF MANUFACTURING TECHNOLOGY MANAGEMENT	Walwyn, David; Bertoldi, Andreas; Gable, Christian	2019	1
JOURNAL OF ORGANIZATIONAL CHANGE MANAGEMENT	Al-edenat, Malek	2018	3
INNOVATIONS IN EDUCATION AND TEACHING INTERNATIONAL	Al-Husseini, Sawasn; Elbeltagi, Ibrahim	2018	0
CREATIVITY AND INNOVATION MANAGEMENT	Chasanidou, Dimitra; Sivertstol, Njal; Hildrum, Jarle	2018	0
INTERNATIONAL JOURNAL OF ENTREPRENEURIAL VENTURING	Corsi, Christian; Prencipe, Antonio	2018	0
JOURNAL OF ENTERPRISING COMMUNITIES-PEOPLE AND PLACES IN THE GLOBAL ECONOMY	Cowell, Margaret; Lyon-Hill, Sarah; Tate, Scott	2018	3
BALTIC JOURNAL OF MANAGEMENT	Crammond, Robert; Omeihe, Kingsley Obi; Murray, Alan; Ledger, Kirstin	2018	1
ENERGY RESEARCH & SOCIAL SCIENCE	Edling, Laura; Danks, Cecilia	2018	1
LEADERSHIP & ORGANIZATION DEVELOPMENT JOURNAL	Fu, Lihua; Liu, Zhiying; Liao, Suqin	2018	1
ASIA PACIFIC JOURNAL OF MANAGEMENT	Harrison, Richard; Scheela, William; Lai, P. C.; Vivekarajah, Sivapalan	2018	3

Source Title	Authors	Year	Cited by
1ST ITB CENTENNIAL AND 4TH PLANOCOSMO INTERNATIONAL CONFERENCE	Holis, Y. M.; Syabri, I.; Prabatmojo, H.	2018	0
INTERNATIONAL JOURNAL OF ENTREPRENEURIAL BEHAVIOUR & RESEARCH	Ilonen, Sanna; Heinonen, Jarna; Stenholm, Pekka	2018	5
RAPID PROTOTYPING JOURNAL	Ituarte, Inigo Flores; Chekurov, Sergei; Tuomi, Jukka; Mascolo, Julien Etienne; Zanella, Alessandro; Springer, Patrick; Partanen, Jouni	2018	3
TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE	JosephNg, P. S.	2018	1
EDUCATION AND TRAINING	Kapasi, Isla; Grekova, Galina	2018	3
JOURNAL OF BUSINESS RESEARCH	Kraus, Sascha; Kallmuenzer, Andreas; Stieger, Daniel; Peters, Mike; Calabro, Andrea	2018	5
JOURNAL OF CLEANER PRODUCTION	Kruger, Claudia; Gusmao Caiado, Rodrigo Goyannes; Braga Franca, Sergio Luiz; Goncalves Quelhas, Osvaldo Luiz	2018	6
R & D MANAGEMENT	McAdam, Maura; Debackere, Koenraad	2018	10
INTERNATIONAL JOURNAL OF ENTREPRENEURIAL BEHAVIOUR & RESEARCH	Perenyi, Aron; Zolin, Roxanne; Maritz, Alex	2018	8
TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE	Reinhardt, Ronny; Gurtner, Sebastian	2018	3
INTERNATIONAL JOURNAL OF LOGISTICS MANAGEMENT	Tu, Mengru	2018	10
BUSINESS PROCESS MANAGEMENT JOURNAL	Bala, Hillol; Venkatesh, Viswanath	2017	2
JOURNAL OF ENVIRONMENTAL POLICY & PLANNING	Berker, Thomas; Throndsen, William	2017	1
JOURNAL OF KNOWLEDGE MANAGEMENT	Bican, Peter M.; Guderian, Carsten C.; Ringbeck, Anne	2017	12
INTERNATIONAL JOURNAL OF KNOWLEDGE-BASED DEVELOPMENT	Fellnhofer, Katharina	2017	2
JOURNAL FOR INTERNATIONAL BUSINESS AND ENTREPRENEURSHIP DEVELOPMENT	Fellnhofer, Katharina	2017	0
International Journal of Project Organisation and Management	Ghaben R.K., Jaaron A.A.M.	2017	2
JOURNAL OF PRODUCT INNOVATION MANAGEMENT	Grimpe, Christoph; Sofka, Wolfgang; Bhargava, Mukesh; Chatterjee, Rabikar	2017	9
MANAGEMENT OF ENVIRONMENTAL QUALITY	Kilkis, Siir	2017	0

