



An Analytical Study of Global Research Output on Disruptive Innovation and Social Change

Kailash Chander Das

Former Head & Professor,
P.G. Department of Library and Information Science,
Utkal University, Vani Vihar
Bhubaneswar- 751004, Orissa, India.
Email: prof.k.c.das@ gmail.com

Kunwar Singh

Assistant Professor,
Department of Library & Information Science,
Banaras Hindu University
Varanasi-221005, Uttar Pradesh, India.
Email: singhdlibhu2015@gmail.com
ORCID: <http://orcid.org/0000-0002-5615-5656>

Ayush Kumar Patel

Junior Research Fellow,
Department of Library & Information Science
Banaras Hindu University
Varanasi-221005, Uttar Pradesh, India
Email: ayush.kumarvns2012@gmail.com
ORCID: <http://orcid.org/0000-0002-5668-1103>

Avadhesh Kumar Patel*

Junior Research Fellow
Department of Library & Information Science,
Banaras Hindu University, Varanasi-221005, Uttar Pradesh, India.

**Corresponding author's* Email: akpbhu20@gmail.com
ORCID: <http://orcid.org/0000-0002-7989-091X>



Abstract

Disruptive innovation and social change are necessary to investigate fields for society. It changes society by introducing new technology and a new context. The main aim of this research study is to conduct a bibliometric analysis and visualization of global research output on disruptive innovation and Social Change. A total of 232 publications were extracted from the Scopus database and saved as a “.csv” file for visualizing with VOS viewer software. The finding indicated that the innovative-based research registered increasing publication trends with fluctuation and an average of 23 publications per year. The authors, C. Laurell and C. Sandstorm were the most productive authors, whereas R. Kitchin had the most citations. The USA and UK had the most publications (54 and 44, respectively) and citations (1052 and 805, respectively) during the study period. The Harvard Business Review, Strategic Management Journal, Research Policy, Scientometrics were the highest cited sources of the study, whereas the authors, C.M. Christensen with 160 and M. Thelwall with 60 citations, were the highest cited authors. Due to this, scholars from throughout the world are likely to benefit from these findings. In the future, this research will help researchers in developing research standards and motivating them to improve their work in this area.

Keywords: Visualization, VOS viewer, Disruptive innovation, Social change, Bibliometrics

0. Introduction

Modernization is a term that became fashionable after World War II. The word “modern” encompasses the whole era since the eighteenth century when inventions like the steam engine and the spinning jenny provided the initial technical basis for the industrialization of societies (Bendix 1967). Modernity is possible only through innovation and social change. For social change to happen over time, it is necessary to have disruptive innovations (Markides 2006). Therefore, disruptive innovation and social change complement each other.

The developers of innovation transform society by simplifying current practices with new technology. Innovation is considered essential for revising old practices and principles. It is argued that social reform is more justified than the cost of adopting new methods and tools. In addition, new technologies are incorporated to change teaching practices, which may include

step-by-step processes for teaching or learning, such as new media, computers, curricula, manipulating ideas, etc (Bower and Christensen 1995; Christensen et al. 2006; Christensen et al. 2018; Christensen, Raynor, and McDonald 2013; Dan and Chieh 2008).

The present paper uses visualization software (VOSviewer) to visualize international research on disruptive innovation and social change. VOSviewer is a popular program for constructing bibliometric networks of diverse entities (e.g., authors, organizations, etc.) utilizing network analysis approaches including co-citation, term co-occurrence, and co-authorship (Patel et al. 2021b; Sharifi, Simangan, and Kaneko 2020; Singh et al. 2021; Van Eck and Waltman 2009).

1. Objective

The main objective is to refer to a vision of leading countries and authors that intervene in developing research on disruptive innovation and social change through their collaborations.

After this introduction, the second part is dedicated to the methodology of this study. Subsequently, in the third and fourth, the researchers present this study's results and discussions, and conclusions.

2. Disruptive Innovation

Clayton Christensen and Joseph Bower coined the term disruptive technologies and presented it in their article *Disruptive Technologies: Catching the Wave* in 1995. Christensen then mentioned it in his book *"The Innovator's Dilemma"* (Christensen et al. 1997) and then replaced it with disruptive innovation (Christensen and Raynor 2003). Disruptive innovations have had a significant impact on industry structures and daily routines, from travel to computer retailing to communications, and have often led to social change in the process. Social change and disruptive innovation are complementary, but the social change caused by disruptive innovation is largely unexpected. However, with disruptive innovations, social change is the primary objective (Christensen et al. 2006).

