

The Application of Bibliometric Analysis in Examining the Research Results on Vulnerability and Resilience of the Local Community on environmental change: a VOSviewer and Rstudio-Based Literature Review

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Abstract. The vulnerability and resilience of local communities in the context of environmental change are spread across multiple fields of study, presenting challenges in knowledge synthesis and the identification of research gaps. This study aimed to show and analyze the global research landscape regarding the vulnerability and resilience of local communities in relation to environmental changes caused by the extractive mining industry. The finding of this study was expected to provide a comprehensive picture of the condition and description of research results on the vulnerability and resilience topic. Furthermore, to achieve the objective of this study, we used bibliometric analysis with the VOSviewer and RStudio approaches. The results showed a total of 408 publications published between 2005 and 2025 were identified in the Scopus database in 20 years. The predominant sources of scientific article publication statistics are three countries—the United States, the United Kingdom, and India. The majority of publications explore the correlation between vulnerability and resilience concerning environmental change associated with disasters or natural hazards. No distinctive correlation exists between local community vulnerability and resilience concerning the extractive mega-mining industry.

1 Introduction

In recent decades, the study of community vulnerability and resilience in the face of natural hazard and/or environmental change has expanded significantly. This growth stems from a deeper understanding that the effects of such events are influenced not only by geophysical and climatic factors but also by the social, economic, and cultural contexts of the impacted

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communities [1]. Studying vulnerability and resilience provide practical benefits across multiple fields including disaster risk management, community development, and individual well-being. Understanding vulnerability enables us to identify and mitigate factors that make individuals susceptible to harm, while understanding resilience helps us develop strategies to strengthen those systems' ability to cope with and recover from adversities.

Approaching on community vulnerability and resilience is crucial for sustainable development planning and effective disaster mitigation. Understanding the level of vulnerability allows us to identify the most vulnerable community groups and design appropriate interventions. Understanding resilience, on the other hand, helps us to better understand communities' ability to recover and adapt after facing challenges, thereby supporting stronger recovery and development strategies.

Vulnerability is a condition of community that lead to inability to face threats. It refers to potential for loss, where losses itself are varies geographically, over time and involving different social group[2]. Vulnerability is a condition of community that lead to inability to face threats. It refers to potential for loss, where losses itself are varies geographically, over time and involving different social group [2]. From anthropology and sociology perspective explains that there is distinction between social and economic vulnerability [3]. For social vulnerability is mostly focus on the multidimensionality of poverty, how to use participatory methods to understand the qualitative features of poverty comprehensively. It also including the analyses on the roles of social institutions and power in creating vulnerability.

Community resilience is the ability of a community to withstand for anticipated of natural/human-caused hazard, adapt to changing condition and recover from disruption. Resilience also enables to imply the degree of shock or change that can be tolerated, which include the idea that resilient system can have the capacity to absorb, utilize or even benefit from shocks. Vulnerability, resilience, and sustainable livelihoods are closely related and influence each other. Vulnerability is susceptibility to threats or negative impacts, while resilience is the ability to survive, adapt, and recover from those impacts. Meanwhile, sustainable livelihoods are efforts to ensure sustainable livelihoods that can withstand external shocks.

However, on the other hand, environmental changes somehow will enhance the community resilience and how they survive by adapting to existing conditions. Resilience, adaptive capacity, and vulnerability are correlating each other. The relation of those three components is using to describe how human and natural system respond to perturbations and shocks. This research will focus on how environmental changes (loss of forest and agricultural lands) around the mining sites have impacts on the level of community vulnerability and resilience toward disruption of local agri-food system, and shifting on livelihoods. Therefore, today, vulnerability approach is mostly based on cross disciplinary integration and multiple factors. Despite the various methods to measuring the vulnerability, still, there are several best practices.

