

# Trend of Radical Innovation Research

## A Bibliometric Study

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### ABSTRACT

This research aims to visualise the state of the art of radical innovation research that furthers research in this topic. Radical innovation research has increasingly been raised since information technology was used in business, but it has not matured. Radical innovation contributes to the high number of research published in recent years. However, there is still limited research focusing on analysing radical innovation in the last decade. This research shows that as many as 1,568 datasets were derived from Scopus databases and visualised using the R-studio bibliometrics package - biblioshiny. This research also presents the potential topics for future study based on the trend topics, co-occurrences, and historical network.

**Keywords:** *Radical Innovation, Bibliometrics, R, Biblioshiny.*

## 1. INTRODUCTION

Radical innovations significantly alter an organisation's operations and deviate significantly from established practices [1]. As a result, radical innovation bears no resemblance to the preceding system [2]. Radical innovation is challenging to achieve, impossible to forecast and schedule, and made even more difficult because established market segments are the primary "client" of new advancements [3]. Radical innovation is a rougher and more dynamic set of procedures than other business processes such as supply chain management or financial operations [3]. A striking example of a publication related to radical innovation was written by Epstein [4]. Epstein examined the role of performance measurement and management control systems in increasing both incremental and breakthrough innovation in large organisations.

Many researchers have analysed and reviewed the innovation field with different objectives such as, eco-innovation [5], green innovation [6], new product development in technology and innovation management [7], innovation management [7][8], frugal innovation [10], social innovation [10][11], technological innovation [13] and financial innovation [14]. Furthermore, other researchers also investigated innovation efficiency [15]; inclusive innovation [16], sustainability [17], innovation adaption [18], front-end innovation [19], innovation in

emerging market [20], and radical innovation in family firms [21]. In addition to providing an outstanding overview of the current state of the art, these researchers can facilitate an in-depth examination of the contribution made by a specific piece of research

Bibliometric analysis is a mathematical methodology used to illustrate recent and updated knowledge in a specific field of study [22]. Tiberius, Schwarzer, and Roig-Dobón recently exemplified this bibliometric analysis using the VOS Viewer with Web of Science (WoS) database in the radical innovation field [23]. Their research suggests that further research in radical innovation should address individual, group (team), organisational, and inter-organisational characteristics. However, to the best of our knowledge, there is a limited bibliometric study on radical innovation using a biblioshiny program that shows a more comprehensive visualisation for bibliometric analysis. Furthermore, the biblioshiny further explains the radical innovation in histogram network and topics evolution. The most compelling reasons to choose biblioshiny over other scientific workflow languages are the presence of robust, suitable statistical methodologies, the availability of high-quality numerical procedures, and comprehensive visualisation techniques [24].

This research then tries to fill the gap by collecting various pieces of literature between 1976 and 2021, including journal articles, book chapters, conference papers, conference reviews, editorial notes, reviews, and short surveys. The purpose is to review radical innovation literature by providing an extensive bibliometric analysis to answer the following question (RQ):

- RQ1. How is the trend of radical innovation research based on the number of publications per year?
- RQ2. What journal has the most published papers in the area of radical innovation?
- RQ3. Who are the most productive authors in the publication of radical innovation?
- RQ4. How does the radical innovation's chronological network change over time?
- RQ5. Who are the most contributing authors in the publication of radical innovation?
- RQ6. What are the potential topics for future study in radical innovation?
- RQ7. What is trend topics in radical innovation research?
- RQ8. Which countries contribute the most to publications in radical innovation?

**2. RESEARCH METHODOLOGY**

As mentioned earlier, the current research conducted a bibliometric analysis using R-studio bibliometrics package – biblioshiny. Biblioshiny is written in R, an open-source programming language and environment. Of many studies, a preliminary study that

is well-known for using such an analysis was conducted by Aria and Cuccurullo [24]. Aria and Cuccurullo suggested three steps to use the biblioshiny. The first step is data collection, including data retrieval, data loading and converting and data cleaning. After that, the researcher goes through the second step, i.e. data analysis. It includes descriptive analysis and citation analysis. Finally, the third step is called data visualisation. It includes a conceptual map and keyword cluster, co-occurrences network, histogram network, and affiliation network-based country. For data collection, we need to define the search keyword, find the initial paper, refine the result and compile preliminary data before further analysis[24] [25].