In technological thought, disruptive innovation is an innovation that creates a new technique and social value and finally vanishes an existing technique and value, displacing existing market-leading firms, products, and alliances (AbRahman, Hamid, and Chin 2017; Christensen et al. 1997; Wu, Wang, and Evans 2019; Patel et al. 2022;). A disruptive process has a longer-term

traditional, and the risk is more significant than others. However, once it develops in society, it becomes highly dominant and influences the existing society (Christensen 1997). Beyond business and economics, disruptive innovations can also be considered to disrupt complex systems, including economic and business-related aspects. By identifying and analyzing systems for possible intervention points, one can design changes focused on disruptive interventions (Durantin et al. 2017).

3. Bibliometrics

It is a research field within the library and information sciences that studies bibliographic material using quantitative methods (Broadus 1987; Pritchard 1969; Tan et al. 2021). "Bibliometrics" is a term made up of two words: "biblio" and "metrics" (Osareh 1996; Sengupta 1992). The word "biblio" comes from the Greek and Latin words "biblion", which means "book". The word "metrics", on the other hand, comes from the Latin or Greek words "metricus" or "metrikos", which both imply "measuring". Pritchard coined the word bibliometrics in 1969 to describe a statistical strategy for analyzing all fields of knowledge quantitatively (Hood and Wilson 2001; Liang and Liu 2018; Mokhtari et al. 2019). It is one of the most popular tools for summarising the most important findings from a set of bibliographic documents (Bhatt, Ghuman, and Dhir, 2020; Ojeda-Pereira and Campos-Medina 2021; Patel et al. 2021a; Parida et al. 2022; Putera and Pasciana 2021).

4. Methodology

The major aim of the study is to visualize the bibliometric output. This study process contains two major categories: data extraction and data analysis.

4.1. Data Extraction

There are many databases such as Scopus, Web of Science, Dimensions, PubMed, and others with different subject domains. Scopus is the largest abstract and citation database of peer-reviewed literature: scientific journals, books, conference proceedings, etc. Therefore, this database was selected for extraction. The data was acquired from the Scopus database, covering 10 years from 2011 to 2020. The search keyword was "Disruptive Innovation and Social Change." The search string used for the study was TITLE-ABS-KEY (disruptive AND innovation AND social AND change) AND (LIMIT-TO (PUBYEAR, 2020) OR LIMIT-TO

(PUBYEAR, 2011)) AND (LIMIT-TO (PUBSTAGE, "final")) accessed on April 4, 2021 (Scopus, n.d.). A total of 232 pieces of published data were extracted and imported into the “.csv” file.

4.2. Data Analysis

After data extraction, the data is imported in the required format, such as ".xlsx", ".txt", and ".csv". The data was analyzed for bibliographic measures and visualized for proper visibility of the results. There is a plethora of software for analysis and visualization tasks here, selected for their accessibility and reliability, along with cost. VOSviewer focuses on visualizing bibliographic data. The researchers performed network mapping and table modeling for the extracted data with MS-Excel and VOSviewer visualization software. The research process is shown in Figure 1 as a step-by-step workflow.

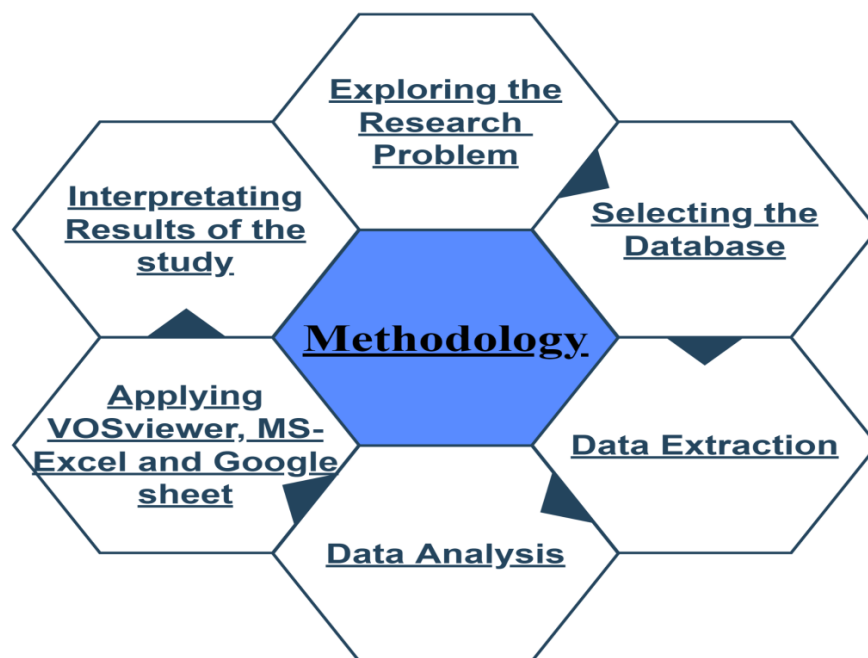


Figure1: Step-by-step workflow

5. Results and Discussions

5.1. Chronological Growth of Publications

During a 10-year period from 2011-2020, 232 documents were published on disruptive innovation and social change (Figure 2). These were articles, book chapters, conference

