



Research Article

## Innovation Management: A Bibliometric Analysis

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### ABSTRACT

Innovation Management has obtained much consideration in the functioning of the management science field from the previous few years. Both managers and academicians seem to be examining the nature of innovation and its significance for the development of an organization and competitive advantage (Lopes et al., 2016). Many research scholars have accepted the positive effects of innovation on an organization and we can find some research studies conducted on it in the past few years. Through this bibliometric analysis of past literature, this research study is an attempt to enhance the knowledge of the subject and to present the extensive analysis of the past research studies. The analysis of this study was conducted to see the trend of publications between the years 1970 to 2019; it used authors, journals, countries, universities/research institutions, and different keywords related to innovation management as search words. After using multiple filters for removing irrelevant researches, 2160 research articles were examined. According to the results of the study number of publications increased after 2008. Therefore, it is assumed that the annual publications will continue to increase. USA & Germany have a higher rate of research publications and the UK has strong international collaborations. Variables such as innovative activity, innovative management, total innovation management, management innovation, and innovation development are the most common terms used in the research of innovation management. Some variables with infrequent occurrences, as well as future recommendations and limitations of the study were also examined.

Keywords: *Innovation Management; Bibliometric Analysis; Scopus Database; VOSviewer*

### 1. INTRODUCTION

The role of innovation is very essential both at the individual level and at the organizational level for the modifying environment of business. Innovation can be known as upgradation in performance and procedures adopted by an organization (Pfeffer and Sutton, 2000). Innovation can be known as expanding beneficiaries' worth by contributing new requirements or we can say that gaining the current beneficiaries and requirements of the market by different processes (Jaskyte, 2011).

Organizational Innovation is defined as follows:

| Authors                        | Definitions                                                                                                                                                                                               |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (Hamel, 2006)                  | "Changes in the methods and practices and policies of traditional management that leads to changes in management performance"                                                                             |
| (Schech-Storz, 2013)           | "Due to varying factors internal to an organization's environment, not all changes are the same; therefore, management needs to use different change models and methodologies depending on the situation" |
| (Tavassoli and Karlsson, 2016) | "Organizational innovations are changes in the routines of organizations to improve productivity, creativity flexibility, efficiency, and profits to the organizations"                                   |

Innovation management includes changes in the 'how and what' of what supervisors implement in preparing guidelines, creating resolutions, managing events, and encouraging individuals (Hamel, 2006; Birkinshaw, 2010; Van den Bosch, 2012). These types of changes are disclosed by novel management procedures, frameworks or methods (Vaccaro, 2010) and they are theme-oriented (Mol and Birkinshaw, 2009), vague and tough to copy, creating them a significant basis of good choice (Birkinshaw and Mol, 2006; Hamel, 2006; Damanpour and Aravind, 2012). Whereas an organization might constitute on the principles of innovation management of other organizations, and the achievement of an organization is similarly regulated by what



means the procedures of innovation management are modified to the unique organizational situation (Ansari et al., 2010).

Organizational innovation includes the development of management processes by means of innovative business methods. Organizational innovation can enhance market efficiency with the help of required improvements, transaction and administrative cost reduction, increasing happiness in the workplace, input costs reduction (Shafiq et al., 2020).

In the past research studies of management, the organizations who are inspired to implement innovation and want to see its outcomes are mostly pursuing the sense of structural change and learning. Researchers on innovation usually supposed that (1) the organizations are adaptable setups that change due to internal goals and external forces to efficiently work and (2) to pursue innovation in organizations are expected to guarantee adaptable performances, permitting the change in organization to produce desired results (Camisón and Lopez, 2010; Damanpour et al., 2009; Mol and Birkinshaw, 2009). Although the expected results after implementing innovation are not assured, this belief assumes that innovation is a process on the way to the success of the organization in the end. Although there is a chance of unpredicted or unwanted results (Rogers, 2010), implementation of innovation in an organization is considered essential to expand or to some extent sustain performance results and allow an organization to adjust, change, produce and endure (Damanpour, 2014).

Management innovations are new methods and styles of developing plans, systems, and procedures that transform the tasks of leaders including other employees and staff of the organization (Vaccaro et al., 2012; Walker et al., 2011). Modern information or learning must be accessible to carry out modernized methods of analyzing and as an indicator of innovation, a strong direction towards innovation and change (Nada et al., 2012). The importance of innovation is not only essential for organizational development but equally for community development. In the past years, innovation has become an essential aspect of establishing companies in an extremely competitive world. Many researchers acknowledge the positive impact of innovation on the company and there are very limited researches on it (Alharbi et al., 2019).