**2.1 Defining the Research Keyword**

This research was conducted on October 5, 2021, utilising terms in the category of database searches related to radical innovation, where keywords are retrieved based on the article's title, keyword, and abstract of the article as follow:

*TITLE-ABS-KEY("radical innovation" or "disruptive innovation" or "breakthrough innovation")*

**2.2 Initial Search Result**

The initial keyword search returned 2.714 documents. As shown in Table 1, this research discovered an article on radical innovation published in 1933. Unfortunately, the research does not pertain to our area of study. As a result, we must refine the keyword to establish more specific criteria for our research.

**Tabel 1.** The Term Radical Innovation Appeared For the First Time in A Journal Article.

Authors	Title	Source	Year
Fedden, A.H.R.	Next decade's aero engines will be advanced but not radical	SAE Technical Papers	1933
PASCAL, J.I.	A radical innovation in contact lenses	Archives of ophthalmology (Chicago, Ill.: 1929)	1947
Chwast, J.	A Small Goal Is Big Enough: Minimal Objectives in Treating the Delinquent	Crime & Delinquency	1963

**2.3 Refinement of Search Results**

After receiving the preliminary findings, we screened all articles using the inclusion criteria established in this study. The search result is screened using two inclusion criteria : (1) subject area is Business, Management, and Accounting, (2) original research written in English. Furthermore, the results were saved in the form for the CSV format. The CSV format was used for further data analysis in biblioshiny.

**Tabel 2.** Refinement of Search Results

Search Keyword	Results
TITLE-ABS-KEY("radical innovation" or "disruptive innovation" or "breakthrough innovation") AND ( LIMIT-TO ( SUBJAREA,"BUSI" ) ) AND ( LIMIT-TO ( LANGUAGE,"English" ) )	1.568 documents

**Tabel 3.** Detail of Information Data in This Research

Description	Results
Timespan	1976-2022
Article	1194
Article in press	1
Book	30
Book chapter	104
Conference paper	168
Conference review	2
Editorial	7
Erratum	3
Note	7
Review	49
Short survey	3

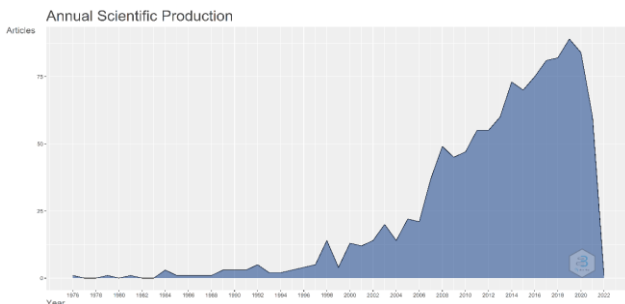
### 3. RESULT

The bibliometric data saved in CSV format will be visualised using biblioshiny in the R Studio application. Figure 1 shows the research trend on radical innovation based on the number of articles published per year. In general, radical innovation research started to grow for the first time since 2000, and presently, the research trend is still growing in terms of the number of publications.

#### 3.1 Descriptive Analysis and Citation Analysis Using Biblioshiny

##### 3.1.1 Trend of Radical Innovation Research Based on Number of Publication (RQ1)

Figure 1 shows the radical innovation research trend based on the number of articles published per year. Research in radical innovation started to grow in 2000 and continues to grow in publications until today.



