Bibliometric Analysis of Sustainability in Business Management Policies Using Artificial Intelligence

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Abstract

This research examines trends in Sustainable Business Models (SBMs), addressing the current deficiency in thorough literature analysis, notwithstanding the extensive studies on this subject. This research analyzes 1879 papers on SBM from 2000 to 2024 using Elsevier's Scopus databases, offering an empirical survey of the topic and emphasizing significant contributions, writers, and publications. This method guarantees the development of a comprehensive, multidimensional database spanning several disciplines while revealing the complex networks of research groups that characterize the SBM area. Utilizing the VOSviewer program for advanced network evaluation reveals the main study clusters within the SBM research. The study seeks to identify the primary research patterns and assess the links and impacts of articles examining the interactions between Artificial Intelligence (AI) and sustainability within a business or management setting. The evaluation encompasses citation evaluation, Bibliographical Coupling (BC), and keyword co-occurrence. Research reveals that several studies focus on innovations and value generation that are important to SBMs. The study's trends discovered by SBMs include several critical areas: incorporating circular economy rules into company structures, innovative strategies in sustainable Supply Chains (SC), the convergence of entrepreneurship with Corporate Social Responsibilities (CSR), and the impact of technological advances and AI on improving environmental oversight. This work creates the present state of SBM studies, identifies discrepancies, and proposes paths for future inquiries, highlighting the necessity of an integrated strategy to develop SBMs that are profitable, ecologically sound, and socially culpable. This expanded knowledge encourages ongoing inquiry and creativity in the sector, facilitating the worldwide shift into more sustainable corporate practices and processes.

Keywords: Sustainability; Business Management; Artificial Intelligence; Bibliometric Analysis.

I. INTRODUCTION

Sustainability and digitization are the two foremost challenges confronting corporate executives and policymakers today (Kurniawan et al., 2022). Sustainability entails fulfilling current demands without jeopardizing the capacity of subsequent generations to satisfy their requirements. In contrast, digitalization involves incorporating electronic devices into daily life by computerizing all possible entities. The current surge in research output indicates growing concerns regarding sustainability and digitalization within management and business contexts. Searching in the Web of Science Core Library (limited to topics and English papers) for [sustainability AND (company OR administration)] yielded 1500 papers published in 2023, while

a comparable search for [digitization AND (company OR administration)] produced 1700 documents published in the same year.

There has been a growing curiosity about Sustainable Business Models (SBMs) in the educational and commercial domains (Karuppiah et al., 2023). SBMs sought to direct companies toward an environmentally friendly economic framework and circular methodologies. The significance of SBMs has increased as several enterprises implement them to improve sustainability and efficiency. This transition is evidenced by the growing academic research, signifying a divergence from previous periods when sustainability was frequently neglected in SBM development. Studies have found numerous kinds of behaviors in sustainable and circular companies.

The notion of a SBM transformed into SMs in the late 1990s with the advent of the internet, modifying conventional banking and financial principles. Creating innovative SBM, rather than only focusing on products or services, is perceived as a means to achieve a competitive edge. SBM fulfills several functions, such as evaluating success and fostering innovation. Conventional approaches prioritized efficiency and profitability, but newer trends have highlighted social and environmental consequences. This modification corresponds with increasing Corporate Social Responsibilities (CSR) recognition and the circular society (Fatima & Elbanna, 2023).

SBM development can enable substantial transformations in corporate objectives and value generation. Sustainable approaches facilitate the management and communication of a company by balancing environmentally friendly, societal, and economic dimensions. Decision-making characteristics in SBM frequently need to correspond with comprehensive sustainability. SBMs, utilizing a triple bottom line framework, address many stakeholder goals encompassing society and environmental issues and play a crucial role in embedding sustainability within business plans.

