

Bamboo Material for Sustainable Development: A Systematic Review

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Abstract. Bamboo is a natural and sustainable material for the export-oriented furniture, architecture, and construction industries. This study aimed to review the body of knowledge and scholarly research on bamboo material for sustainable development. It identifies significant issues, trends, and knowledge gaps in bamboo materials for sustainable development. A systematic literature review was conducted using the PRISMA protocols for working and summarising published studies. Twenty-two peer-reviewed publications were included after a thorough search of the Scopus databases. Bamboo material plays a role in supporting the implementation of sustainable development as a renewable resource, low carbon footprint, sustainable harvesting, and versatile material. Sustainable development, governance, and regulation of government policies on natural material resources such as bamboo are expected to increase the productivity of companies and are suggested in future considerations.

1 Introduction

Bamboo, a naturally occurring material, possesses numerous advantageous qualities and thrives in tropical regions [1]. In this study, we aim to investigate the effects of climate change on biodiversity. Specifically, Bamboo plants are distributed throughout a vast expanse exceeding 35 million hectares inside tropical and subtropical climates. This particular plant serves as a crucial provider of sustainable biomass and has historically been utilized as a domestic commodity [2]. According to the second source, the aforementioned plant has a distinctive characteristic of possessing a notable level of output. The plant exhibits rapid growth and establishes a dense forested region, characterized by a relatively short production cycle, hence yielding advantageous outcomes over an extended duration. Bamboo possesses the capacity to enhance the local economy and make a significant contribution towards mitigating the effects of climate change. Bamboo serves as a viable ecological substitute for wood species that face the risk of extinction [3]. Bamboo material holds promise as a viable construction and industry resource in developing nations. Bamboo is often regarded as a significant factor in promoting sustainable development, particularly in

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rural regions. In addition to its prolific growth, bamboo possesses potential for future generations as a fundamental commodity and various other significant applications [4]. This plant has a range of advantages in terms of its economic, social, and environmental implications. The utilization of bamboo material in the production of furniture and craft products has been substantiated as a viable commercial practice, hence presenting economic prospects for rural populations [5].

Nevertheless, it is worth noting that the management and utilization of bamboo, despite being an abundant natural resource, is not commonly recognized. Bamboo, a non-wood species, thrives in tropical and subtropical regions. It has been cultivated as a viable alternative material with economic significance, offering the advantage of substituting wood in the production of various items such as pulp and paper, stripboard material, matboard, veneer, plywood, particle board, and fiberboard [6]. In order to ensure the sustainable growth of bamboo materials in the future, it is imperative to adopt a strategy that promotes a harmonious coexistence between social, economic, and natural environmental systems. This is particularly crucial in developing nations where bamboo resources play a significant role in enhancing rural economies. This approach is deemed suitable for attaining sustainable development, which encompasses three primary dimensions, including the fundamental principles pertaining to economic advancement, environmental preservation, and social equity [7]. As stated by the source [8], the incorporation of sustainable development is a crucial aspect of the forestry industry's long-term sustainability plan. This is particularly significant in developing nations where the utilization of natural resources plays a vital role in alleviating poverty among rural communities. Sustainable development is anticipated to offer viable resolutions for addressing fundamental human necessities, fostering economic progress, attaining social equity, and safeguarding the environment. The primary premise and essential goal is to foster the development of a civilization characterized by heightened consciousness through the adaptation to environmental constraints [9].

This research article offers novel perspectives on the significance of bamboo material policy in the context of developing nations that possess the capacity for cultivating bamboo plantation forests. Previous studies have not examined or addressed the regulatory aspects of managing bamboo plants for the furniture and crafts industry, particularly in relation to sustaining continuous export-oriented manufacturing. In the future, it is anticipated that the endeavour to establish governance and government regulatory involvement will be a strategic measure aimed at achieving sustainable development.

The examination of bamboo plants as a feasible alternative natural resource is of utmost importance given their significant capacity to promote economic development and social well-being in rural areas. This study undertakes a thorough examination of relevant scholarly literature in order to explore the possibilities of bamboo materials within the context of sustainable development. This research provides valuable insights into the significance of literature reviews in enhancing researchers' comprehension of the potential applications of bamboo in addressing strategies for natural resource processing within the craft industry. Furthermore, it underscores the significance of government policy recommendations in effectively exploiting the future potential of bamboo. A systematic review is utilized to collect all pertinent empirical information, adhering to pre-established eligibility criteria, in order to address a certain research question. The selected methodology, characterized by its explicit and systematic nature, is utilized in order to mitigate bias and guarantee the generation of reliable outcomes. This methodology is employed to draw inferences and assist the process of making decisions [10]. Scholars utilize systematic review procedures in relevant academic sources to conduct a systematic review, which requires setting a feasible timeline for its completion [11].