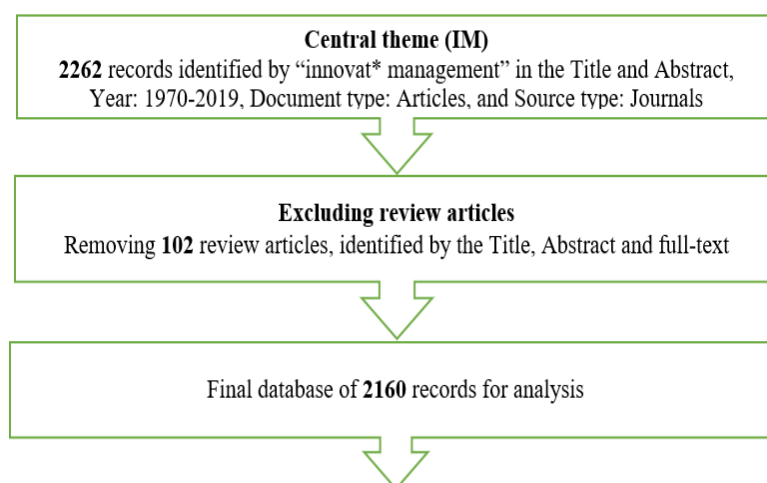
Several researchers have concentrated on innovation research particularly in recent decades, which confirms significant discipline growth (Chen, Damanpour, & Reilly, 2010). This is proven not only by the number of papers published every day on this topic but also by the number of new research centers that are being established. They put together experts to further determine innovation market growth reasons (Cancino, Merigó, & Palacios-Marqués, 2015; Fagerberg, Fosaas, & Sapprasert, 2012). To the degree that the number of researchers on innovation continues to increase it is important to investigate further, who are the most active and prominent researchers, and to recognize leading journals and universities in this discipline. Although some researches have been carried out on this topic (Fagerberg et al., 2012; Linton, 2004; Shafique, 2013; Yang & Tao, 2012) not every research study describes which universities are looking deeper into innovation research (Cancino, Merigó, & Coronado, 2017). The paper intends to highlight the importance of innovation in the field of management. After reviewing past research studies, this paper aims to expand our knowledge about the topic and to present a bibliometric review of the literature.

## 2. METHODOLOGY

The methodology used for the present research is a bibliometric study with content analysis. The bibliometric analysis includes a sequence of approaches that give both qualitative and quantitative analysis of past research studies (Ikpaahindi, 1985). The best technique to conduct a bibliometric analysis study is to carry out an analysis of publications that permits to find out a suitable number of journals, the progress of publications along with years including relevant subject areas (Prasad and Tata, 2005). A few studies on bibliometric also examine citations, the study belongs to where, authors with most citations and also possible research tendencies can be recognized (Neely, 2005). At present, bibliometric analysis is a global approach that analyses the current state of the study fields (Mutschke et al., 2011).

## 2.1. SEARCH STRATEGY AND SAMPLE COLLECTION

The data of this bibliometric analysis study was gathered during the last week of February 2020 using the Elsevier Scopus database at different time slots. The main search keyword of this bibliometric analysis work was research papers comprising "innovate\* management" in their titles and abstracts. According to our data, the latest research articles are from 2019 and the oldest research article is from 1970. We have used the following query string for our search; TITLE-ABS ("innovate\* management") AND (LIMIT-TO (SRCTYPE, "j")) AND (LIMIT-TO (DOCTYPE, "ar")) AND (EXCLUDE (PUBYEAR, 2020)). After applying this query string, we get the result of 2262 documents. In the next step of our analysis, we added more phrases in our query string to make sure there were no review articles in our analysis, after that we found 476 articles possibly not related to our bibliometric study. These 476 articles include review, conceptual or meta-analysis articles. After a thorough examination of these articles, we have identified that 102 of the documents were review articles. In the next step, to make sure there were no review articles are included in this analysis we excluded these 102 articles from the query string. For this purpose, we noted EIDs from these articles, and then we excluded EIDs from the search string so they should not occur in our next search results. Therefore, a total of 2160 articles were used in the final data analysis. The process of data collection and limitations of the study is provided in Figure 1, whereas the search strings are available in Appendix-A



**Figure:1.** A pictorial overview of data collection of research articles

## 2.2. Bibliometric Maps

To create and visualize bibliometric maps, we exported authors' details, data of affiliated countries, and information of authors keywords of 2160 articles to VOSviewer (version 1.6.13), a software tool typically used for creating and visualizing bibliometric maps. In our study, maps created through VOSviewer include items that object to be studied i.e. authors keywords or affiliated countries. Among any set of items, you can find an association-link between two items. The strength of each association-link has shown in a positive number or digit. If the link is representing the highest number, it means they have a stronger relationship.

Similarly, when we are doing co-authorship analysis, link strength among countries is representing a number of co-authored research articles affiliated with different countries; however, total link strength in our bibliometric map is showing the total strength of co-authorship links of a specific country with different countries. Likewise, when we are doing co-occurrence analysis, a link among authors' keywords is representing the research articles where two keywords appear together. Van Eck and Waltman (2013) have discussed in detail about the main characteristics of VOSviewer in their book.

Next, we have added all 84 countries which are affiliated with 2160 authors while doing our co-authorship analysis of this study. Now we have categorized these affiliated countries of our analysis in five different continents i.e. Asia, Oceania, Europe, Africa, and America.



We have included 99 keywords from 2160 research articles while doing a co-occurrence analysis of authors' keywords. Then we examined manually all identical and similar words including phrases before adding the list of authors' keywords into VOSviewer. For instance, management innovation and innovative management all counted as innovation management and re-labeled as such. Similarly, innovativeness and innovations were relabelled as innovation. The same technique was used with all the terms which were used similarly in the research articles. The trend of research outcome among the keywords co-occurrences and its main features in all research articles were examined too. For instance, business model innovation, collaborative innovation, creativity, change management, knowledge management were all included. It may also be noted that we have the English small alphabet “n” which refers to “number of occurrences”.