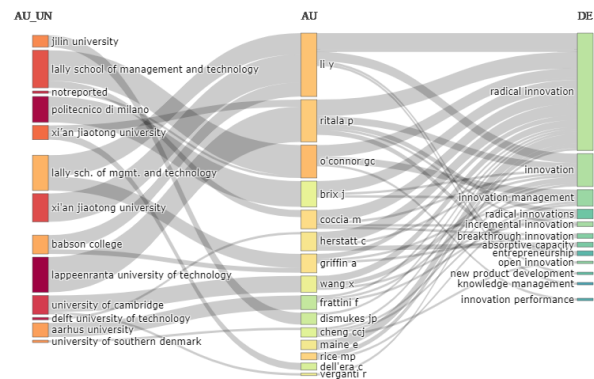
**Figure 1.** Trend Research of Radical Innovation

#### 3.2. Data Analysis and Visualization Using Biblioshiny

##### 3.2.1 Three-Field Plot

Figure 2 shows the three fields plot that illustrates three elements: a list of affiliation names, authors, and

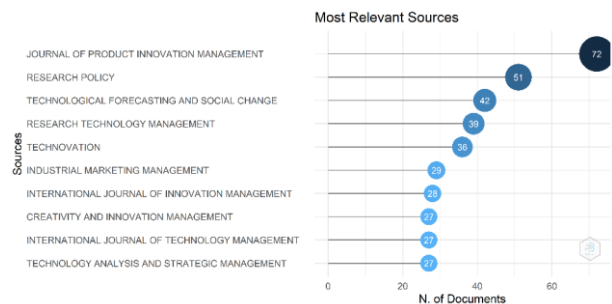
keywords. Each rectangle in each list is sized according to the number of papers associated with it. The affiliation is the first element on the left. Ten affiliations were indexed in the three fields plot as having published papers on the topic of radical innovation, and the top affiliation that published the most papers on this topic was the Laily school of management and technology, Xian Jiatong University, and Lappeenranta University of technology which is depicted with a red rectangle and connected to several authors, namely O'Connor GC, Li Y, and Ritala.



**Figure 2.** Illustration of three elements, consisting of a list of journal names, authors, and keyword

##### 3.2.2 Journal Have Most Papers Published in Area of Radical Innovation (RQ2)

Figure 3 shows the top ten journals with the most publications in radical innovation research. The journal leader based on publication number is the Journal of Production Innovation Management, which has 72 documents. The second leader is Research Policy Journal which has 51 documents.



**Figure 3.** Top Ten Journals Have Most Papers Published in Radical Innovation

##### 3.2.3 The Most Productive Authors in Publication of Radical Innovation (RQ3)

Figure 4 shows the top ten contributing authors with

published articles in journals. O'Connor has become the most productive author on the list, with around 21 articles with 2.506 citation numbers. Ritala is the second

productive author with producing nine articles with 934 citation numbers, and also Li Y made eight articles with 213 citation numbers.