Many of the previous study are more corresponding to how environmental change or destruction led to an increase of people vulnerability as well as resilience toward hazard/shock or stress. But there are just a few focus on how environmental degradation causes by mega mining industry and its consequences toward the exposure such as disruption of local agri-food system and change of land-based livelihoods. This study is aiming to documenting all the exposure as above mentioned toward the local community vulnerability and how they build up their adaptive capacity to survive and to continue life in that living zone.

Bibliometric analysis is a quantitative approach for examining scientific literature by utilizing publication statistics, which encompass citation patterns, researcher collaboration, and trends within fields. This tool is essential for assessing research productivity, recognizing emerging topics, and mapping interdisciplinary scientific collaborations [4]. The application of tools like VOSviewer and RStudio analysis yields significant insights into research

dynamics, assisting researchers and policymakers in developing strategies and guiding future research efforts.

Bibliometric analysis is a technique employed to assess and evaluate scientific literature through diverse metrics. Bibliometric analysis is a valuable approach for investigating scientific communication, trends, influences, and interactions across different fields[5]. This is the statistical study that examines bibliographic data, including citations, publication frequencies, author affiliations, and keywords, that provides insights into the patterns and trends of scientific literature[6].

Bibliometric analysis tools, including VOSviewer and Rstudio, are essential for mapping collaboration networks among researchers, identifying thematic clusters, and tracing the evolution of key concepts within scientific literature[7]. Furthermore, Bibliometric, an R-studio based software, has been developed to facilitate comprehensive bibliometric analysis, incorporating advanced data visualization techniques. These tools facilitate complex and interactive network visualization, assisting researchers in identifying key trends and relationships among subjects within a specific field.

The main objective of bibliometric analysis is to evaluate the impact and influence of scientific research, as well as to identify key contributors and research domains within a specific field. This offers researchers, institutions, and policy makers essential insights into productivity, visibility, and collaboration patterns within a specific area of study.

2 Research Method

This study uses bibliometric approaches to identify trends, patterns, and developments in research on vulnerability and resilience of the local community over the past twenty years. Bibliometric analysis is one method that can provide in-depth insights into the network of researchers, journals, and research topics through bibliographic data mapping. This study utilizes VOSviewer and Rstudio software, which allows data visualization in the form of a network map of relationships between authors, journals, and keywords that often appear in the literature.

The flow diagram created for this research is shown in Figure 1. In the first stage, the data collection starts by conducting a systematic search in the Scopus database using keywords such as "vulnerability and resilience of the local community. The data collected involves metadata such as author name, title, journal name, year of publication, keywords, author's affiliation and publisher from 2005 to 2025 (20 years). The data received was in CSV file (stage 2) which comprising of 408 documents from journal, books and etc. The next stage (stage 3) is importing the bibliographic file into VOSviewer and Rstudio for further processing. The result of the data display (stage 4 and 5) will provide several important information such as main information about the topic, most relevant author, and countries production over time.