Among the several technological advances facilitating digitalization and influencing sustainability in both beneficial and detrimental ways, Artificial Intelligence (AI) has recently acquired prominence (Rana et al., 2022). Characterized as "the capacity of a machine to exhibit human-like skills such as thinking, learning, organizing, and imagination," AI has become pivotal in the digital evolution of society. It possesses substantial potential donations to sustainability across multiple domains, including business administration, power, medical care, farming, movement, and security, alongside equally important related hazards such as energy usage, greenhouse gases, electronic waste, information privacy concerns, moral difficulties, and the labor movement. This investigation aims to determine the primary research strands and patterns and to assess the connections among them and the effect of publications examining the interactions among AI and long-term viability within a business or administration setting. Performance and technology mapping were evaluated to achieve this purpose, utilizing the Web of Science repository for data gathering and VOSviewer for bibliometric analysis (Cavalcante et al., 2021).

This research seeks to elucidate the conceptual theories, present status, and prospective trajectories of SBM literature by bibliometric research. This analysis reviews 1,879 papers from Scopus from 2000 to 2024, pinpointing significant papers, authors, publications, and research

trends in SBMs. The study examines the rate of academic papers, prominent sources and researchers, key research patterns, and prospective paths in the SBM study. The research applies bibliometric methods for objectively examining the literature, adding to sustainable and SBM disciplines by identifying prominent papers, widely employed keywords, inventors in the domain, and critical growing sub-fields.

II. BACKGROUND

2.1. Search Strategy

The technique for conducting bibliometric evaluation in the investigation was rigorously prepared to ensure a thorough and exact knowledge of the research advancement in SBMs. This method corresponds with the organizational research paradigm, emphasizing comprehending specific domains' social, mental, and philosophical structures—the research started by choosing suitable resource databases, an essential step in conducting efficient bibliometric analyses. The selections were Google Scholar, Web of Science (WoS), and Scopus, each possessing distinct advantages and drawbacks. Google Scholar, recognized for its vast archives, was deemed less appropriate owing to its ineffectiveness in accurately identifying genuine scholarly connections. WoS, a primary bibliometric resource in several institutions, was evaluated versus Scopus for its more extensive journal coverage. Scopus has developed as an acceptable replacement for WoS, providing a similar scope of literature searching and citation evaluation functionalities.

The analytical technique entailed certain retrieval circumstances. The first phase was picking pertinent keywords obtained from a preliminary literature assessment. This procedure resulted in selecting "SBM" as a critical concept. To enhance the search, the research experimented with other keyword pairings in Scopus and WoS, ultimately selecting "viable business strategy*" OR "Business Model (DM) AND sustainable" OR "BM* for sustainable" as the definitive search strategy.

The comparative examination of results retrieved from the WoS and Scopus libraries revealed Scopus's better journal protection, greater publication quantity, and extensive citations and abstract databases, prompting the decision to select it for further investigation. After this selection, the research implemented filters according to language, source category, and topic area, yielding an initial retrieval of 1879 articles from Scopus. The citations mainly consisted of articles, proceedings, and conference evaluations, underscoring their pertinence to the study's emphasis.

The analysis revealed that the most relevant SBM study is categorized under the Scopus topics of Business, Administration, and Accountancy; Environmental Sciences; Power; and Economics, Econometrics, and Economics. In Scopus, publications are categorized into broad and interdisciplinary sections, which include more generic items that only tangentially relate to the subject of study. A comparative analysis of databases revealed that the search term SBM in Scopus yields papers in 25 groups, while it encompasses 105 groups in WoS. In Scopus, these groups are consolidated under four overarching domains: Health, socialization, Physical, and Biological Sciences.

Thus, the research exclusively examined elements that pertain to the discipline of Social Sciences. Most of the publications examined in this research are classified inside the relevant

category the research established, excluding those that only tangentially reference the issue in other disciplines (e.g., Nursing, Chemical Sciences, Pharmacology, etc.) (Negri-Ribalta et al., 2024). The researchers chose research from these areas, resulting in a final collection of 700 data. The duration of the study was extended from 2000, the commencement of SBM studies, until 2024. This timeframe was selected to thoroughly document the progression and present condition of the SBM study.