The central emphasis of the systematic review revolved around the research inquiry: "What are the effective and sustainable methods of utilizing natural bamboo materials?" The primary aim of this study is to analyze the potential of bamboo resources as a viable strategy for advancing sustainable development by utilizing alternative materials. There is a

significant focus on the exploitation of craft businesses that are oriented towards export. There exists a significant emphasis on the significance of governmental rules pertaining to the governance and formulation of policies regarding bamboo natural resources. This phenomena might be ascribed to the potential for enhancing organizational efficiency, hence emphasizing the importance of careful consideration in future endeavors. This study examines the imperative nature of performing a comprehensive inquiry into bamboo materials, followed by a subsequent part that outlines the methodology employed to address the specified research questions. A comprehensive analysis and synthesis of scholarly literature was undertaken to differentiate, choose, and assess noteworthy studies pertaining to the control of raw material procurement for firms focused on exporting. The concluding portion of this article examines the fundamental measures that the government must do in order to prioritize sustainable governance in resolving the aforementioned concerns. The materials and methods component of the study consists of five primary sub-sections, namely PRISMA, resources, inclusion and exclusion criteria, systematic review phases, and data abstraction and analysis.

The foundation of this systematic review is in the primary research inquiry: In what ways can natural bamboo materials be employed in a sustainable manner? The primary focus of this inquiry is on bamboo resources and their role in supporting the implementation of sustainable development for alternative materials. Significant emphasis is placed on the utilization of export-oriented craft industries. Significant emphasis is placed on the significance of government regulation in relation to the governance and implementation of policies pertaining to bamboo as a natural resource. This is due to the potential for such regulations to enhance the productivity of firms, hence necessitating careful consideration for future endeavors. Furthermore, this part elucidates the necessity of undertaking a comprehensive systematic review pertaining to bamboo materials. In contrast, the subsequent sections outline the methodology employed to address the research inquiries presented in the present study. In addition, the process involves the systematic review and synthesis of scientific literature in order to discern, choose, and assess noteworthy studies pertaining to the governance of raw material sourcing in enterprises focused on exporting. This portion of the study examines the necessary activities that the government must do to prioritize sustainable management in addressing the stated challenges. The materials and methods section of the study encompasses five primary sub-sections, namely PRISMA, resources, inclusion and exclusion criteria, stages of systematic review, abstraction, and data analysis. These sub-sections provide a comprehensive description of the approach and techniques employed in the research process.

2 Material and Methods

This section describes the five main sub-sections namely: PRISMA, resources, inclusion criteria and exclusion, the systematic review process, and abstraction and analysis of research data.

2.1 Prisma

The PRISMA, also known as the Preferred Reporting Items for Systematic Review and Meta-Analysis, is a widely accepted and recommended protocol for the systematic examination of literature. The aforementioned publication guidelines are necessary for the purpose of identifying, selecting, evaluating, and integrating research findings. The systematic review employs the PRISMA 2020 reporting guidance, which has been introduced as a replacement for the 2009 declaration. According to [12] modifications have been made to the structure and presentation of elements in order to enhance implementation. It is imperative to provide a comprehensive account of the methodologies employed and the outcomes obtained in

systematic reviews, so as to facilitate the evaluation of the dependability and relevance of the review's conclusions by its consumers. The authors of the article "The Statement of Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)" have developed a guideline called PRISMA, which aims to enhance the transparency and comprehensiveness of reporting in systematic reviews. The guideline has been recently updated to PRISMA 2020 in order to incorporate the latest advancements in systematic review methodology and terminology [13]. In order to enhance the transparency of review reporting, aid in the assessment of validity and applicability, promote review replication, and enhance the utility of systematic review findings in the context of diagnostic test accuracy studies, it is recommended to utilize the PRISMA diagnostic test accuracy guidelines as outlined by [14]. The objective of the PRISMA methodology is to comprehensively evaluate the database by systematically locating, evaluating, and summarizing all pertinent research in a manner that is transparent and can be replicated. Furthermore, the utilization of the PRISMA framework facilitates the systematic extraction and synthesis of pertinent data pertaining to sustainable development evaluations in the context of future bamboo research. The authors employ a business model innovation framework in order to generate thematic maps based on the emerging topics [15].