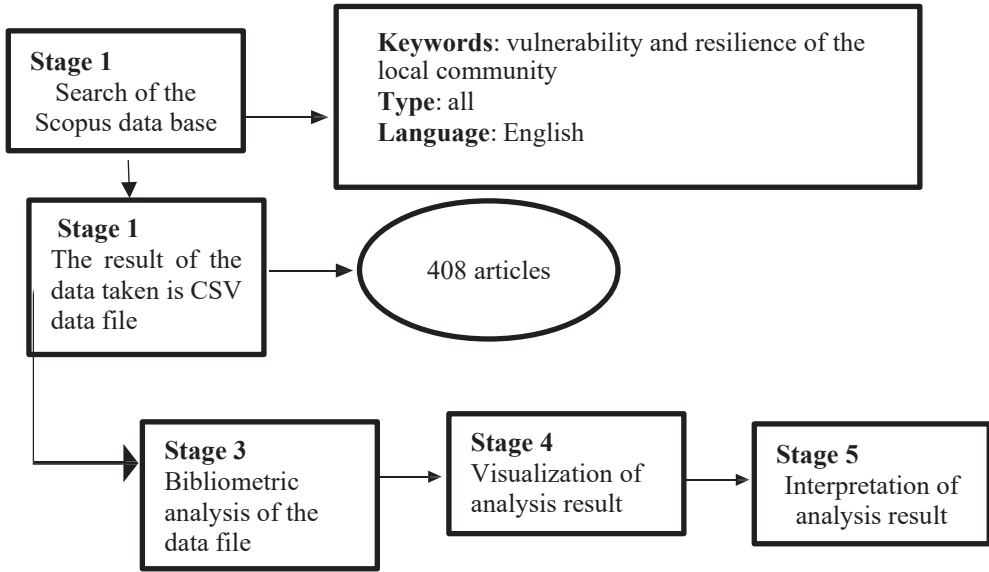


Fig. 1. Diagram of the research.

3 Results and Discussions

3.1 Main information about the topics

A total of 408 publications published between 2005-2025 were identified. In Table 1, general information about the data set obtained after the search profile of publications related to vulnerability and resilience of the local community and enterprises in the Scopus database in 20 years is given.

Table 1. Main information about the topic.

Description	Results
Main information about data	
Timespan	2005:2025
Sources (Journals, Books, etc)	295
Documents	408
Annual Growth Rate %	15,55
Document Average Age	4,49
Average citations per doc	20,3
References	22713
Document contents	
Keywords Plus (ID)	1609
Author's Keywords (DE)	1303
Authors	
Authors	1523
Authors of single-authored docs	64

Description	Results
Authors collaboration	
Single-authored docs	67
Co-Authors per Doc	3,88
International co-authorships %	32,6
Document types	
Article	266
Book	3
Book chapter	83
Conference paper	34
Data paper	1
Editorial	1
Review	20

This data presents a statistical overview of a research topic over a 20-year period, from 2005 to 2025. A total of 408 documents were published from 295 sources (journals, books, etc.). This research topic shows steady and significant growth, with an annual growth rate of 15.55%. The average document age is 4.49 years, indicating that most publications are relatively recent. Furthermore, each document has an average of 20.3 citations, indicating that publications in this field have a significant impact on the academic community.

These documents included a total of 1,609 keywords from "Keywords Plus" and 1,303 keywords from "Author's Keywords," indicating that the research topic is highly diverse and encompasses numerous subfields. The study involved a total of 1,523 authors, with an average of 3.88 authors per document. This suggests that collaboration is a common practice in this field. However, 67 documents were written by a single author, involving 64 different authors. International collaboration was also quite prominent, with the percentage of international collaboration reaching 32.6%.

Majority of published documents are journal articles, with a total of 266 documents. In addition to articles, there are also 83 book chapters, 34 conference papers, and 20 reviews. Other document types, such as books, data papers, and editorials, are also found, but in very small numbers. This distribution of document types indicates that scientific journals are the primary publication medium for disseminating research findings in this field, but publications in the form of books and conference proceedings also play an important role.

The result shows that bibliometric analysis data of 408 Scopus-indexed documents are mostly focus on vulnerability and resilience in relation to disaster risk, natural hazards and climate-induced extreme events. No articles explicitly connect vulnerability and resilience with environmental change caused by mining activities. Although vulnerability and resilience have been extensively studied in the context of natural hazards and disaster risks, their application to environmental change driven by extractive industries, particularly mining, remains critically underexplored.

3.2 Most relevant authors

The "Most Relevant Authors" chart is a simple visualization that displays a list of the most relevant authors based on the number of documents or publications they have produced. The visualization is organized in a horizontal bar chart format, where each row represents an author and the length of the row indicates the number of documents published by that author.