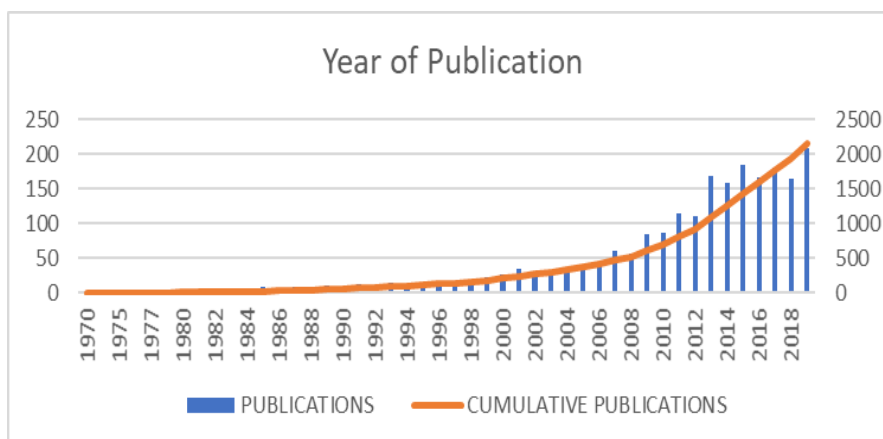
### 3. RESULTS OF THE STUDY AND DISCUSSION

#### 3.1 ANALYSIS OF PUBLICATIONS

According to our results of this bibliometric study, in the last 49 years between 1970 to 2019, about 2160 research publications on innovation management were made (Figure 2). After analyzing figure 2 we have determined that the first research publication on innovation management was done in 1970 and after that, we have found no research publication on it till 1973. The articles crossed the 100 publications barrier in 1994. By the end of the 20th century, a stable increase in publications has occurred in academic literature. Also, 75.41% of the articles were published after 2008. Hence, it is predicted that the annual publications will continue to increase. Among these 2160 publications, only 259 are available with open access. We recommend that a research paper can obtain maximum citations if it is published by a journal with open access (Khudzari et al., 2018).

Innovation is something new that brings benefits for an organization or the public so it's not specific to any particular field. Almost all subject areas such as business, social sciences, environmental, agricultural, biological sciences, and engineering have investigated innovation management. The Scopus database has characterized these 2160 articles 27 subject areas. In innovation management research, business, management, and accounting have the highest number of publications (1383) whereas economics, econometrics, and finance have the second-highest number (413 articles) and social sciences have the third-highest number (403 articles). Subject areas of the rest of the publications are classified as: Engineering (402 articles), Decision Sciences (216 articles), Computer Science (188 articles), Environmental Science (164 articles), Medicine (107 articles), Agricultural and Biological Sciences (101 articles), Energy (71 articles), Arts and Humanities (47 articles), Earth and Planetary Sciences (46 articles), Mathematics (34 articles), Psychology (30 articles), Multidisciplinary (28 articles), Biochemistry, Genetics and Molecular Biology (25 articles), Materials Science (21 articles), Nursing (18 articles), Chemistry (13 articles), Chemical Engineering (12 articles), Health Professions (9 articles), Pharmacology, Toxicology and Pharmaceutics (6 articles), Physics and Astronomy (6 articles), Neuroscience (3 articles), Immunology and Microbiology (2 articles), Veterinary (2 articles), Dentistry (1 article).

Research on innovation management is multilingual as we found research articles in various languages. Results of this bibliometric analysis study have shown that all research publications were in 22 languages. About 89.53% of research articles were published in English followed by 2.36% in Portuguese and Spanish, 2.03% in German, 1.48% in Chinese, 1.43% in Russian, 0.74% in French, 0.60% in Ukrainian, while 14 languages including Turkish, Malay, Lithuanian and Japanese had fewer than 5 articles published. According to the rule imposed by most of the publishers, the author should submit an abstract in English even it is written in any other language, which may enhance the scope of the Scopus database.



**Figure 2:** Publications on innovation management (1970 to 2019)

### 3.2. Analysis of Journals

While analyzing the results we have found that 4 famous publishers are maintaining our 5 most productive journals of this study (shown in table 1). Taylor & Francis was the publisher of our most productive journal. The second and third top journals were published by Wiley-Blackwell. The rest of the two journals were published by Sociacion de Profesionales y Tecnicos del CONICIT and Inderscience. In this study, the Asian Journal of Technology Innovation was the top journal which has 206 publications, which means this journal has produced 9.53% of total research articles. The number of research publications and the overall ratio of publications of the remaining four journals is as follows; Journal of Product Innovation Management (76, 3.52%), Creativity and Innovation Management (40, 1.85%), Espacios (40, 1.85%) and International Journal of Technology Management (40, 1.85%). Results of our analysis have shown that the Journal of Product Innovation Management had the maximum number of citations (3083) and also one of its publications had maximum citations of 369 times.

Report of citation score 2018 has shown that two journals of our study had cite scores 3 and more. Journal of Product Innovation Management had the highest cite score 5.43 and Espacios had the lowest cite score 0.19. We also analyzed that Espacios had 40 publications but it's cited score is comparatively lesser than other journals. The reason behind the lower cite score of Espacios is the main language of publications in Spanish, that's why not available for English readers around the globe.

It has been observed too that, Asian Journal of Technology Innovation was ranked first due to its high number of publications, but it has a cite score below one, which shows the journal is not frequently cited. We have assembled the list of top 12 cite score journals having over 20 articles on innovation management in Table S2. We hope this table will be informative for academics to search relevant journals for their research publications on innovation management.