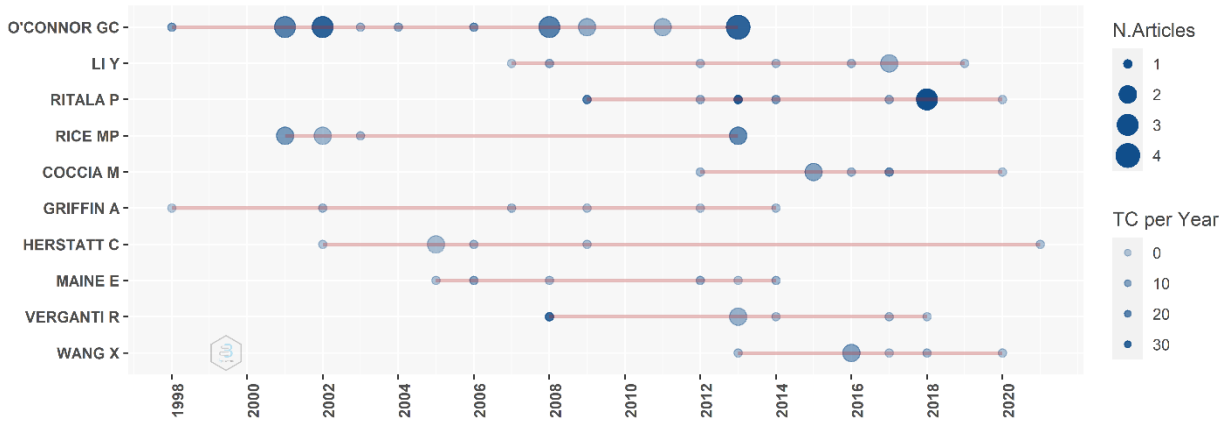


Figure 4. Top Ten Contributing Authors in Radical Innovation Research

### 3.2.4 Historical Direct Citation Network (RQ4)

The historical direct citation networks are shown in Figure 5. The figure illustrates the article connection among authors. As presented in Figure 6, two papers contribute to current radical innovation research. Herrmann et al. [27] [28] contribute the determinants of radical product innovations and the antecedents for

radical product innovations and capabilities for transformation. Moreover, Cabrales et al. [29] examined the effect of team diversity, encouragement to take risks, and team incentives on the degree of the radicalness of innovation. Chiesa et al. [30] also examined the management control to radical innovation with the case study method.

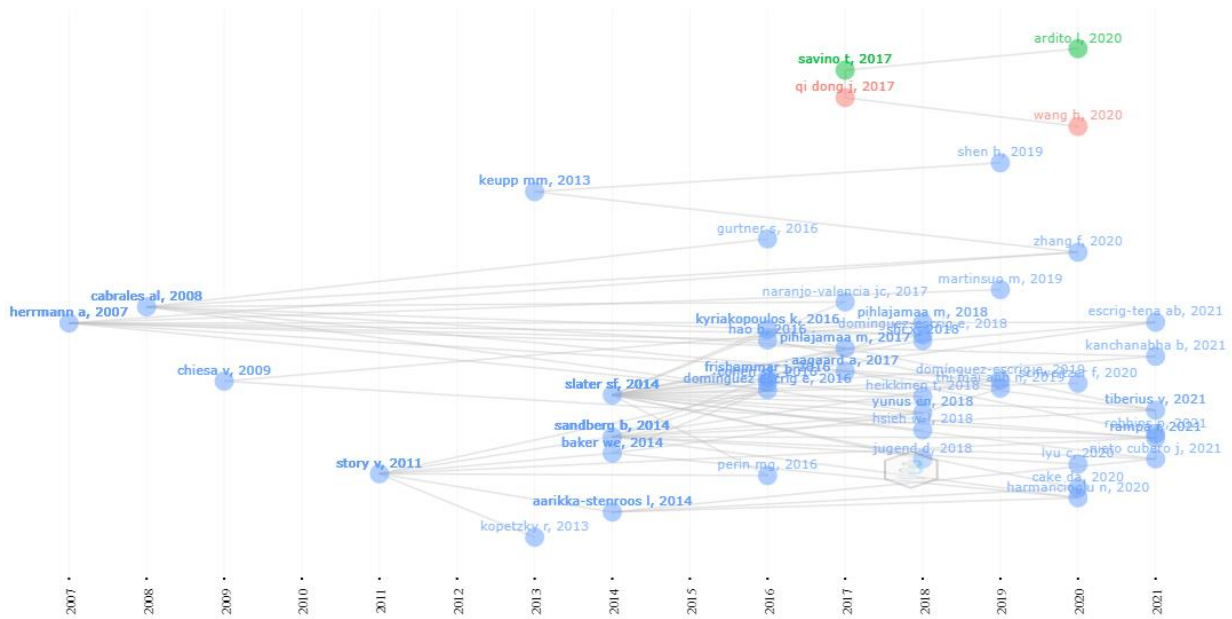


Figure 5. Direct Citation Network for the Historical Period

### 3.2.5 The Influential articles based on citation measures in radical innovation (RQ5)

Our study shows that Scopus journals substantially

impact metrics related to citations. Table four shows the top ten most cited articles in the radical innovation area, and figure 6 also shows a citation network based on authors.