proceedings, reviews, etc. Thus, the average number of publications published each year is 23. During the study period, only during the last three years was the number of papers published greater than the average. The highest-ranked publication is 43 in the year 2020. The pattern of growth indicates an inconsistent trend growth. Here, the trend line for documents ($R^2 = 0.813$) is drawn by using a regression analysis with 3 degrees of polynomial, which is greater than 0.5. It means the trend line of publications is increasing over time.

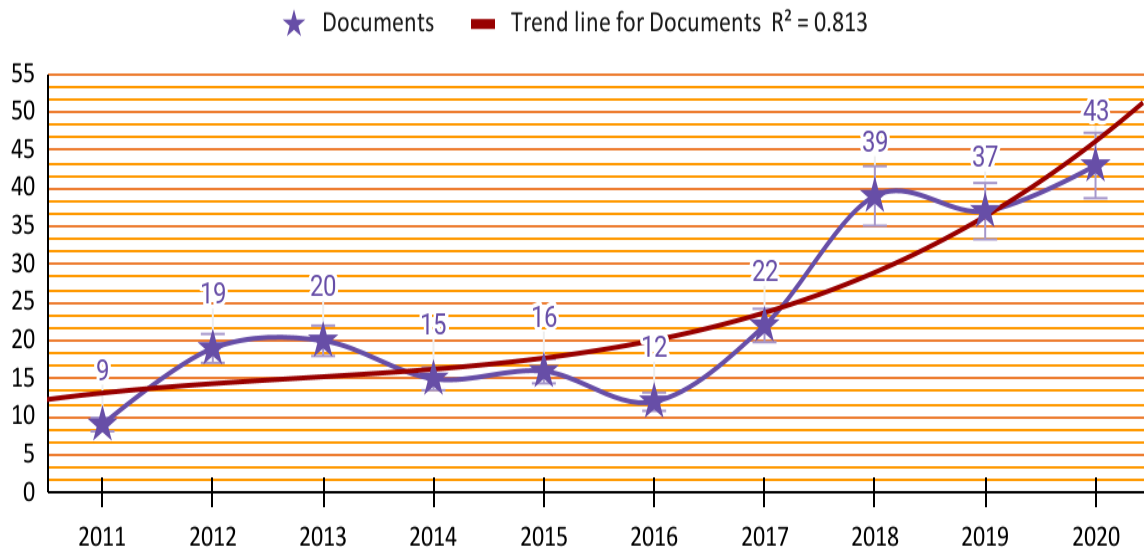


Figure 2: Publication growth

5.2. Co-authorship Analysis of Leading Authors

Out of 589 authors, 10 authors had 2 or more publications and 9 or more citations. C. Laurell (SVP & Head of Research and Public Affairs at Einride, Stockholm School of Economics and the Royal Institute of Technology (KTH), Stockholm, Sweden) and C. Sandstorm (Chalmers University of Technology, Gothenburg, Sweden) had the most publications in disruptive innovation and social change with four. C. Laurell is associated with disruptive innovation, technology, digital research methods, and social media analytics. But they were not the most cited authors. But R. Kitchin has the most citations (761), but the total link strength is zero. With the help of VOSviewer visualization software, out of 589 authors, 31 authors are highly connected to each other, which are categorized into two clusters with two different colors. The network visualization shows the highly connected authors, in which, J. Bousquet, belonging to green colored cluster 2, has the greatest total link strength among these highly connected authors

(Figure 3a), while L. Santos, the second author, belonging to red-colored cluster 1, has the highest total link strength (Figure 3b). The entity's font size and circles describe its measures.