**Table 1.** Top 5 Journals on Innovation Management

| Rank | Journal                                  | TP (%)      | NC  | CS 2018 | The most cited article                                                                                                                             | TC  | Publisher        |
|------|------------------------------------------|-------------|-----|---------|----------------------------------------------------------------------------------------------------------------------------------------------------|-----|------------------|
| 1    | Asian Journal of Technology Innovation   | 206 (9.53%) | 802 | 0.95    | Knowledge management enablers, knowledge sharing, and research collaboration: a study of knowledge management at research universities in Malaysia | 25  | Taylor & Francis |
| 2    | Journal of Product Innovation Management | 76 (3.51%)  | 308 | 5.43    | Development of a technical innovation audit                                                                                                        | 369 | Wiley-Blackwell  |
| 3    | Creativity and Innovation Management     | 40 (1.85%)  | 910 | 3.11    | Open innovation - the Dutch treat: Challenges in thinking in business models                                                                       | 135 | Wiley-Blackwell  |

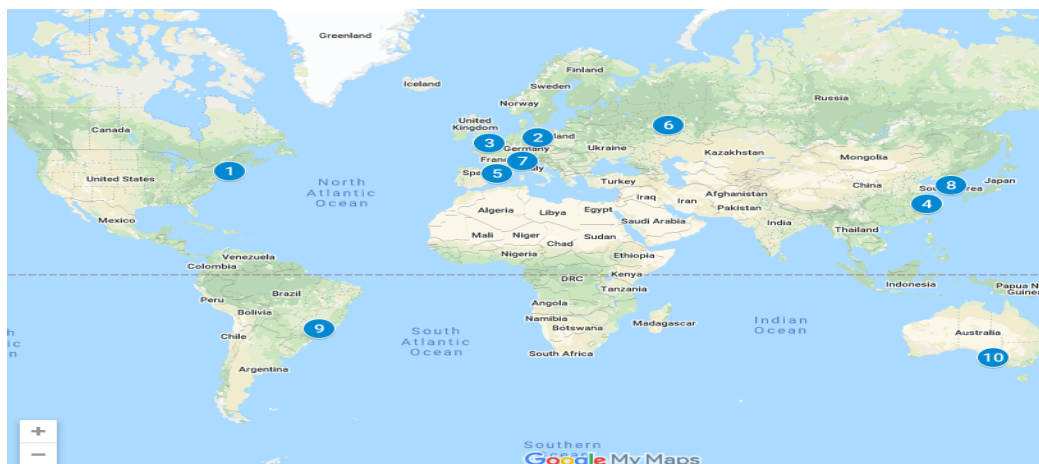
|   |                                                |            |     |      |                                                                                                  |     |                                                         |
|---|------------------------------------------------|------------|-----|------|--------------------------------------------------------------------------------------------------|-----|---------------------------------------------------------|
| 4 | Espacios                                       | 40 (1.85%) | 21  | 0.19 | The integral technique for analyzing national innovation systems development                     | 5   | Sociacion de Profesionales y Tecnicos del Indersciencia |
| 5 | International Journal of Technology Management | 40 (1.85%) | 619 | 1.47 | Innovation, what innovation? a comparison between product, process and organizational innovation | 162 |                                                         |

TP: Total publications; NC: Number of citations; CS: Cite Score; TC: Total citations

### 3.3. ANALYSIS OF COUNTRIES, INSTITUTIONS AND INTERNATIONAL COLLABORATION

Figure 3 is showing 10 leading countries that are mostly producing research papers in the field of innovation management and sharing their research contribution globally. From 1970 to 2019, about 21.89% of worldwide research publications were made by the USA and Germany, which means these two countries played a significant role in boosting research growth in the field of innovation management. These top ten countries have produced 66.71% of the total publications on Innovation Management research. However, from a total of a hundred countries, 57 countries have less than 10 publications.

In addition to figure 3, we have also made a list of the top 23 institutes which are producing maximum publications on “Innovation Management” (Table S3). This additional information consists of both academic and non-academic institutes for instance CNRS Centre National de la Recherche Scientifique (French National Centre for Scientific Research).



**Figure 3.** The top 10 most productive countries and academic institutions in “Innovation Management” publications.

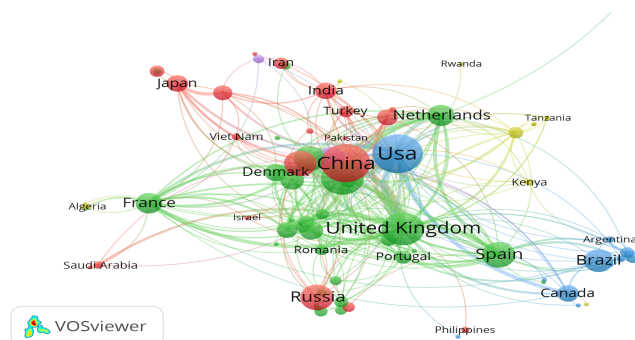
| Rank | Country     | TPc | SCP (%) | Most Productive Academic Institution | TPi |
|------|-------------|-----|---------|--------------------------------------|-----|
| 1    | USA         | 273 | 63      | Babson College                       | 4   |
| 2    | Germany     | 200 | 65      | Technical University of Berlin       | 11  |
| 3    | UK          | 194 | 51.03   | University of Sussex                 | 7   |
| 4    | China       | 178 | 66.85   | Zhejiang University                  | 20  |
| 5    | Spain       | 111 | 65.76   | Universitat de Barcelona             | 4   |
| 6    | Russia      | 108 | 89.81   | Kazan Federal University             | 15  |
| 7    | Italy       | 103 | 62.13   | Politecnico di Milano                | 18  |
| 8    | South Korea | 103 | 82.52   | Seoul National University            | 11  |
| 9    | Brazil      | 88  | 85.22   | Universidade de Sao Paulo-USP        | 24  |
| 10   | Australia   | 83  | 59.03   | The University of Adelaide           | 5   |

TPc: Total publications of a given country; TPi: Total publications of a given academic institution; SCP: single-country publications.