2.2. Method of Analysis

Bibliometrics is the management and analysis of bibliographic information from diverse sources via statistical methods to improve literature evaluations. This methodology facilitates identifying significant publications and examining citation patterns via author citation evaluation, citation networking visualization, and co-citation evaluation. The research utilized scientific mapping to comprehend the theme's emphasis on SBM. Science modeling elucidates a topic's breadth, developing themes, and temporal evolution, delivering a thorough view with less bias from researchers. The research included three principal analytical techniques: direct reference, co-citation, and Bibliographic Coupling (BC) (Farrukh et al., 2020). Direct reference refers to one publication referencing another, co-citation happens when a third article references another two, and BC transpires when two papers are referenced by a third. The research prioritized BC because of its precision in statistically evaluating linkages among texts.

BC quantifies the intensity of the connection between texts through common citations. In contrast to co-citation, which emphasizes previous works, BC is advantageous for examining current investments, as the frequency of citations of older publications does not limit it. The researcher employed co-occurrence analysis of terms, utilizing text-mining techniques on article positions, descriptions, and phrases to discern prevalent topics. This approach ascertains the correlation between keywords depending on their publication co-occurrence rate.

2.3. Clustering Strategy

The research employed a clustering methodology utilizing phrase co-occurrence, co-citation, and linking of bibliographic studies. This methodology seeks to extract lessons from both ancient and modern research. The researcher expected these strategies to produce clusters of papers with analogous or related research topics. Each article is shown as a node in the bibliometric system, with links indicating co-citations or BC, contingent upon the relationship under consideration. A conventional method in bibliometric evaluation entails selecting an article set, employing BC or co-citation evaluation to identify commonalities between content pairings, and utilizing similarity indices for grouping purposes (Filseret al., 2021).

The research employed VOSviewer to view and evaluate bibliometric systems. VOSviewer specializes in integrating visualizing networks with grouping, and VOS represents similarity visualization. It produces co-citation diagrams, BC, and groups, utilizing a distance-based mapping technique to indicate the degree of connection among entities. This mapping illustrates that the closeness of two things signifies the intensity of their connection, with shorter distances indicating stronger connections.

This bibliometric method has several advantages. It primarily depends on rigorous data analysis and generates a reliable dataset of numerous peer-reviewed publications across diverse

fields and specialties. The visual study of networks enables an in-depth comprehension of the field's breadth and framework. This is accomplished by recognizing influential authors or papers and significant current research clusters. These conclusions are crucial in delineating the primary domains and patterns within the topic area, offering substantial advice for prospective research trajectories.

III. MATERIALS AND METHODS

3.1. Sample Descriptive Analysis

Studies on SBM have notably increased attention and papers over the last twenty years. Figure 1 depicts this trend, beginning with less than ten articles each year until a significant surge in 2016, when the total surpassed 100. This developing tendency reflects the expanding participation of corporations and researchers in this field.