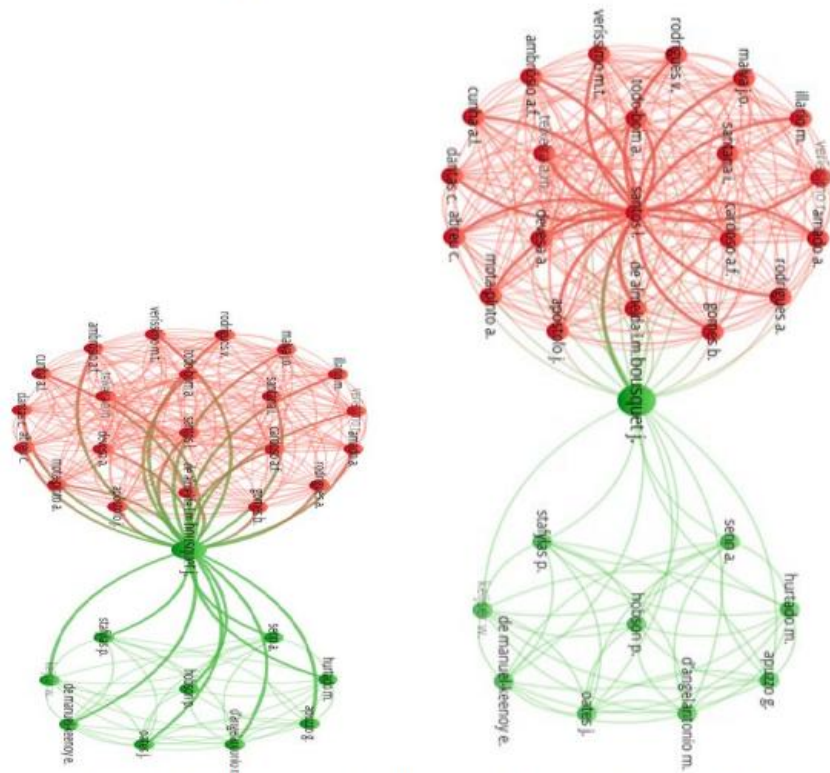


Figure 3: Network Visualizations of the authors' (a) J. Bousquet's network, (b) L. Santos's network

5.3. Co-Authorship Analysis of Institutions

Figure 4 depicts the network visualization of institutional and organizational collaboration for disruptive innovation and social change research publications. The minimum number of citations for an institution is ten, so 160 meet the fulfilment. Some of the total items (institutions) are not connected to each other. Here, 19 items (institutions) are highly connected, which is shown in Figure 4 to have almost the same total link strength in one cluster. The University of Oxford, England (one of the world's leading universities) (six publications), Wageningen University & Research, Netherlands (five publications), Chalmers University of Technology, Sweden (four publications), University of Groningen, Netherlands (four publications) and University of Melbourne, Australia (four publications) are among the top five highly productive institutions. The National Institute for Regional and Spatial Analysis (NIRSA) at Maynooth University in Ireland (761 citations), the University of Surrey's Department of Health Care Management and Policy (264 citations), and the University of Oxford's Department of Public Health (264

citations) were among the top collaborative institutions for disruptive innovation and social change research.