Figure 3 is showing that only Russian Federation (89.81%), Brazil (85.22%), and South Korea (85.22%) had produced over 2/3 single-country publications (SCP) among the other ten countries, which shows that Russian Federation, Brazil, and South Korea have the strongest collaborations within their countries. However, the UK had the minimum SCP (51.03%), in which 157 from 185 research papers were affiliated with 48 countries. The benefits of international linkages or collaborations are not merely restricted towards sharing expertise, exchange knowledge, and expanding networks but also a beneficial approach for ranking up your institution.

Furthermore, In World University Rankings 2020, Seoul National University, South Korea has ranked at 64th best university. This shows that the field of “Innovation Management” has now gained so much consideration at the leading educational institutions of the world.



**Figure 4.** Snapshot of the bibliometric map representing co-authorships in network visualization mode. Fig.4 created in VOSviewer may also be available on the following URL: <https://bit.ly/2XRbnjt>

Figure. 4 is showing the categorization of countries according to their regions. When we examine this VOSviewer map we came to know that if it is showing any two countries or territories are closely located to one another then it means these two countries have a stronger relationship and affiliation between them and also, we can see a thicker line between them. According to this map number of countries per region is as follows; 33 from Europe, 22 belong to Asia, 15 from the American region, 12 falls in Africa, and two belong to Oceania. Therefore, Europe is at the top with a maximum number of countries. Our co-authorship analysis has shown that the UK has maximum affiliations with 48 countries including 157 co-authorships. While the USA has 37 links including 141 co-authorships, Spain has 29 links including 68 co-authorships, France has 28 links including 58 co-authorships and Germany has 27 links including 113 co-authorships. Our co-authorship analysis has also explained that about 2/3 countries had co-authored their research work with below than ten countries.

Various aspects are contributing to boost international collaboration for instance maximum number of visiting researchers, the variety of partnerships in research, and also big funding for conducting research. To boost our international linkages, we need a stable and flexible policy on research (Khudzari et al., 2018).

### 3.4. ANALYSIS OF AUTHORS

Top 10 authors in the field of innovation management have affiliation with six countries, their details are shown in table 2. Four authors belong to Germany, two authors are from Italy, and each author from Japan, UK, South Korea & Ireland. The first research papers of these authors have published from 1996 to 2013 wherein 4 authors worked as first authors in their publications, 5 worked as co-authors and only 1 was the last author. The last author is generally known as the senior or supervisor of the research work.

**Table 2.** Top 10 authors in the field of “Innovation Management”

| Rank | Name of the Author      | Author's Scopus ID | FPY  | TP | h-index | TC  | Author's Current affiliation                                | Name of the Country |
|------|-------------------------|--------------------|------|----|---------|-----|-------------------------------------------------------------|---------------------|
| 1    | Brem, Alexander Michael | 23984395500        | 2007 | 10 | 6       | 415 | Friedrich-Alexander-Universität Erlangen-Nürnberg, Erlangen | Germany             |
| 2    | Frattini, Federico      | 22834504500        | 2010 | 8  | 6       | 554 | Politecnico di Milano, Milan                                | Italy               |
| 3    | Intarakumnerd, Pat      | 8617827600         | 2012 | 8  | 3       | 32  | National Graduate Institute for                             | Japan               |



|    |                          |             |      |   |   |     |                                                           |                |
|----|--------------------------|-------------|------|---|---|-----|-----------------------------------------------------------|----------------|
| 4  | arapong Bessant, John R. | 55900391200 | 2005 | 6 | 5 | 415 | Policy Studies, Tokyo University of Exeter School, Exeter | United Kingdom |
| 5  | Chiesa, Vittorio         | 7006157998  | 1996 | 6 | 5 | 711 | Politecnico di Milano, Milan                              | Italy          |
| 6  | Herstatt, Cornelius      | 6508325339  | 2002 | 6 | 4 | 111 | Hamburg University of Technology, Hamburg                 | Germany        |
| 7  | Hoegl, Martin M.         | 12765439300 | 2009 | 6 | 4 | 51  | Ludwig-Maximilians-Universität München, Munich            | Germany        |
| 8  | Kim, Byungkeun           | 55972264000 | 2013 | 6 | 3 | 19  | Korea University of Technology and Education, Cheonan     | South Korea    |
| 9  | O'Sullivan, David        | 7202553965  | 1999 | 6 | 5 | 279 | National University of Ireland Galway, Galway             | Ireland        |
| 10 | Salomo, Sören            | 6507439737  | 2005 | 6 | 5 | 300 | Technical University of Berlin, Berlin                    | Germany        |

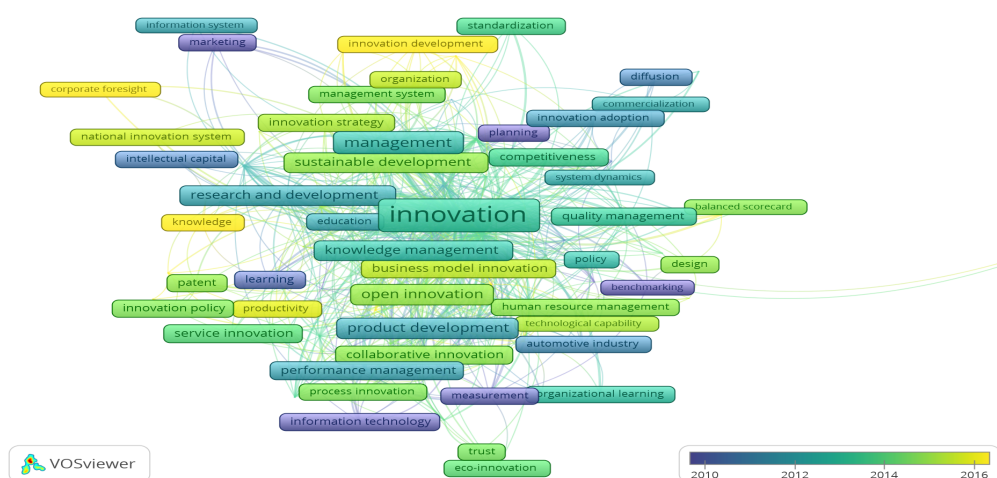
FPY: First publication year; TP: Total publications; TC: Total citations