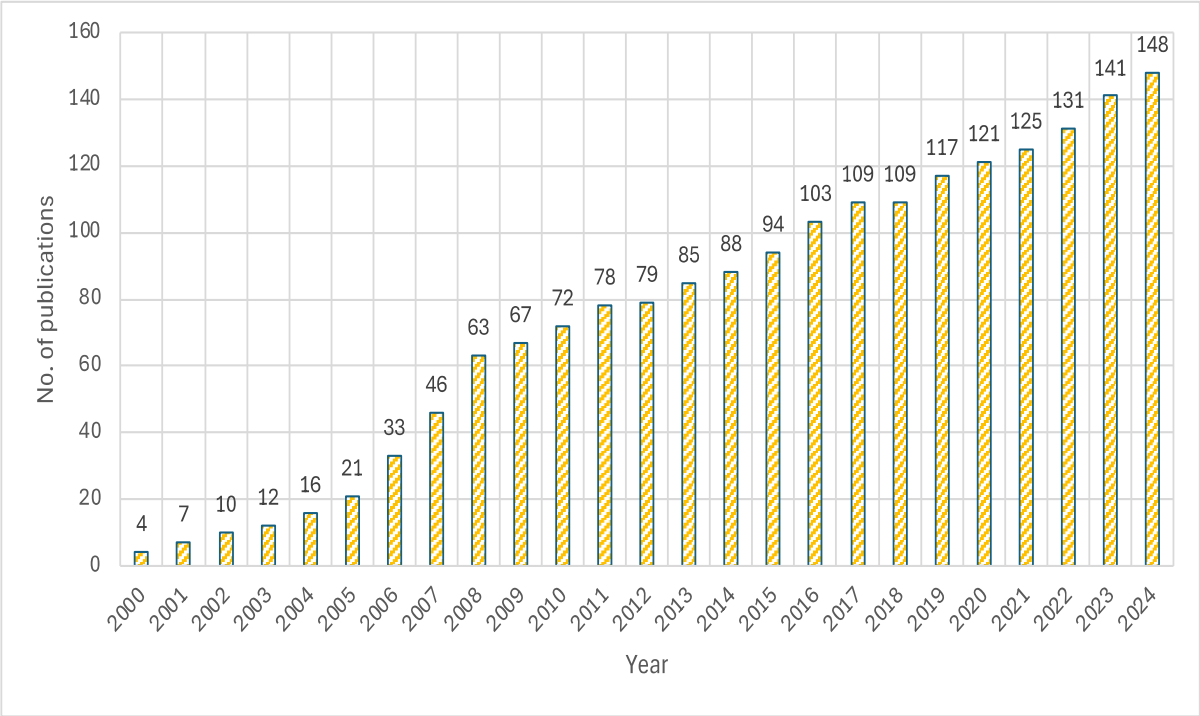

Figure 1: SBM Publication Analysis

3.2. Performance Analysis

WoS retrieved 1879 documents that fit the search requirements and amassed 10k citations throughout the analyzed time Figure 2. The significant rise in paper references reflects the increasing academic interest in exploring the interconnections between two prominent contemporary difficulties: AI and sustainability within an SBM.