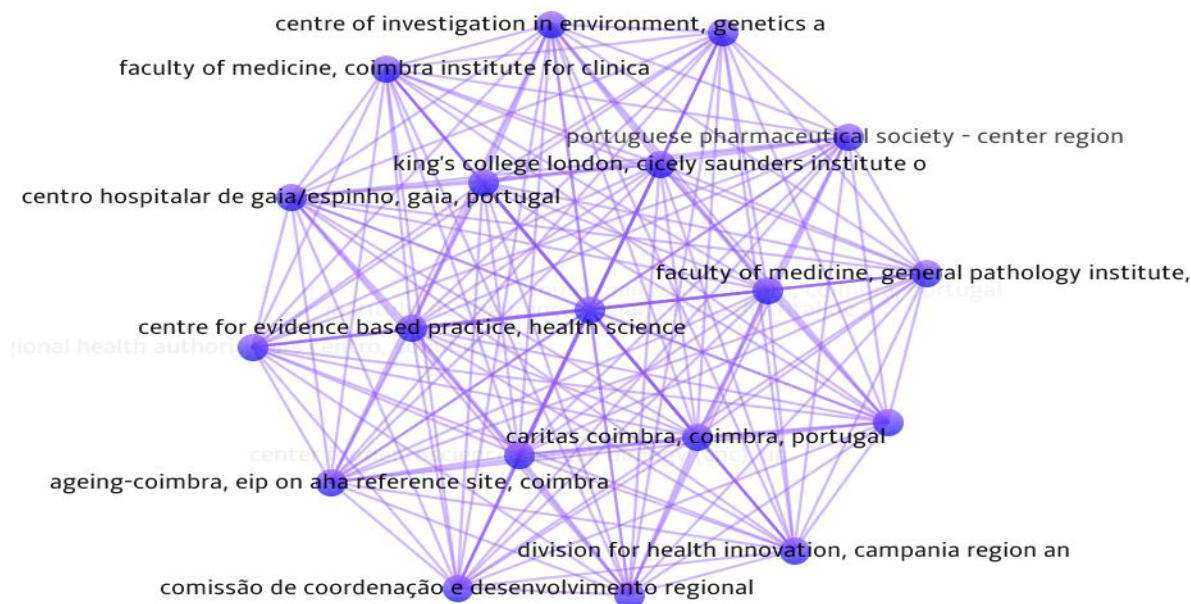


Figure 4: Network visualization of collaborative institutes

5.4. Co-authorship Analysis of Countries

The VOSviewer software is used to visualize collaboration between countries (Figure 5). Out of 54 countries, 10 countries satisfy the requirement for a minimum of seven publications and a minimum of 69 citations. The United States and the United Kingdom were present at the forefront of disruptive innovation and social change research, working closely with Australia, the Netherlands, Italy, France, Finland, Nigeria, and others. There were also significant research collaborations between Germany and other nations, such as Spain, Finland, Switzerland, and Canada. The Russian Federation, India, Romania, Israel, and others have fewer collaborations and contributions.

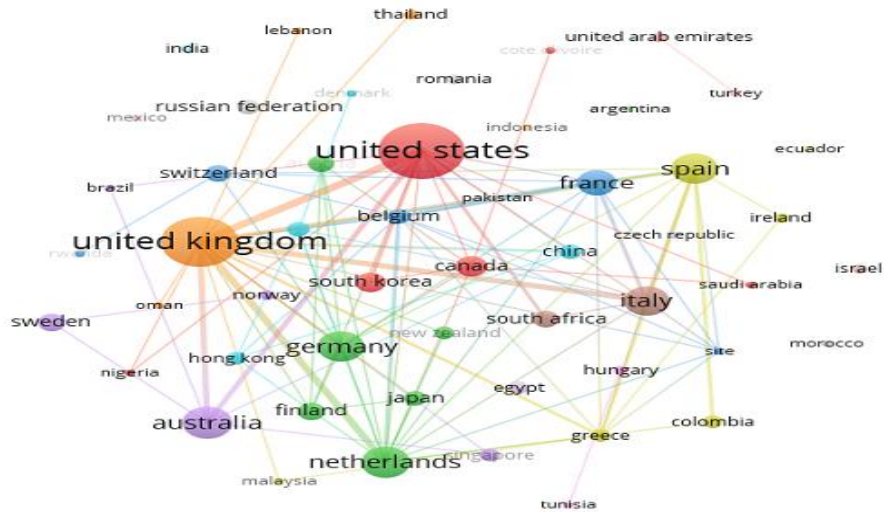


Figure 5: Network visualization of collaborative countries

5.5. Comparison of the geographical contributions

Table 1 shows a comparison list of countries, together with their productivity and presumably citations. Many countries were ranked in the top positions in terms of the number of publications and citations. The United States and the United Kingdom, for example, have the most publications (54 and 44, respectively), as well as the most citations (1052 and 805, respectively). The United States and the United Kingdom are the developed countries with the most publications on disruptive innovation and social change. These two have the highest number of Nobel Prizes in the world, i.e., they have more researchers and scientists, who have disruptive innovation thoughts (Nobel Laureates and research affiliations n.d.).

Table 1
Comparison of Countries' List

Most productive vs. Most cited Countries					
Country	Doc*	Cit.	Country	Cit*	Doc
	.			.	.
United States	54	105	United States	105	54
		2		2	
United Kingdom	44	805	United Kingdom	805	44



Australia	19	238	Ireland	765	2
Netherlands	18	211	Germany	318	17
Germany	17	318	Australia	238	19
Spain	17	212	Spain	212	17
Italy	16	176	Netherlands	211	18
France	12	106	Austria	187	5
Canada	8	185	Canada	185	8
South Korea	7	69	Italy	176	16

Note: Doc.=Documents, Cit.=Citations

5.6. Co-citation analysis of Cited References

Figure 6 illustrates a co-citation analysis of cited references in disruptive innovation and social change publications. Set the parameter strategy to two minimal numbers of citations per cited reference for visualization. Only 152 of the 13535 referenced references fit the criteria, which are organized into five distinct clusters with various colors. The most cited publication is R. Belk's (2014) publication "You are what you can access: Sharing and collaborative consumption online", which was published by Elsevier in the Journal of Business Review, has the most citations, followed by M.L. Tushman and P. Anderson's (1986) publication "Technological Discontinuities and Organizational Environments," which was published by JSTOR in the Administrative Science Quarterly Journal. As shown in Figure 6, these are all highly connected to each other.