Authors' affiliations with their respective institutions have shown that research on innovation management was carried out in areas associated with business and technology. Alexander Brem from Germany is our top author, from 2007 he has published 10 research articles which have 415 citations and 6 h-index. Federico Frattini is our second leading author and Vittorio Chiesa is on the fifth number, both of them are affiliated with Politecnico di Milano, Milan. Our third leading author Patarapong Intarakumnerd is associated with National Graduate Institute for Policy Studies, Tokyo, Japan. It has been also observed that the research paper published in 1996 (table 2) mentioned the same publication (Chiesa et al., 1996), written by our top 5th prolific author Vittorio Chiesa.

It is not necessary that authors with the most cited publications mentioned in table 1 should also be shown in table 2 as well. If maximum publications have been produced by these authors then their names could be shown in both tables.

### 3.5. ANALYSIS OF AUTHORS KEYWORDS

In terms of keyword analysis, 24% of the articles were without author keywords. Also, we determined 5 as a minimum number of keyword appearances while uploading the data in VOSviewer (van Eck and Waltman, 2018), therefore, the database identified 126 keywords for the 5214 keywords. These 126 keywords have 892 links with each other, while the total link strength reaches 1638. Then we re-labeled the identical/similar words including phrases and created a map of 99 authors' keywords in VOSviewer, same as the previous step we fixed the threshold to 5 as a minimum number of appearances or occurrences. These 99 keywords have 628 links with each other, while total link strength reaches 1253.



**Figure.5.** Snapshot of the bibliometric map representing authors keywords co-occurrences (n=5) in overlay visualization mode. Fig.5 created in VOSviewer may also be available on the following URL: <https://bit.ly/3bryxRg>





Results of the study show that the term ‘Innovation Management’ has  $n=260$  and 248 total link strength to other keywords (Figure 5). ‘Innovation’ is the most frequently encountered keyword with  $n=361$  and 415 total link strength to other keywords followed by ‘Management’ with  $n=68$  and 90 total link strength to other keywords. We have also observed that the concept of ‘Innovation Management’ had co-occurrence with theoretical keywords such as ‘knowledge management’, ‘total quality management’, ‘performance management’, ‘process management’, and ‘research & development’.

Moreover, we noticed some terms-innovative activity (7 occurrences), innovative management (15 occurrences), total innovation management (5 occurrences), management innovation (6 occurrences), and innovation development (5 occurrences), were used to refer to Innovation Management. The concept of ‘open innovation’ seems to be a new philosophy aimed to manage organizational innovation. It was primarily presented by Chesbrough in his book published in 2003. We have observed results that shows that the term ‘Open Innovation’ has 59 occurrences and 80 total link strength to other keywords. The data shows a strong link between ‘Innovation’ and ‘Management’, with  $n=33$ .

Figure 5 shows the overlay visualization mode, which is shown in different colors. The overlay visualization mode shows the average publication year of the keywords. For instance, the yellow color represents the variables with the average publication year 2016 while the purple color represents the variables average publication year 2010. Furthermore, this color scheme also shows the variables with infrequent occurrences. For example resilience ( $n=5$ ), development ( $n=9$ ), innovation system ( $n=6$ ), corporate foresight ( $n=5$ ), productivity ( $n=7$ ), co-creation ( $n=8$ ), knowledge ( $n=9$ ), user innovation ( $n=7$ ), integration ( $n=8$ ), innovative development ( $n=6$ ), firm performance ( $n=12$ ) and all others remaining all have been shown with yellow color. The overlay visualization mode also recognizes variables by their publication years which have fewer occurrences with studies of Innovation Management. Although, more research is required to determine the effect of innovation management on such variables as total quality management ( $n=7$ ), corporate strategy ( $n=7$ ), management strategy ( $n=5$ ), market orientation ( $n=7$ ), innovation success ( $n=5$ ), and change management ( $n=10$ ).

### 3.6. LIMITATIONS OF THE STUDY

Despite all efforts and time consumed in conducting this bibliometric analysis study, it has some limitations. Firstly, we restricted our search of “innovate\* management” to titles and abstracts, so results of our search have also included researches on innovation management, innovative management, or innovational management available on the Scopus database. According to the results of the study, we noticed some terms-innovative activity ( $n=7$ ), innovative management ( $n=15$ ), total innovation management ( $n=5$ ), management innovation ( $n=6$ ), and innovation development ( $n=5$ ), were used to refer to Innovation Management.

Future researchers may restrict their search string to innovation management with its dimensions for a more comprehensive analysis of the variable. As this was a general study and it attempts to cover all the terms related to the main variable among the subject areas listed in the Scopus database, it did not restraint itself to any specific field. However, it is very difficult to apply findings to any specific field rather the researchers of every area can take some ideas for future activities. Secondly, our co-occurrence analysis on author’s keywords was comprised of 76% publications of the study, because information of the author’s keywords was not available in some journals. So, our analysis is restricted to these author’s keywords.