2.2 Resource

This research review method was carried out using the main database, namely indexed Scopus. A structured systematic review uses keywords to collect, find, assess, and summarize all studies that match predetermined review questions. Appropriate data sources must be available before conducting a review and find as many as 546 journals related to the study of bamboo materials for sustainable development. A systematic literature review was carried out to obtain relevant research possibilities, but a comprehensive manual search for database access was also carried out in this study to obtain topics related to bamboo material resources in the introductory section.

2.3 The Systematic Review Process for Selecting the Articles

2.3.1 Identification

The PRISMA methodology was employed in this investigation to facilitate the execution of a comprehensive and methodical examination of the existing literature. The investigation conducted a thorough examination of a wide-ranging scientific literature database by means of a complete literature review. This study employed pertinent keywords in the investigation of bamboo plants in the context of sustainable development goals, as documented in the Scopus worldwide database. The Scopus database is widely regarded as the foremost source of information and literature, particularly in the realm of scientific papers. The present study employed the terms "bamboo" and "sustainable development" in the title, abstract, and author keywords to retrieve pertinent Scopus data, as depicted in Figure 1. The method of searching for data is constrained to the acquisition of annual data, with the aim of gathering comprehensive and fully published data pertaining to a specific year. The search query choices utilized in the field of mining may include the combination of the terms "Bamboo*" and "Sustainable Development*" in the title and abstract keywords, as of May 2023. During this stage, a total of 22 articles were identified.

2.3.2 Screening

The initial phase of the filtration process is designed to eliminate duplicate items by means of identification. In this particular instance, no articles were omitted during the initial phase,

however 27 articles were eliminated in the subsequent stage based on the inclusion and exclusion criteria established by the researchers. The process of data extraction was conducted by two independent reviewers, and the results obtained were afterwards compared. Based on the initial criterion, the researchers made the decision to concentrate on research articles that provide empirical data derived from primary sources. Consequently, for the present study, disbursement types such as systematic reviews found in book series, conference proceedings, and trade publications were excluded. Furthermore, it is crucial to acknowledge that only studies published within the past five years (namely, between 2018 and 2024) were chosen for inclusion in this study. In summary, a total of five articles were removed based on the aforementioned criteria (see to Table 1).

Table 1. The inclusion and exclusion criteria

Criterion	Eligibility	Exclusion
Literature type	Journal (research articles)	Review, Conference Paper, Book Chapter, Conference Review, Book, Data Paper, Note, Short Survey
Language	English	Non-English
Timeline	Between 2018 and 2024	< 2018
Countries and territories	Asian countries, Americas countries, Africas countries	Other than mentioned
Subject Area	Agricultural and Biological Science	Other than Agricultural and Biological Science

2.3.3 Eligibility

During the third stage, a number of articles are prepared to assess their practicality. During this phase, a comprehensive examination is conducted on all articles that include the title, abstract, and primary content. The purpose of this examination is to verify that the articles meet the predetermined inclusion criteria and are pertinent for use in research, aligning with the study objectives to be accomplished. Consequently, a total of five publications were omitted from the analysis due to their reliance on empirical evidence and lack of emphasis on the utilization of bamboo materials in the context of sustainable development. In the final analysis, a total of 22 articles were retained (Refer to Table 2).

Table 2. The main theme and sub themes

Author	Material	Environment	Social	Economi	Regulation
	TT	SM	RR	I	IR
Ishimaru H., et al (2023)	✓				
Liang E., et al (2023)	✓				
Yu L., et al (2023)	✓				
Luo Y., et al (2023)					✓
Wu F., et al (2023)	✓				
Shen X., et al (2022)	✓				
Bora M., et al (2022)	✓				
Guo Z., et al (2022)	✓				
Yang K., et al (2022)	✓				
Luan Y., et al (2022)	✓				

Huang B., et al (2022)	✓				
Xu Z., et al (2022)	✓				
Zhou X., et al (2022)	✓				
Alamerew A., et al (2022)	✓				
Si C., et al (2021)	✓				
Liu P., et al (2021)	✓				
Zhu A., et al (2021)	✓	✓		✓	✓
Tian T., et al (2020)		✓			
Luo B., et al (2020)				✓	✓
Sawarkar A.D., et al (2020)				✓	✓
Li X., et al (2020)	✓	✓			
Xie L., et al (2019)					