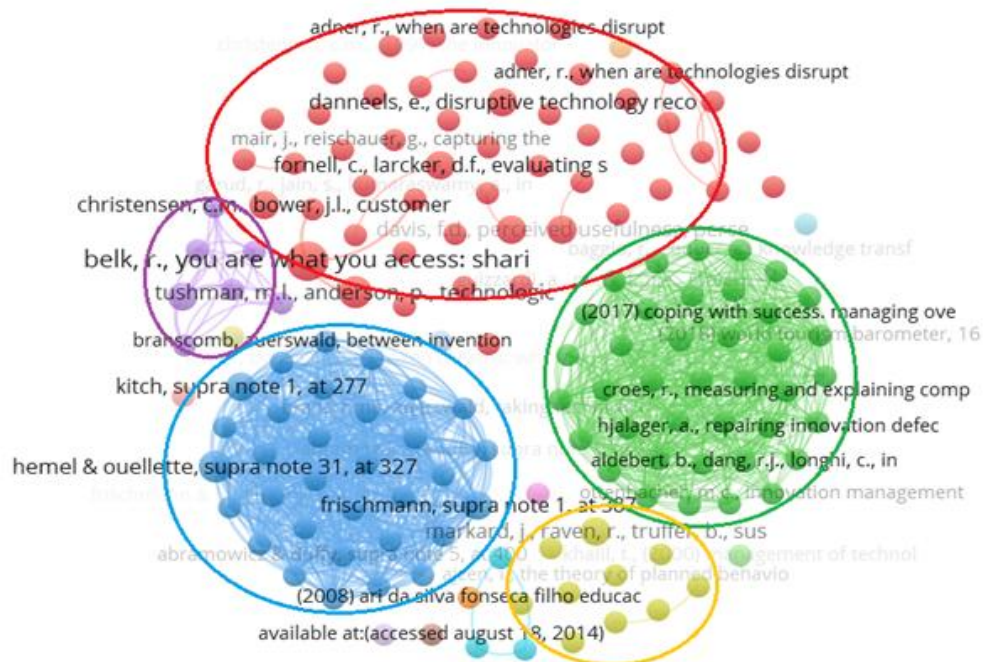


Figure 6: Network visualization co-citation of cited references

5.7. Co-authorship analysis of Cited sources

The examination of the co-citation of referenced sources of the study keywords is shown in Figure 7. According to the VOS viewer, only 284 of the 7827 referenced sources match the criteria of 5 minimum citations. The Harvard Business Review has the most citations (77), followed by Strategic Management Journal (69), Research Policy (67), and Scientometrics (59 citations). With 52 citations, the American Society of Information Science and Technology (JASIST) is the fourth most cited source. During the study period, JASIST had the highest total link strength (8479), followed by Scientometrics with 8424 total link strength.