## 4. CONCLUSION

We have examined the research on ‘Innovation Management’ indexed in the Scopus database through mapping countries, authors, and keywords. This research study has provided a summary of ‘Innovation Management’ research trends consisted of 2160 publications obtained from the Scopus database. By the end of the 20th century, a stable increase in publications has occurred in academic literature. Also, 75.41% of the



articles were published after 2008. Hence, it is predicted that the annual publications will keep on increasing. It has been also identified academic institutes from the USA and Germany have maximum research publications. Our results have shown that the UK was the country that has minimum SCP (51.03%) but it has vast global linkages. The above-mentioned academic institutes could be a platform for scholars and academics who belong to different nations/territories, that will help them to boost their research collaborations or linkages. We have also discussed the trend of publications with renowned keywords as well as overlooked ones. We aimed to describe the past research trends and major practicing keywords but found no clear theme except the 'Innovation Management' research is moving towards innovative activity, innovative management, total innovation management, management innovation, and innovation development. It seems that since the knowledge world is developing, some key concepts presently dominating the area now may be replaced with more important keywords in the future.

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## Appendix-A

**Table S1.** The search strategies and query strings used in Scopus

| Item | Search Purpose?                              | Search String                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|------|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| i    | Articles (main search)                       | TITLE-ABS ( "innovat* management" ) AND ( LIMIT-TO ( SRCTYPE , "j" ) ) AND ( LIMIT-TO ( DOCTYPE , "ar" ) ) AND ( EXCLUDE ( PUBYEAR , 2020 ) )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| ii   | Identifying review articles                  | TITLE-ABS ( "innovat* management" ) AND ( TITLE ( "recent" OR progress OR review OR critical OR revisit OR advance OR development OR highlight OR perspective OR prospect OR trends OR bibliometric OR scientometric ) OR ( ABS ( progress OR review OR bibliometric OR scientometric ) ) ) AND ( LIMIT-TO ( SRCTYPE , "j" ) ) AND ( LIMIT-TO ( DOCTYPE , "ar" ) ) AND ( EXCLUDE ( PUBYEAR , 2020 ) )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| iii  | Removed all review articles from main search | TITLE-ABS ( "innovat* management" ) AND NOT EID ( 2-s2.0-84952402319 OR 2-s2.0-84952416337 OR 2-s2.0-0023591057 OR 2-s2.0-0000476959 OR 2-s2.0-84935272410 OR 2-s2.0-85025282869 OR 2-s2.0-0009114994 OR 2-s2.0-0030674663 OR 2-s2.0-0031371306 OR 2-s2.0-84992945570 OR 2-s2.0-84993683910 OR 2-s2.0-0000812392 OR 2-s2.0-29344467162 OR 2-s2.0-0036307466 OR 2-s2.0-0142043413 OR 2-s2.0-85064742813 OR 2-s2.0-7544234464 OR 2-s2.0-7744231132 OR 2-s2.0-18044396727 OR 2-s2.0-20144371477 OR 2-s2.0-28444457332 OR 2-s2.0-33748742359 OR 2-s2.0-34250366294 OR 2-s2.0-37549057372 OR 2-s2.0-43149101644 OR 2-s2.0-47249098544 OR 2-s2.0-47649109682 OR 2-s2.061449123003 OR 2-s2.0-70049092598 OR 2-s2.0-73449090097 OR 2-s2.0-77952644009 OR 2-s2.0-85041024566 OR 2-s2.0-77649251164 OR 2-s2.0-77949904736 OR 2-s2.0-77952840655 OR 2-s2.0-77955009149 OR 2-s2.0-78649748871 OR 2-s2.0-78650365350 OR 2-s2.0-79955031485 OR 2-s2.0-80051583078 OR 2-s2.0-84860845035 OR 2-s2.0-84859433558 OR 2-s2.0-84873639611 OR 2-s2.0-84874465245 OR 2-s2.0-84958046910 OR 2-s2.0-84900304835 OR 2-s2.0-84883620846 OR 2-s2.0-84905163919 OR 2-s2.0-84916896299 OR 2-s2.0-84893683783 OR 2-s2.0-84952931084 OR 2-s2.0-84951068946 OR 2-s2.0-84928410386 OR 2-s2.0-84921789194 OR 2-s2.0-84938746356 OR 2-s2.0-85017593653 OR 2-s2.0-84964703579 OR 2-s2.0-84966698955 OR 2-s2.0-84968546876 OR 2-s2.0-84952673970 OR 2-s2.0-84960893621 OR 2-s2.0-84962168886 OR 2-s2.0-85014086628 OR 2-s2.0-84991759946 OR 2-s2.0-84982712537 OR 2-s2.0-85028515093 OR 2-s2.0-85032129819 OR 2-s2.0-85042651695 OR 2-s2.0-85018768127 OR 2-s2.0-85016124869 OR 2-s2.0-85007552743 OR 2-s2.0-85021277849 OR 2-s2.0-85022321501 OR 2-s2.0-85044147527 OR 2-s2.0-85030548633 OR 2-s2.0-85049599766 OR 2-s2.0-85049234820 OR 2-s2.0-85028319919 OR 2-s2.0-85043997317 OR 2-s2.0-85058130268 OR 2-s2.0-85073269040 OR 2-s2.0-85076994979 OR 2-s2.0-85072799433 OR 2-s2.0-85064006521 OR 2-s2.0-85077652824 OR 2-s2.0-85059878710 OR 2-s2.0-85053288709 OR 2-s2.0-85031816172 OR 2-s2.0-85067176350 OR 2-s2.0-85064229978 OR 2-s2.0-85064225567 OR 2-s2.0-85065247731 OR 2-s2.0-85064506514 OR 2-s2.0-85054805165 OR 2-s2.0-85055170388 OR 2-s2.0-85073392072 OR 2- |



|  |  |                                                                                                                                                                                                                                            |
|--|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  | s2.0-85068034529 OR 2-s2.0-85048507537 OR 2-s2.0-85070776246 OR 2-s2.0-85070564195 OR 2-s2.0-85074216292 OR 2-s2.0-85075164546 ) AND ( LIMIT-TO ( SRCTYPE , "j" ) ) AND ( LIMIT-TO ( DOCTYPE , "ar" ) ) AND ( EXCLUDE ( PUBYEAR , 2020 ) ) |
|--|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**Table S2.** The top cite score journals publishing Innovation Management research with minimum 20 research articles.