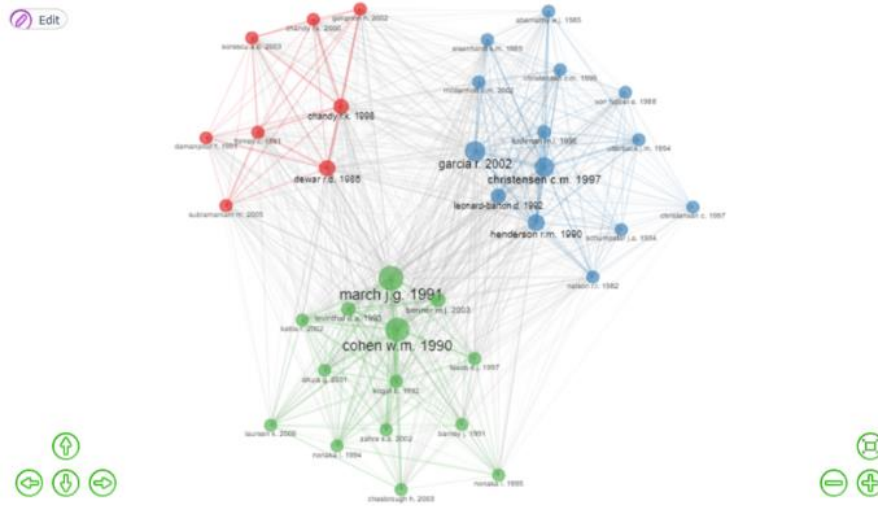


Figure 6. Co-Citation Network

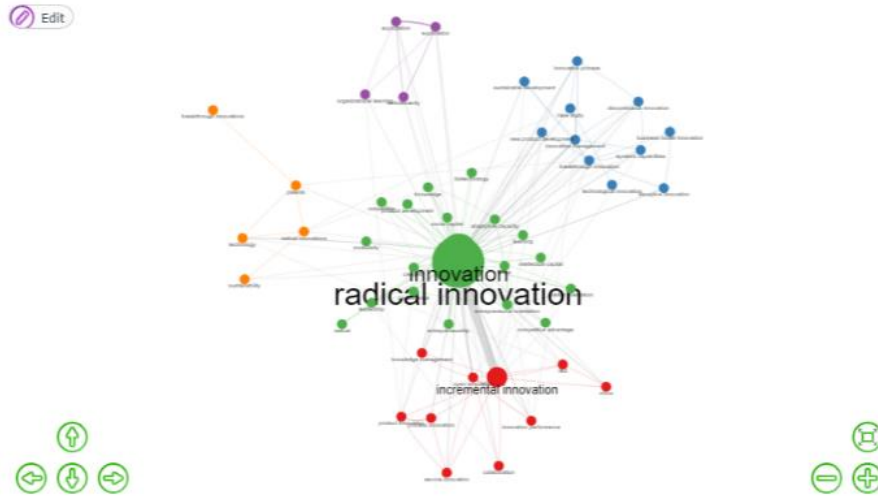
Table 4. Top Ten Influential Articles

Authors	Title	Year	Citations
Ahuja, Gautam; Morris Lampert, Curba [31]	Entrepreneurship in the large corporation: a longitudinal study of how established firms create breakthrough inventions	2001	1229
Andriopoulos, constantine. Lewis, Marianne W. [32]	Exploitation-Exploration Tensions and Organisational Ambidexterity: Managing Paradoxes of Innovation	2009	1013
Zhou, Kevin Zheng Yim, Chi Kin (Bennett) Tse, David K. [33]	The Effects of Strategic Orientations on Technology- and Market-Based Breakthrough Innovations	2005	940
Atuahene-Gima, Kwaku [34]	Resolving the Capability–Rigidity Paradox in New Product Innovation	2005	903
Ettlie, John E. Bridges, William P. O’Keefe, Robert D. [35]	Organisation Strategy and Structural Differences for Radical Versus Incremental Innovation	1984	901
Belderbos, René, Carree, Martin, Lokshin, Boris [36]	Cooperative R&D and firm performance	2004	787
Tellis, Gerard; Chandy, Rajesh [37]	The Incumbent’s Curse? Incumbency, Size, and Radical Product Innovation	2000	730
Markard, J, Truffer, B [38]	Technological innovation systems and the multi-level perspective: Towards an integrated framework	2008	623
Lynn, Gary S., and Morone, Joseph and Paulson, Albert. [39]	Marketing and Discontinuous Innovation: The Probe and Learn Process	1996	594
Veryzer, Robert W [40]	Discontinuous innovation and the new product development process	1998	549