Material **Environment** **Social** **Economy** **Regulation**
 TT = Treatment SM = Strategy RP = Rural I = Industry IR = Intervention
 Technology Management People Regulation

2.4 Data Abstraction & Analysis

The present study employs an integrative review, which is a research methodology that combines and analyzes several research designs, including qualitative, quantitative, and mixed methodologies approaches. An integrative literature review is a research methodology that involves the comprehensive examination, critical evaluation, and synthesis of relevant scholarly works pertaining to a specific theme or topic. The primary objective of this approach is to generate a novel framework and viewpoint on the subject matter by analyzing and integrating representative literature [16]. The present study employed a thematic analysis methodology to establish relevant themes and sub-themes. The initial phase of theme creation involves the compilation of data. At this juncture, a meticulous examination of the 546 chosen articles was undertaken to extract assertions and data sources that addressed the research inquiry. During the second step, the data collected by the author's group is given significance through a process of coding based on the inherent properties of the data. The difficulty in constructing themes is comparable to that of constructing categories, as both require maintaining consistent levels of abstraction and interpretation throughout the process. This involves ensuring that all measures are logically grouped and performed in a congruent manner [17]. During the third step, the review process yielded the identification and categorization of five primary topics, specifically: material, environmental, social, economic, and regulatory. The subsequent protocol entails the reviewer's progression through each chosen item, wherein each topic, concept, or idea is interconnected in the formation of overarching themes and sub-themes. Moreover, additional processing led to the identification of 12 sub-themes. The articles were generated by the corresponding author, who relied on the consistent contributions of the co-authors in terms of identifying recurring themes in the research. Throughout the analysis process, meticulous records were maintained to capture any notions or ideas relevant to the interpretation of the data. Furthermore, the researchers conducted comparisons and engaged in conversations in order to address any contradictions that arose during the process of theme creation. There is a need to make adjustments to the developed themes and sub-themes in order to ensure consistency. Ultimately, the author assesses the appropriateness of the paper's substance in relation to the theme and guarantees coherence.

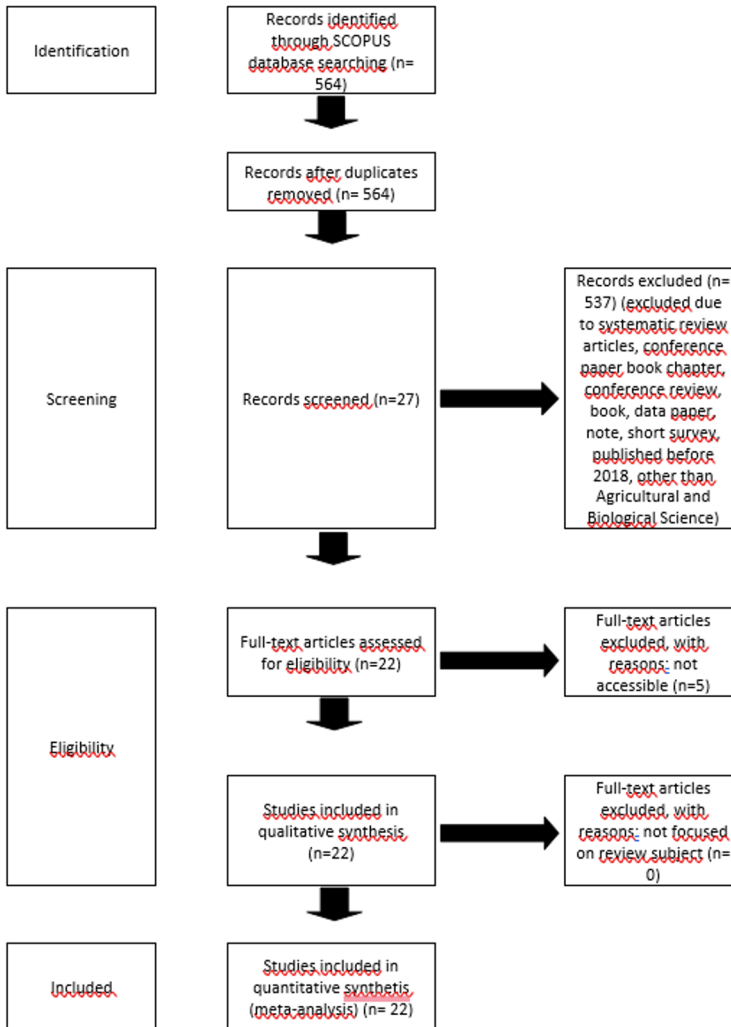


Fig. 1. Flow Diagram of the study

This comprehensive literature review employs both quantitative and qualitative synthesis analyses. Quantitative analysis includes the examination of country affiliations and writers. Qualitative research uses a topic matrix methodology to examine the interplay between bamboo and sustainable development. The qualitative perspective encompasses various themes, including care technology, strategic management, rural communities, industry, and regulatory interventions. The sub-themes encompassed within the industrial topic are pulp and paper, housing, construction, health, renewable energy, handicraft products, furniture products, and food.