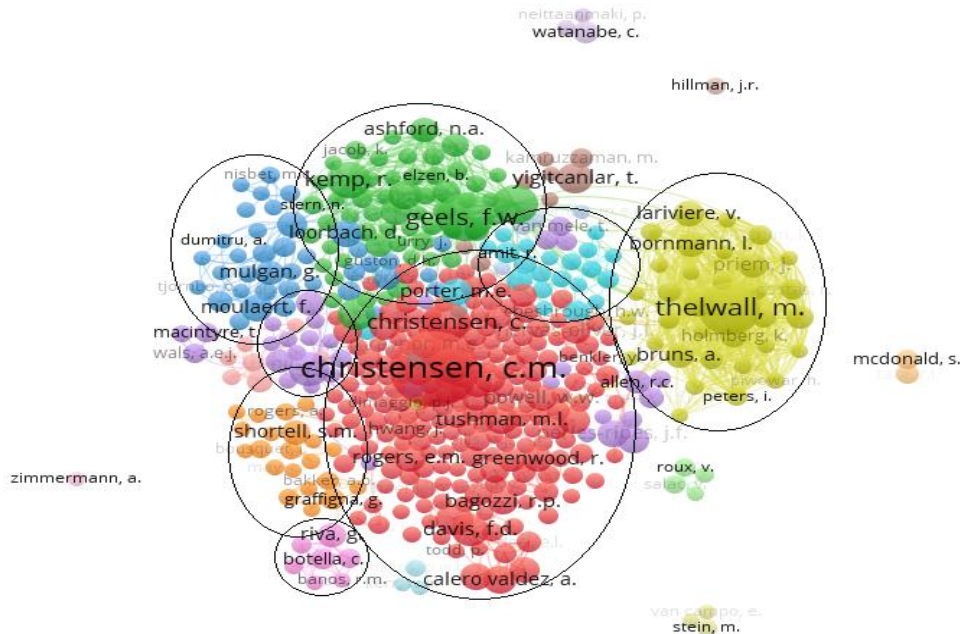


Figure 8: Network visualization of co-citation of cited authors

5.9. Network mapping of keyword occurrences

The required data was taken from the Scopus citation database, and the map was created using VOSviewer visualisation software. The Keyword Co-occurrence Map displays terms that appeared at least twice as keywords in all of the papers. The above map contains ten clusters, each with 350 keywords and 5105 linkages. The number of times the keywords connected appeared together in the publications is shown by the links between two keywords in the network (Patel et al. 2021c; Rawat et al. 2021). The greater the number of linkages between two keywords, the more frequently they appear in the same document. The nature of research and hotspots in disruptive innovation and social change (DISC) are determined by a network based on keywords. The keywords (innovation, disruptive innovations, disruptive technologies, sustainability, sustainable development, education, climate change, social innovation) suggest that the DISC research focused on technical innovation in relation to sustainability requirements. Due to recent original research articles on disruptive inventions, keywords such as "innovation", "disruptive innovations", "disruptive technology", "education", and "artificial intelligence" were prominently positioned in these heavily utilized keywords and produced a separate cluster in red. In a distinct cluster, in green, the terms "sustainability", "sustainable development", "climate change", "environment", and "green-house effect" show the social safety and sustainability-



research fields are required in these areas. This study will be useful in the future for researchers in developing research standards and motivating them to enhance their work.

References

- AbRahman, A., Hamid, U. Z. A., & Chin, T. A. (2017). Emerging technologies with disruptive effects: A review. *PerintiseJournal*, 7(2), 111-128.
- Bendix, R. (1967). Tradition and modernity reconsidered. *Comparative studies in society and history*, 9(3), 292-346. <http://doi:10.1017/S0010417500004540>
- Bhatt, Y., Ghuman, K., &Dhir, A. (2020). Sustainable manufacturing. Bibliometrics and content analysis. *Journal of Cleaner Production*, 260, 120988.<https://doi.org/10.1016/j.jclepro.2020.120988>
- Bower, J. L., & Christensen, C. M. (1995). Disruptive technologies: Catching the wave. *Harvard Business Review*, 73(1):43–53.
- Broadus, R. N. (1987). Toward a definition of “bibliometrics”. *Scientometrics*, 12(5), 373-379.
- Christensen, C. (1997). *The Innovator’s Dilemma: When New Technologies Cause Great Firms to Fail*.Harvard Business School Press.
- Christensen, C. M., Baumann, H., Ruggles, R., &Sadtler, T. M. (2006). Disruptive innovation for social change. *Harvard Business Review*, 84 (12):94–101.
- Christensen, C. M., McDonald, R., Altman, E. J., &Palmer, J. E. (2018). Disruptive innovation: An intellectual history and directions for future research, *The Journal of Management Studies*, 55 (7):1043–1078.
- Christensen, C., &Raynor, M. (2003). *The Innovator’s Solution: Creating and Sustaining Successful Growth*.Harvard Business School Press.
- Christensen, C., Raynor, M. E., & McDonald, R. (2013). *Disruptive innovation*.Harvard Business Review.
- Dan, Y., &Chieh, H. C. (2008). A reflective review of disruptive innovation theory. In *PICMET'08-2008 Portland International Conference on Management of Engineering & Technology*, (pp. 402-414). IEEE.