| Rank | Journal                                                             | Cites Score 2018 | Journal's Homepage                                                                                                                                                        | Publisher                                         | No. of Publications |
|------|---------------------------------------------------------------------|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|---------------------|
| 1    | Technovation                                                        | 6.25             | <a href="https://www.journals.elsevier.com/technovation">https://www.journals.elsevier.com/technovation</a>                                                               | Elsevier                                          | 36                  |
| 2    | Journal of Product Innovation Management                            | 5.43             | <a href="https://onlinelibrary.wiley.com/journal/15405885">https://onlinelibrary.wiley.com/journal/15405885</a>                                                           | Wiley-Blackwell                                   | 76                  |
| 3    | Technological Forecasting and Social Change                         | 4.32             | <a href="https://www.journals.elsevier.com/technological-forecasting-and-social-change">https://www.journals.elsevier.com/technological-forecasting-and-social-change</a> | Elsevier                                          | 22                  |
| 4    | Creativity and Innovation Management                                | 3.11             | <a href="https://onlinelibrary.wiley.com/journal/14678691">https://onlinelibrary.wiley.com/journal/14678691</a>                                                           | Wiley-Blackwell                                   | 40                  |
| 5    | R And D Management                                                  | 2.99             | <a href="https://onlinelibrary.wiley.com/journal/14679310">https://onlinelibrary.wiley.com/journal/14679310</a>                                                           | Wiley                                             | 24                  |
| 6    | European Journal of Innovation Management                           | 2.08             | <a href="https://www.emeraldgroupublishing.com/ejim.htm">https://www.emeraldgroupublishing.com/ejim.htm</a>                                                               | Emerald                                           | 31                  |
| 7    | International Journal of Technology Management                      | 1.47             | <a href="https://www.inderscience.com/jhome.php?jcode=ijtm">https://www.inderscience.com/jhome.php?jcode=ijtm</a>                                                         | Inderscience                                      | 40                  |
| 8    | International Journal of Innovation Management                      | 1.32             | <a href="https://www.worldscientific.com/toc/ijim/0/0">https://www.worldscientific.com/toc/ijim/0/0</a>                                                                   | World Scientific                                  | 30                  |
| 9    | Asian Journal of Technology Innovation                              | 0.95             | <a href="https://www.tandfonline.com/toc/rajt20/current">https://www.tandfonline.com/toc/rajt20/current</a>                                                               | Taylor & Francis                                  | 206                 |
| 10   | Journal of Technology Management and Innovation                     | 0.94             | <a href="https://www.jotmi.org/index.php/GT">https://www.jotmi.org/index.php/GT</a>                                                                                       | World Scientific                                  | 24                  |
| 11   | International Journal of Entrepreneurship and Innovation Management | 0.49             | <a href="https://www.inderscience.com/jhome.php?jcode=ijei">https://www.inderscience.com/jhome.php?jcode=ijei</a>                                                         | Inderscience                                      | 23                  |
| 12   | Espacios                                                            | 0.19             | <a href="https://www.revistaespacios.com/">https://www.revistaespacios.com/</a>                                                                                           | Sociacion de Profesionales y Tecnicos del CONICIT | 40                  |

**Table S3.** The top 23 most productive institutions in “Innovation Management” Research

| Rank | Institution                        | Country | No. of Publications |
|------|------------------------------------|---------|---------------------|
| 1    | Universidade de Sao Paulo - USP    | Brazil  | 28                  |
| 2    | Politecnico di Milano              | Italy   | 27                  |
| 3    | Lappeenranta Teknillinen Yliopisto | Finland | 26                  |
| 4    | Zhejiang University                | China   | 25                  |
| 5    | Technical University of Berlin     | Germany | 18                  |
| 6    | Kazan Federal University           | Russia  | 16                  |





|    |                                                            |             |    |
|----|------------------------------------------------------------|-------------|----|
| 7  | Aalto University                                           | Finland     | 15 |
| 8  | Delft University of Technology                             | Netherlands | 14 |
| 9  | University of Malaya                                       | Malaysia    | 14 |
| 10 | Sungkyunkwan University                                    | South Korea | 13 |
| 11 | Friedrich-Alexander-Universität<br>Erlangen-Nürnberg       | Germany     | 12 |
| 12 | Seoul National University                                  | South Korea | 12 |
| 13 | Wageningen University and<br>Research Centre               | Netherlands | 11 |
| 14 | University of Sussex                                       | England     | 11 |
| 15 | University of Twente                                       | Netherlands | 11 |
| 16 | Korea Advanced Institute of<br>Science & Technology        | South Korea | 11 |
| 17 | Chalmers University of<br>Technology                       | Sweden      | 10 |
| 18 | CNRS Centre National de la<br>Recherche Scientifique       | France      | 10 |
| 19 | Università degli Studi di Torino                           | Italy       | 10 |
| 20 | Universidade Federal de Santa<br>Catarina                  | Brazil      | 10 |
| 21 | National Research University<br>Higher School of Economics | Russia      | 10 |
| 22 | Lunds Universitet                                          | Sweden      | 10 |
| 23 | Aarhus Universitet                                         | Denmark     | 10 |