3 Result

3.1 General Findings & Study Background included in the Review

The research study yielded five distinct themes pertaining to the utilization of bamboo in the context of sustainable development. As depicted in Figure 4, the five overarching themes

identified are material (with 1 subtheme), environment (with 1 subtheme), social (with 1 subtheme), economic (with 8 subthemes), and regulation (with 1 subtheme). The main and sub-theme study encompasses a comprehensive range of research on material, social, economic, environmental, and regulatory aspects, as indicated in Table 2.

Table 3. Analysis of Qualitative Bamboo Sustainable Development

Theme		Authors
Material	Treatment Technology	[1,2,8,18–30]
Environmental	Strategy Management	[23,31]
Social	Rural People	[32]
Economy	Industry	[3,33]
Regulation	Intervention Regulation	[3,33]

The economic features of an intelligent society can be examined using a viewpoint analysis, as seen in Table 1. The existing literature primarily centers its analysis on three key elements, namely individuals or citizens, the economy, and institutions. This inquiry seeks to obtain a more comprehensive understanding of various aspects, such as inclusivity, environment, quality of life, talent development, trust, the state of talent and the human condition, public services, offline and online freedom, as well as safety and security. Economic analysis is classified according to its global interconnectedness, entrepreneurial environment, economic resilience, and innovation capacity. In the context of this study, an examination of the publishing year can be conducted via quantitative analysis, as illustrated in Table 3. The present investigation has scrutinized the quantity of scholarly articles across different years, specifically in 2019 (n=1), 2020 (n=4), 2021 (n=3), 2022 with the most substantial volume of publications (n=9), and 2023 (n=5).

Six countries are currently engaged in the study of bamboo for the purpose of sustainable development, as depicted in Figure 2. China has been identified as the leading country in conducting sustainable bamboo research, with a sample size of 16. Other countries that have made contributions in this field include India (n=2), the United States (n=2), Japan (n=3), Hong Kong (n=1), and Ethiopia (n=1). However, it is noteworthy that China has emerged as the most prominent nation in terms of its research efforts in bamboo plant research for the purpose of sustainable development.

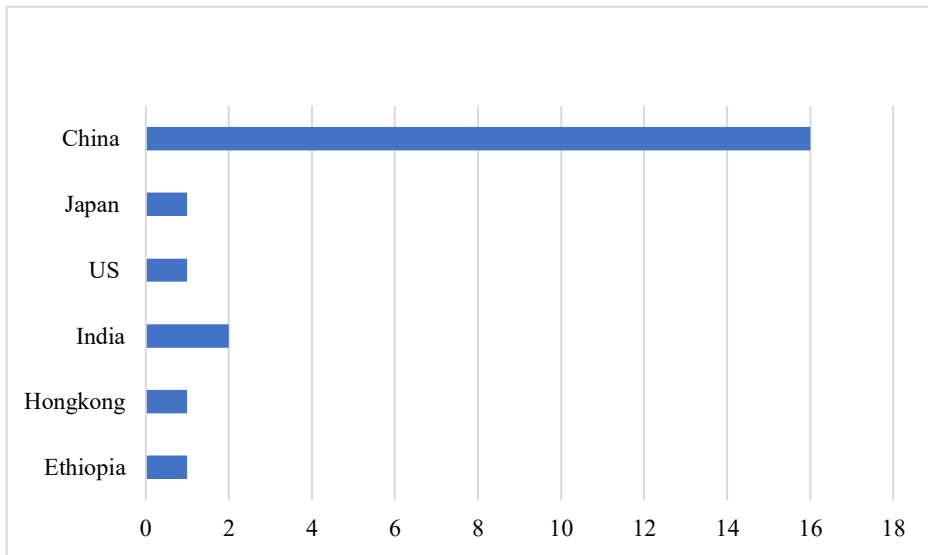


Fig. 2. Countries where the studies were conducted.