The number of documents is also displayed within a coloured circle at the end of each bar. The "Most Relevant Authors" chart is a simple visualization that lists the most relevant authors based on the number of documents or publications they have produced. The visualization is organized in a horizontal bar chart format, where each row represents an author and the length of the row indicates the number of documents published by that author.

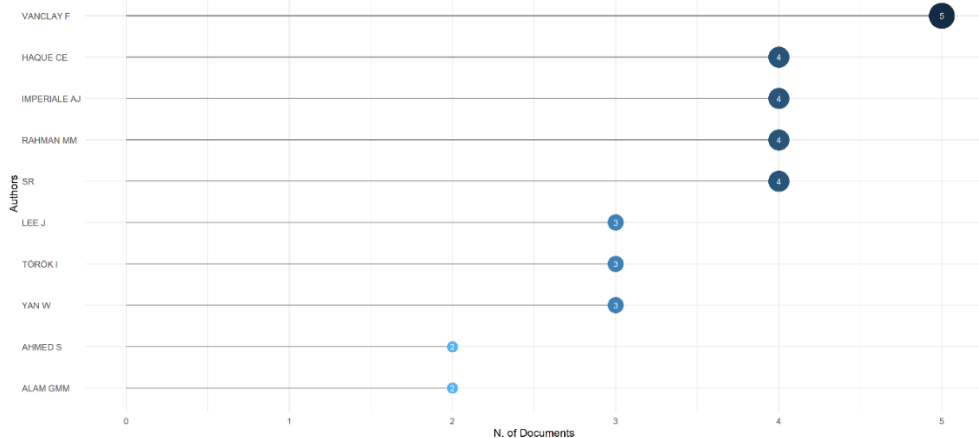


Fig 2. Most relevant author

The "Most Relevant Authors" chart is a simple visualization that displays a list of the most relevant authors based on the number of documents or publications they have produced. The visualization is organized in a horizontal bar chart format, where each row represents an author and the length of the row indicates the number of documents published by that author. The number of documents is also displayed within a coloured circle at the end of each bar. The "Most Relevant Authors" chart is a simple visualization that lists the most relevant authors based on the number of documents or publications they have produced. The visualization is organized in a horizontal bar chart format, where each row represents an author and the length of the row indicates the number of documents published by that author. The number of documents is also displayed within a coloured circle at the end of each bar. Based on the data presented, Vanclay et al, are the most productive or relevant author, [8], [9], and [10]. This author occupies the top position, and the circle at the end of the bar is the largest, visually reinforcing his position as the author with the most contributions. Vanclay's publications focus on the relationship between community resilience and disaster risk reduction. Below him are four other authors with the same number of documents. They are Haque CE[11], and [12]. Similarly, Haque also mostly concentrate on community vulnerability and resilience on disaster risk reduction. Each of them has significant contributions and is in the second most productive cluster. There are three authors who have published three papers They are Lee J, Torok I, Yan W.[13] and [14] [15] . They form a medium-level productivity group. Overall, this visualization clearly and concisely shows the hierarchy of author contributions, highlighting Vanclay F as the leading author and grouping the other authors based on their productivity levels. Lastly, all the most relevant actors above are contributing to the discourse on community vulnerability and resilience concerning natural hazard and disaster risk. However, the approaches and research founding describe the fragility of the local community in facing hazard. Thus, it can be applied to comprehend the concept of vulnerability and resilience in relation to environmental change caused by mega mining industry. This study further re-contextualize the concept that transfer the vulnerability-resilience framework from natural hazard paradigm to anthropogenic environmental, specifically mining-induced change.

3.3 Countries production over time

As mentioned previously, that the data taken is referring the Scopus database The predominant sources of scientific article publication statistics are three countries—the United States, the United Kingdom, and India during the period from 2021 to 2025 (Table 2). The United States and the United Kingdom were the two countries with the highest number of published articles during this time period. Specifically, publications from the United States showed a consistent annual increase, from 99 articles in 2022 to 171 articles in 2025. Similarly, the United Kingdom also experienced an upward trend, with the number of articles increasing from 94 in 2021 to 148 in 2025. Meanwhile, India entered the list in 2025 with 137 articles, placing it in third place behind the United States and the United Kingdom for the same year. This data provides a snapshot of the scientific production of some of the most productive countries during the listed.