3.2.6 Co-Occurrence Network (RQ 6)

Figure 7 network visualisation describes 7 clusters and their interrelationship within the studied topic area.

Each cluster describes a central topic as a research direction in the radical innovation field based on its unique association of the keywords within the cluster representing the research stream.



**Figure 7.** Co-Occurrence Network

Based on co-occurrence analysis, some keywords that have less frequent occurrence become potential topics to be examined for future research such as emerging market, government policy, environmental innovation, knowledge sharing, innovation radicalness, management

control, frugal innovation, ambidexterity, and culture. On the other hand, some keywords were reported to have the most frequent occurrence, as provided in Table 5.

**Tabel 5.** Most frequent keywords and potential keywords in radical innovation research

No	Cluster Name	Most Frequent Keywords	Potential Keywords
1	Breakthrough innovation	Breakthrough innovation (25), firm innovation (10)	Emerging Market (3)
2	Innovation management	Innovation management (12), innovation systems (7)	Government policy (3), environmental innovation(3)
3	Innovation performance	Innovation performance (32), incremental innovation (17)	Human capital (3), knowledge sharing (3), innovation radicalness (3), innovation speed (3), innovation network (3)
4	Process innovation	Process innovation (8), organisational learning (7)	Learning capability (3), high tech firms (3)
5	Radical innovation	Product development (32), product innovation (24), absorptive capacity (16), innovation capability (11)	Management control (3), knowledge transfer (3), Frugal innovation (3)
6	Service innovation	Service innovation (8)	Organisational culture (4)
7	Technological innovation	Technological change (8), firm performance (8)	Intellectual property (3), innovation generation (3), knowledge sources (4), ambidexterity (4)

**3.2.7 Trend Topics Related Radical Innovation Research (RQ7)**

In this section, Figure 9 shows the trend topics related to radical innovation from 2008 until 2021. In 2020-2021, entrepreneurial orientation, innovation capabilities, supply chain management, radical innovation

performance and quality management were among the popular topics in radical innovation research. In particular, collaboration and leadership continued to increase until 2021.

Related to collaboration, the increased alignment results from enterprises sharing strategic information at the first phases of collaborative new product development,

impacted by the trust and commitment developed in the supplier-client relationship while developing radical innovation. Additionally, the greater intensity of

alignment in collaborative new product development is unrelated to firm size, even though large organisations have a higher level of alignment in reality. [41]



Figure 8. Trend topics related to radical innovation research

### 3.3 Countries of Author and Collaboration Visualization Using Biblioshiny

In this part, a bibliometric analysis was conducted to analyse and visualise the author's countries that contribute to radical innovation research. Sixty-one countries produce articles related to radical innovation. However, only 29 of them produced more than ten articles. Figure 9 shows the top ten countries with the

highest publication number.

#### 3.3.1 Countries of Author That Contribute Most Publication in Radical Innovation (RQ8)

The United States (USA) has the highest country that produced documents among others with number publication are 511 articles. Followed by China with 237 articles and the United Kingdom with 234 articles.