China's preeminence as a global leader in bamboo research for sustainable development can be attributed to seven key elements. China possesses a wide array of bamboo species resources, which serves as a robust foundation for research and development endeavors. Furthermore, it is worth noting that this nation has a rich and extensive historical background in the utilization of bamboo, spanning over several millennia. This versatile natural resource has been employed in several domains, including but not limited to construction and the creation of artistic and craftwork. Moreover, China boasts numerous research organizations that specialize in the study of bamboo plants, positioning itself as a prominent global reference point for bamboo research. Furthermore, China strategically incorporates innovative practices in both development and research, aiming to implement them on a large-scale industrial level through a comprehensive and integrated approach. Furthermore, the Chinese government offers support through the provision of incentives aimed at fostering research and promoting academic endeavors. The utilization of bamboo plants is a focal point for the Sixth China, which demonstrates a strong dedication to acknowledging the significance of sustainable development as a viable solution to global environmental issues. Additionally, the Seventh China has actively fostered research partnerships with numerous countries and international research organizations to advance the study and development of bamboo plants.

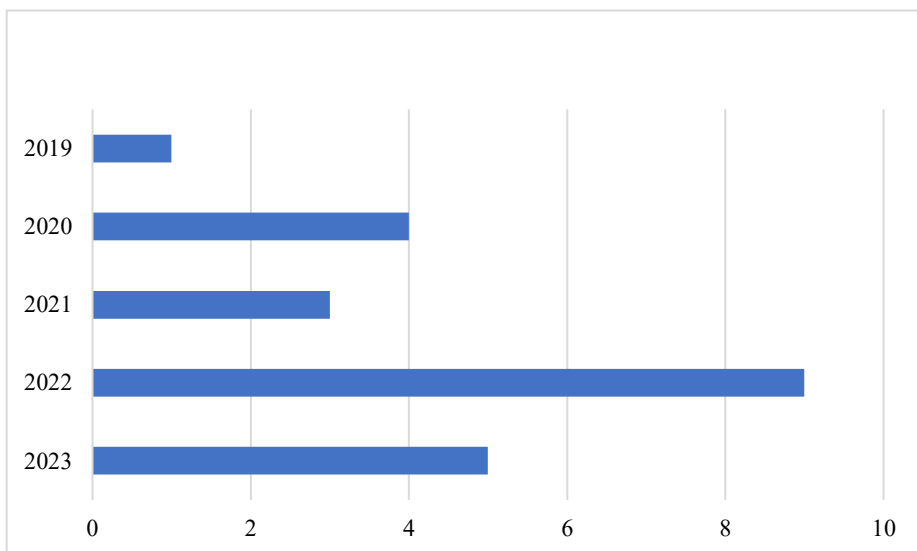


Fig. 3. Year of publication

The year 2022 exhibits the most substantial quantity of research conducted on bamboo for the purpose of sustainable development, with a total of 10 studies. This is succeeded by the years 2020, 2023, 2011, and 2019, which include 6, 5, 3, and 3 studies respectively. The year 2022 represents the pinnacle of this study endeavor. The rise of worldwide public awareness regarding the importance of maintaining harmony with the environment and the necessity of adopting sustainable practices has been significantly influenced by the COVID-19 epidemic. The aforementioned phenomenon is said to have stimulated the curiosity of scholars across many nations to explore sustainable resolutions derived from bamboo vegetation.

3.2 Main Finding

A total of 546 publications were retrieved from the selected database. After the Identification process, and Screening in the last 5 years, 27 selected articles were obtained, and based on the eligibility of relevant articles, a total of twenty-two (22) selected articles were obtained,

then the thematic analysis developed five themes, namely material development methods, environmental, social, economic and category regulations as shown in table 4. Further analysis of the themes resulted in 12 sub-themes (see Table 3). Of the 22 articles selected in this section, the discussion revolves around five main themes, namely material, environmental, social, economic, and regulatory along with 12 emerging sub-themes (see Table 3).