Table 2. Countries production over time.

Country	Year	Articles
USA	2025	171
UNITED KINGDOM	2025	148
USA	2024	140
INDIA	2025	137
USA	2023	119
UNITED KINGDOM	2024	116
UNITED KINGDOM	2023	107
UNITED KINGDOM	2022	101
USA	2022	99
UNITED KINGDOM	2021	94

3.4 Word cloud

Based on the presented word cloud (Figure 3), it can be seen that the most dominant key topics are "vulnerability" and "climate change," indicated by their very large font size. This indicates that these two keywords are central and most frequently discussed themes in the analysed document collection. Other smaller, but still prominent, keywords closely related to these two main topics are "disaster management" and "risk assessment," indicating the research's focus on disaster management and risk assessment.

Furthermore, there are a few other smaller keywords clustered around these main topics (Figure 2). Words such as "sustainable development," "human," "adaptive management," "decision making," "flooding," and "local community" indicate diverse subthemes. Some keywords also indicate specific geographic locations, such as "Pakistan," "Bangladesh," "United States," and "Australia," as well as specific issues, such as "food security," "resilience," and "biodiversity." This entire word cloud illustrates that the related research areas are very broad, with "vulnerability" and "climate change" as the core of the discussion, which then branch out into various social, environmental, and managerial aspects.

participation in reducing disaster risk and achieving sustainable development. Another cluster focuses on "adaptive management" and "local knowledge," which are linked to terms such as "mangroves," "coastal zone," and "ecosystems." This demonstrates that adaptive management and traditional knowledge are vital in maintaining ecosystems and protecting coastal zones from threats. A time-trend analysis, indicated by a colour scale ranging from purple (2017) to yellow (2022), reveals the evolution of research topics. Older nodes (in purple and blue), such as "urban planning" and "disaster prevention," indicate that these topics were the foundation of research. Over time, the focus shifted to the central topics (in green), namely "vulnerability" and "resilience," which became very dominant in the 2018-2020 period. Furthermore, in the more recent period (2020-2022), yellow nodes, such as "COVID-19," "pandemic," and "psychology," appeared on the periphery of the network. This indicates a broadening of the research focus to integrate the impacts of the global pandemic, demonstrating how the health crisis also affects issues of vulnerability and resilience, and adding a psychological dimension to the study.

4 Conclusion

This study used a bibliometric approach to identify recent research trends regarding the vulnerability and resilience of local communities in the context of environmental change, utilizing VosViewer and RStudio software. The study results show a consistent increase in publications related to the number of publications concerning this issue over the past two decades. A total of 408 documents were published from 295 sources (journals, books, etc.) and the most publications are relatively recent. Significant growth was seen in research focusing on "vulnerability" and "resilience" as the central core connecting various other topics that closely related to disaster management and sustainable development. The majority of scientific article publication data come from three countries—the United States, the United Kingdom, India, and others also contributed to the increasing number of studies in this area. Bibliometric analysis enabled us to identify significant contributors and research among the relevant literature. This bibliometric analysis provides a foundational reference for future empirical and conceptual investigations into community vulnerability and resilience in areas impacted by mining activities

In conclusion, this study enhances the existing literature by identifying a notable thematic gap in vulnerability and resilience research, specifically the lack of investigations into environmental change resulting from mining activities. This study maps global research trends from 2005 to 2025, offering a foundational reference for future investigations aimed at expanding vulnerability and resilience frameworks beyond the contexts of natural hazards to include environmental changes driven by extractive industries. This work establishes a foundational conceptual and bibliometric baseline for further research on mining-affected communities.

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