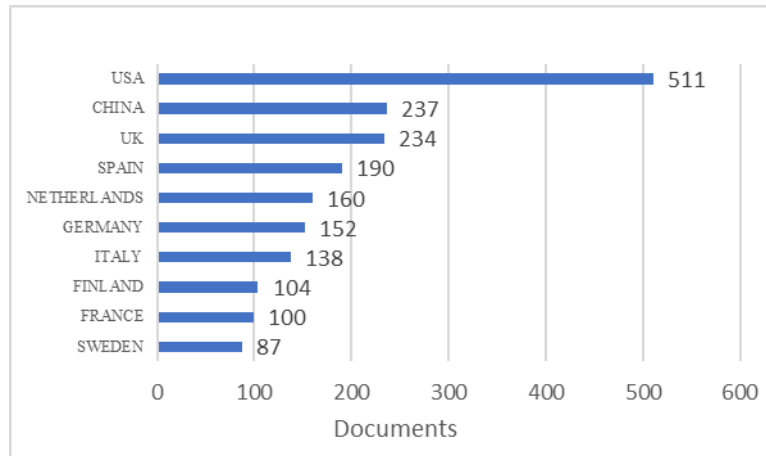


Figure 9. Top ten countries that produced radical innovation research

Figure 10 depicts the author of the country's partnership in radical innovation research, representing the countries' interaction networks. To illustrate the partnership, a network with a circular network layout and clustering was provided through the louvred

algorithm. A larger circle indicates the larger published number of a country. According to this figure, the United States of America has the largest circle, which implies their domination in this field of study.



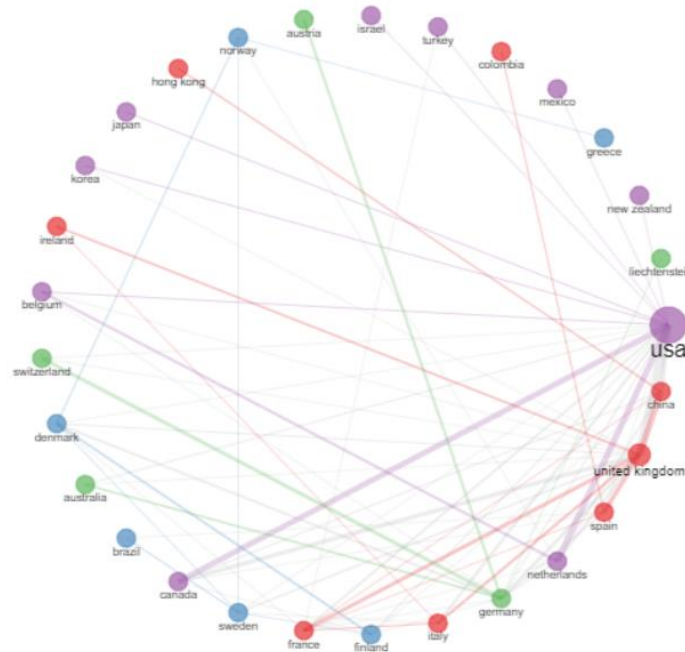


Figure 10. Collaboration Documents Based on Country

#### 4. CONCLUSIONS

This study used bibliometric analysis to review all articles published in journals in the field of radical innovation. Each year, radical innovation has grown in popularity due to technological advancements and changes in the business environment. Science mapping is rapidly becoming a required skill set for scholars across all disciplines. The intellectual structure and research frontiers of scientific domains are critical for research, policy, and practice. This research then allows authors to understand radical innovation better. It also helps us in the next step of the research workflow (e.g., systematic literature review). It can be achieved since this article answers some questions that had been set before the data were analysed..

This research noted that the initial outcome step mainly contained 2,178 datasets from the Scopus database. It was then reduced to 1,568 datasets following refinement of the inclusion criteria. The findings of this study demonstrated the trends in radical innovation research, including the contributing authors, productive countries, and the most influential authors and articles. Furthermore, co-occurrence analysis visualisation revealed some keywords that could serve as potential research topics in the future. Some examples included organisational control's role in influencing radical innovation and how the collaboration can motivate the organisation to build radical innovation. Another example was examining the best model of the government policy to innovation needed by market, business player, and supplier

#### AUTHOR'S CONTRIBUTIONS

Putri Mutira: writing – original draft. Meutia: review the article. Helmi Yazid: conceptualization, data curation. Elvin Bastian: editing and visualization.

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