- Durantín, A., Fanmuy, G., Miet, S., & Pegon, V. (2016). Disruptive innovation in complex systems. In *International Conference on Complex Systems Design & Management* (pp. 41-56). Springer, Cham.
- Hood, W., & Wilson, C. (2001). The literature of bibliometrics, scientometrics, and informetrics. *Scientometrics*, 52(2), 291-314.
- Liang, T. P., & Liu, Y. H. (2018). Research landscape of business intelligence and big data analytics: A bibliometrics study. *Expert Systems with Applications*, 111, 2-10. doi:10.1016/j.eswa.2018.05.018
- Markides, C. (2006). Disruptive innovation: In need of better theory. *Journal of product innovation management*, 23(1), 19-25.
- Mokhtari, H., Roumiyani, A., & Saberi, M. K. (2019). Bibliometric Analysis and Visualization of the Journal of Artificial Societies and Social Simulation (JASSS) between 2000 and 2018. *Webology*, 16 (1):166-183.
- Nobel Laureates and research affiliations. (n.d.). NobelPrize.Org. Accessed on January 24, 2022. <https://www.nobelprize.org/prizes/facts/lists/affiliations.php>
- Ojeda-Pereira, I., & Campos-Medina, F. (2021). International trends in mining tailings publications: A descriptive bibliometric study. *Resources Policy* 74:102272. <https://doi.org/10.1016/j.resourpol.2021.102272>
- Osareh, F. (1996). Bibliometrics, citation analysis and co-citation analysis: A review of literature I. *Libri*, 46 (3):149-158.
- Patel, A. K., Singh, K., Singh, M., & Patel, A. K. (2021b). Publication trends in Financial Inclusion: A Scientometric Assessment and Visualization. *Library Philosophy and Practice (e-journal)*, 5115:1-20. <https://digitalcommons.unl.edu/libphilprac/5115>
- Patel, A. K., Singh, K., Parida, D. K., & Patel, A. K. (2022). Visualization of Global Research Output on Disruptive Innovation in Health Care. *Journal of Hospital Librarianship*, 22(4), 1-15. DOI: 10.1080/15323269.2022.2124802
- Patel, A. K., Singh, M., Singh, K., Patel, A. K., Varma, A. K., & Kuri, R. (2021a). Visualizing Publication Trends in Webology Journal: A Bibliometric Review based on the Scopus Database (2006-2020). *Library Philosophy and Practice (e-journal)*, 5995:1-24. <https://digitalcommons.unl.edu/libphilprac/5995>



- Patel, A. K., Singh, M., Patel, A. K., & Singh, K. (2021c). Mapping of Global Research Trends in Financial Literacy: A Scientometric Approach. *Library Philosophy and Practice (e-journal)*, 5141:1-19. <https://digitalcommons.unl.edu/libphilprac/5141>
- Parida, D. K., Singh, K., Nayak, S., Patel, A. K., & Patel, A. K. (2022). Publication trends in nature reviews molecular cell biology: A scientometric analysis based on scopus database. *Pearl: A Journal of Library and Information Science*, 16(1), 29-40.
- Pritchard, A. (1969). Statistical bibliography or bibliometrics? *Journal of Documentation*, 25:348–349.
- Putera, P. B., & Pasciana, R. (2021). Big Data for Public Domain: A bibliometric and visualized study of the scientific discourse during 2000–2020. *Policy & Governance Review*, 5(3):220-239.
- Rawat, D. S., Singh, K., Singh, M., Patel, A. K., & Patel, A. K. (2021). Research Productivity of Wadia Institute of Himalayan Geology. *Library Philosophy and Practice (e-journal)*, 5804:1-22. <https://digitalcommons.unl.edu/libphilprac/5804>
- Scopus. (n.d). Welcome to Scopus. Accessed April 4, 2021. <https://www.scopus.com/>
- Sengupta, I. N. (1992). Bibliometrics, informetrics, scientometrics and librmetrics: an overview. *Libri*, 42 (2):75-98.
- Sharifi, A., Simangan, D., & Kaneko, S. (2020). Three decades of research on climate change and peace: a bibliometrics analysis. *Sustainability Science*, 16:1079–1095. <https://doi.org/10.1007/s11625-020-00853-3>
- Singh, I., Singh, P., Rawat, P., Patel, A. K., Singh, M., Singh, K., & Patel, A. K. (2021). Research Productivity of Forest Research Institute, Dehradun during 1990-2019: A Scientometric Approach. *Indian Forester*, 147 (8):767-777. DOI: 10.36808/if/2021/v147i8/164678
- Tan, H., Li, J., He, M., Li, J., Zhi, D., Qin, F., & Zhang, C. (2021). Global evolution of research on green energy and environmental technologies: A bibliometric study. *Journal of Environmental Management*, 297:113382. <https://doi.org/10.1016/j.jenvman.2021.113382>
- Van Eck, N., & Waltman, L. (2009). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*, 84 (2):523–538.
- Wu, L., Wang, D., & Evans, J. A. (2019). Large teams develop and small teams disrupt science and technology. *Nature*, 566 (7744):378–382.
-