Source Title	Authors	Year	Cited by
Journal of technology management & innovation	O'Dwyer, Clare; Cormican, Kathryn	2017	1
ENTREPRENEURIAL BUSINESS AND ECONOMICS REVIEW	Radovanovic, Nikola; Dmitrovic, Veljko; Joksimovic, Nevenka Zarkic	2017	1
MEASURING BUSINESS EXCELLENCE	Saunila, Minna	2017	6
BUSINESS PROCESS MANAGEMENT JOURNAL	Thomas, Ashish	2017	0
INDUSTRIAL MANAGEMENT & DATA SYSTEMS	Ai, Chi-Han; Wu, Hung-Che	2016	2
JOURNAL OF ORGANIZATIONAL CHANGE MANAGEMENT	Ai, Chi-Han; Wu, Hung-Che	2016	5
EDUCATION AND TRAINING	Birdthistle, Naomi; Costin, Yvonne; Hynes, Briga	2016	3
EXTRACTIVE INDUSTRIES AND SOCIETY-AN INTERNATIONAL JOURNAL	Boerchers, Morrissa; Fitzpatrick, Patricia; Storie, Christopher; Hostetler, Glen	2016	3
R & D MANAGEMENT	Cortimiglia, Marcelo Nogueira; Ghezzi, Antonio; Frank, Alejandro German	2016	35
JOURNAL OF BUSINESS RESEARCH	Guidice, Rebecca M.; Mero, Neal P.; Matthews, Lucy M.; Greene, Juanne V.	2016	6
RESEARCH POLICY	Hayter, Christopher S.	2016	43
TECHNOVATION	Ho, Yuen-Ping; Ruan, Yi; Hang, Chang-Chieh; Wong, Poh-Kam	2016	8
STRATEGIC MANAGEMENT JOURNAL	Klingebiel, Ronald; Joseph, John	2016	14
BRITISH JOURNAL OF EDUCATIONAL TECHNOLOGY	Kopcha, Theodore J.; Rieber, Lloyd P.; Walker, Brandy B.	2016	5
IEEE TRANSACTIONS ON PROFESSIONAL COMMUNICATION	Lucas, Kristen; Kerrick, Sharon A.; Haugen, Jenna; Crider, Cole J.	2016	3
BRITISH FOOD JOURNAL	McCarthy, Breda; Liu, Hong-Bo; Chen, Tingzhen	2016	17
JOURNAL OF SMALL BUSINESS AND ENTERPRISE DEVELOPMENT	Monsson, Christian Kjaer; Jorgensen, Soren Berg	2016	8
INDUSTRIAL MARKETING MANAGEMENT	Purchase, Sharon; Kum, Christina; Olaru, Doina	2016	4
INTERNATIONAL JOURNAL OF GENDER AND ENTREPRENEURSHIP	Swartz, Ethne; Amatucci, Frances M.; Coleman, Susan	2016	0
INTERNATIONAL JOURNAL OF INNOVATION MANAGEMENT	Vicente-Oliva, Silvia; Martinez-Sanchez, Angel; Berges-Muro, Luis	2016	0
WORLD JOURNAL OF ENTREPRENEURSHIP MANAGEMENT AND SUSTAINABLE DEVELOPMENT	Abubakar, Habib Auwal	2015	3

Source Title	Authors	Year	Cited by
RESEARCH POLICY	Bakhshi, Hasan; Edwards, John S.; Roper, Stephen; Scully, Judy; Shaw, Duncan; Morley, Lorraine; Rathbone, Nicola	2015	7
JOURNAL OF SMALL BUSINESS AND ENTERPRISE DEVELOPMENT	Bouette, Martin; Magee, Florence	2015	6
TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE	Hofmann, Rupert	2015	7
JOURNAL OF ENTERPRISING COMMUNITIES-PEOPLE AND PLACES IN THE GLOBAL ECONOMY	Khosa, Risimati Maurice; Kalitanyi, Vivence	2015	10
JOURNAL OF ENGINEERING DESIGN AND TECHNOLOGY	Owusu-Manu, D.; Quaigrain, R.; Edwards, D. J.	2015	1
ENGINEERING CONSTRUCTION AND ARCHITECTURAL MANAGEMENT	Singh, Vishal; Holmstrom, Jan	2015	14
Research Journal of Business Management	Siripongdee S., Fongsuwan W.	2015	2
INTERNATIONAL JOURNAL OF ENTREPRENEURIAL VENTURING	Spiegel, Markus; Marxt, Christian	2015	0
INTERNATIONAL SCIENTIFIC CONFERENCE ENVIRONMENTAL AND CLIMATE TECHNOLOGIES, CONECT 2014	Timma, Lelde; Blumberga, Andra; Blumberga, Dagnija	2015	2
RESOURCES CONSERVATION AND RECYCLING	Udawatta, Nilupa; Zuo, Jian; Chiveralls, Keri; Zillante, George	2015	41
TELEMATICS AND INFORMATICS	Walravens, Nils	2015	32
European Journal of Innovation Management	Yström A., Aspenberg H., Kumlin A.	2015	5
Research Journal of Applied Sciences, Engineering and Technology	Jafarnejad A., Mohaghar A., Manteghi M., Yasaei M.	2014	0
PROGRESS IN INDUSTRIAL AND CIVIL ENGINEERING III, PT 1	Titarenko, B.; Titov, S.; Titarenko, R.	2014	5
TOTAL QUALITY MANAGEMENT & BUSINESS EXCELLENCE	Dadfar, Hossein; Dahlgaard, Jens J.; Brege, Staffan; Alamirhoor, Amir	2013	23
R & D MANAGEMENT	Teirlinck, Peter; Spithoven, Andre	2013	19
EUROPEAN JOURNAL OF MARKETING	Hoffmann, Stefan	2011	18
TECHNOLOGY PEDAGOGY AND EDUCATION	Hu, Zhiwen; McGrath, Ian	2011	18
International Journal of Knowledge, Culture and Change Management	Jensen K.R.	2011	2
European Research Studies Journal	Lagos D., Kutsikos K.	2011	1

Source Title	Authors	Year	Cited by
Journal of Product Innovation Management	Blindenbach-Driessen F., Van Dalen J., Van Den Ende J.	2010	52
International Journal of Production Research	Hwang R., Katayama H.	2009	57
SCIENCE AND PUBLIC POLICY	Islam, Nazrul; Miyazaki, Kumiko	2009	2
TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE	Santo, Marcio de Miranda; Coelho, Gilda Massari; dos Santos, Dalci Maria; Filho, Lelio Fellows	2006	43

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