Table 4. Analysis of year of publication

2019	2020	2021	2022	2023
[34]	[2,3,33]	[21–23]	[1,18–20,28–30]	[8,24–27]

3.2.1 Material

Multiple scholarly articles have been published on the topic of bamboo, specifically focusing on lignocellulosic composite materials blended with polymers. These materials have garnered significant interest as they are perceived as novel alternatives for construction and furniture, aligning with the objectives of sustainable development [24]. Research has been conducted in China pertaining to various aspects of bamboo plants, including spatial distribution, landscape dynamics, forest ecosystem management, sustainable development, and forest resource utilization. China is widely recognized as the country with the highest abundance of bamboo plants [26]. Furthermore, scholarly investigations on bamboo material technology elucidate that enhancing the drying procedure can enhance the efficacy of producing bamboo manuscripts and significantly diminish energy usage, hence fostering the sustainable advancement of bamboo in agricultural agriculture [25]. The current prevalence of composite materials has resulted in their widespread adoption as cost-effective and environmentally sustainable alternatives. Consequently, there has been a growing trend towards incorporating natural elements into polymer matrices [8].

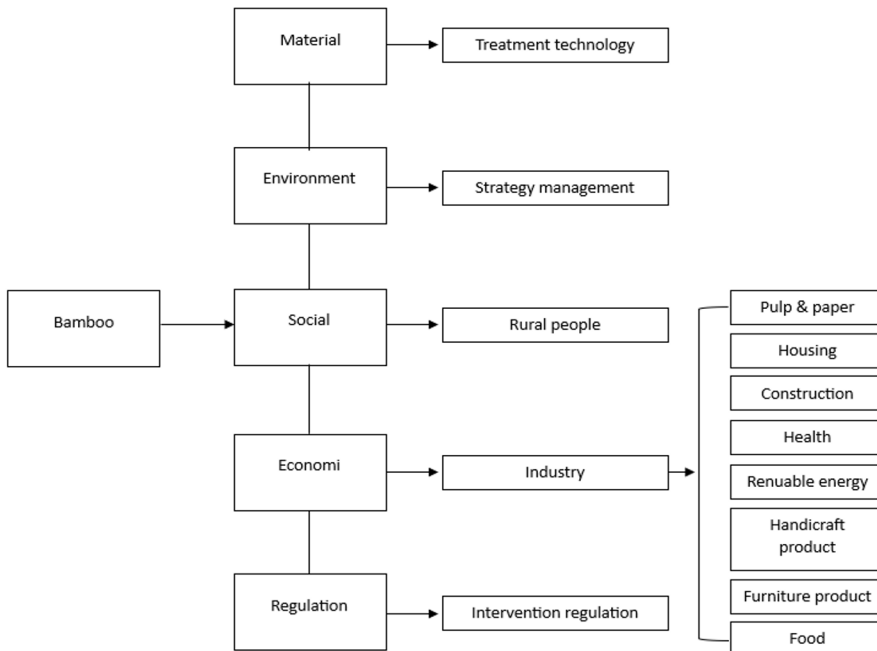


Fig. 4. Thematic map

3.2.2 Environmental

Articles on environmental themes were found to review the importance of national carbon trading for forest carbon sequestration and emission reduction, research identifying endogenous and exogenous factors for promoting stable projects and mitigating global climate change. Based on the theory of endogenous and exogenous incentives explaining internal and exogenous factors affecting forest carbon. sustainable participation of farmers in forest absorption projects [26].

3.2.3 Social

In discussing this theme, learning from the article on Moso bamboo forests in China was preceded by a study of natural and socio-economic factors from landscape changes in Moso bamboo forests and their buffer zones in China. Based on data related to social themes, Moso China bamboo forests are known to grow very fast and expand between 2010 and 2020, with the landscape becoming more fragmented, increasing landscape fragmentation, reducing aggregation, and decreasing the overall quality of the landscape [26].

3.2.4 Economy

The procurement of raw materials is crucial for the efficiency, competitiveness, and long-term sustainability of the bamboo craft and furniture business. Scholarly literature has highlighted several key findings on the industrial theme. These findings encompass the significance of collaborative efforts among craftsmen and the contribution of the local traditional bamboo industry towards fostering sustainable economic development in rural areas [8] (Refer to Table 2).

3.2.5 Regulation

Regarding the regulatory aspect, scholarly articles were discovered that discuss the resurgence of the bamboo weaving industry in Sansui, China. This resurrection was attributed to the combined efforts of government policy intervention and the endeavors of key stakeholders within the bamboo weaving sector, particularly in terms of product innovation. Ethnobotanical methodologies are employed to gather indigenous information pertaining to the practice of bamboo weaving. There is empirical evidence supporting the validity and feasibility of utilizing the internet as a tool for promoting poverty alleviation and preserving intangible cultural assets [3] (Refer to Table 2).

3.3 Discussion

This component of the study focuses on the evaluation of existing literature and research pertaining to bamboo and its role in sustainable development. The analysis conducted in this section encompasses both quantitative and qualitative synthesis. The quantitative synthesis of research source countries and scholars reveals China's prominent role in bamboo research for the sake of sustainable development. The qualitative analysis is conducted using study findings pertaining to several themes, including material, economic, social, environmental, and regulatory aspects.

The findings from qualitative research indicate that bamboo plants have emerged as a viable alternative material for promoting sustainable development. The field of material innovation includes the development of novel materials, such as lignocellulosic composites integrated with polymers, as well as the application of bamboo laminate in various industries, including furniture and crafts. The processing and preservation processes are essential for the

industry. In order to effectively participate in the global market, the furniture and crafts industry necessitates a reliable and uninterrupted flow of raw materials, thereby ensuring the industry's long-term viability and fostering enhanced production.

Promoting the recognition of environmental equilibrium and socio-economic considerations necessitates a certain degree of public consciousness and educational efforts. The widespread use of bamboo plants necessitates a comprehensive comprehension among the general public and industry stakeholders regarding the economic and environmental advantages associated with these plants. The objective is to enhance the economic conditions and well-being of impoverished communities residing in rural regions.

Government participation is necessary for achieving sustainable development in developing nations that possess locations with the potential for bamboo cultivation. The primary objective of government policies pertaining to the regulation and facilitation of bamboo-related sectors is to offer support for the expansion and development of the bamboo industry. These policies also aim to safeguard the rights of local people, so ensuring that they receive the associated benefits. Additionally, these policies incorporate measures to preserve and protect the environment.

4 Conclusion

The current body of scholarly work pertaining to bamboo materials in the context of sustainable development demonstrates the proactive nature of study in harnessing the potential of this natural resource for future applications. Furthermore, the current researchers conducted a comprehensive analysis and identified five principal features that characterize bamboo plants. The initial theme pertains to the material aspect. Furthermore, this particular issue pertains to the consciousness around environmental preservation. It is worth noting that bamboo plants possess considerable potential as a viable substitute for plantation forests in terms of natural resource management. The subsequent theme pertains to the sociocultural dimensions of bamboo plants. The fourth theme highlights the economic potential associated with industry, as well as the social and environmental concerns that arise from it. The final aspect is to the thematic connection between recommendations for laws and the imperative for policy action in the future management of bamboo plants. In the context of poverty alleviation in developing nations, the implementation of sustainable development strategies holds promise as a viable solution in the medium and long term. Specifically, the cultivation of bamboo in tropical and subtropical regions, where such countries possess the capacity to do so, emerges as a potential avenue. However, it is crucial to acknowledge the imperative of raising awareness regarding the finite availability of land for bamboo forests and the consequential role they play in preserving environmental equilibrium. Hence, it is anticipated that the advancement of knowledge through diverse research discoveries will aid stakeholders in devising policy measures that align with the specific circumstances and requirements of communities residing in regions with potential for bamboo cultivation.

5 Recommendation

The findings of this research and the systematic review process have yielded a number of recommendations that could prove valuable in the future, particularly in addressing the issues faced by the export-oriented craft industry. Future researchers may direct their attention towards conducting further studies to ascertain the industry's requirement for bamboo plant raw materials in manufacturing and the global market's demand. In addition to this, it is imperative to analyze the involvement of governments in developing nations about their engagement with bamboo resources, as well as their awareness of international regulatory rules pertaining to bamboo forests. These policies are designed to promote global strategies for sustainable development in bamboo forest management. In the interim, it is imperative to

direct one's focus towards salient economic and social aspects. Bamboo plants possess the potential to serve as a viable alternative in the forthcoming years, effectively bolstering the craft and furniture industries. The research study conducted by Sawarkara et al. (2020) highlights the considerable potential of bamboo plants in fostering the growth of the bamboo sector and subsequently enhancing the rural economy, particularly in India. Hence, this observation underscores the necessity for further investigations pertaining to the regulation of bamboo plants. In this particular scenario, it is imperative to acquire empirical facts and scholarly literature pertaining to the regulatory function of policymakers in developing nations that exhibit the capacity for cultivating bamboo vegetation. In addition, there is a need for further study on policy interventions pertaining to the management of bamboo plant resources in tropical and sub-tropical regions. This is because existing research primarily concentrates on materials, particularly studies on treatment and technology.

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