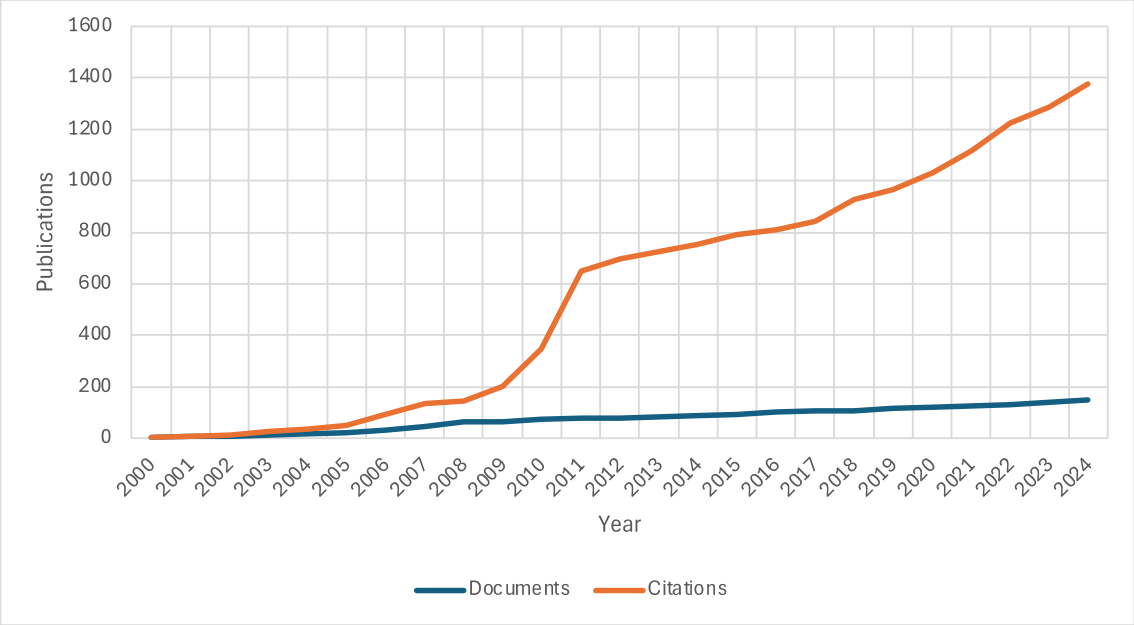

Figure 2: Citation Analysis

The articles address 75 Study Areas (Several Research Topics are linked to one record), including all five primary categories of WoS's Research Topics. There are five Research Regions, each containing over 100 papers, to which every article is ultimately placed Figure 3. The fields of Environment and Ecology constitute 31% of all documents, categorized under the Life Studies and Biomedicine Studies Region; Engineering accounts for 26% of all documents; Science and Technology, In addition to Topics, represent 25% of all documents; software engineering comprises 15% of all documents, classified under the Technology and Computing Studies Region; and Business and Economics make up 13% of all documents, categorized under the Social Sciences Studies Region.

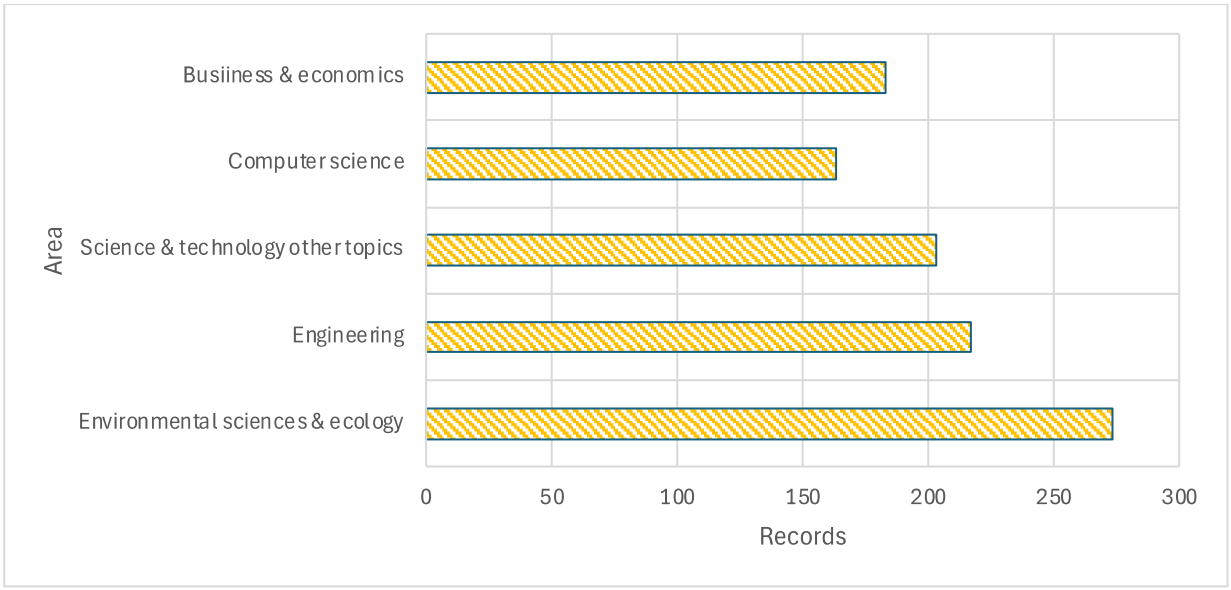

Figure 3: Research Area Analysis

3.3. Science Mapping and Visualization

3.3.1. Citation Analysis

Twenty-one papers, constituting less than 4% of the total papers, have been referenced over 100 times; jointly, they account for about a quarter of all references, totaling 3500 citations. The Top 10 Most Cited Papers, comprising 2.1% of all publications, have jointly garnered almost 10% of the total citations. Upon examining the direct references among the 58 publications that achieve a 55 h-index, the most extensive collection of interconnected things comprises 15 articles. The papers are categorized into four groups, consisting of the following papers:

- **Group 1:** On Big Data (BD), AI, and Smart City (SC), allowing methods and viable SC, Metropolis AI: From Automating to Independence in the SC, Intelligent Society, and AI: BD Planning and the Global Standard Technique Used to Smart Maintaining.
- **Group 2:** Collaboration of Blockchain (BC) and AI in IoT networks for the viable SC, A study on Collaborative Smart Helicopters and IoT for Enhancing the Intelligence of SC Globalization, digitization, and Sustainable Development: Are SMEs prepared? A review on synergy and substitute effects among development trajectories. Drones in Intelligent Environments within 5G: The Synthesis of BC and Distributed Learning.
- **Grouping 3:** AI for Environmental Sustainability: Obstacles, possibilities, and an Academic Agenda, Advances, and Issues in Sustainability Industrial and Operations Design, Towards Industry 4.0: A Data-Driven Evaluation, Global Warming: Are Modern Technology and Data Governance Contributing to the Issue or the Answer? An editorial contemplation and appeal for action.
- **Group 4:** Linking the circular market and Industry 4.0, Role of historical pressures and capital in promoting the use of BD data analytics supported AI, environmentally friendly production procedures, and circular economy functions, Industry 4.0 to speed up the Growth of the Circular Economic Situation: An Investigation of Vehicle Utilizing.

3.3.2. Co-citation Analysis

Of 58k referenced sources, 44 achieved the minimum criterion of 12 mentions. After removing six references with an aggregate link value under 12, the analyzed collection comprised 38 papers; 19 were released before 2020, and 20 were produced during 2021 and 2022. The 38 resources are clustered in four groups, led by the group of most representative articles (taking into account their overall link power):

- **Group 1:** AI: Multidisciplinary viewpoints on new difficulties, possibilities, and agenda for study, practice, and rules, additional pertinent topics (considering the paper's total connect power): AI for decision-making, AI as well as SDGs, AI as well as the next phase of work;
- **Group 2:** On BD, AI, and SC, supplementary relevant subjects: AI for long-term viability SC, AI and company models in SDGs.
- **Group 3:** SC Risk Administration and AI: Current Status and Future Research Objectives; further pertinent subjects include Industry 4.0 methods, IoT and SC oversight, and Industry 4.0 about the sustainable economy.

- **Group 4:** Assessing Structural Equation Modelling with Latent Variables and Measuring Error. Additional pertinent topics include methodological flaws in behavioral studies, organizational resources, enduring advantages, flexible skills, and strategic administration.

3.3.3. BC

Of the 1879 papers, 500 fulfilled the criterion set at five references. The overall power of the bibliometric connection relationships has been computed for each individual. Of the documents with the highest overall link power, 50 papers (12%) were chosen; after removing one article (due to its overall link power being below 12), 52 papers stayed. These papers are divided into five groups, each being characterized by a particular number-color-composition, study subject, and sample functions:

- Group 1 (15 articles) - Sustainable SC via digitalization.
- Group 2 (15 articles) - Technological advances for Industry 4.0, sustainable production, and the sustainable economy.
- Group 3 (10 articles) - Sustained SC.
- Group 4 (10 articles) - Administration and leadership of corporate talent for sustained competitive benefit.
- Group 5 (10 articles) - AI demonstrating sustainability, equitable growth, and the Sustainable Development Goals (SDGs).

IV. RESULTS

4.1. BC Analysis

BC quantifies similarities between two texts based on the number of shared references. In contrast to co-citation, which connects two papers by a standard citation from a third record, BC associates papers through mutual connections to a third article. BC occurs when articles are linked due to their citation of identical resources. The BC utilizes a forward strategy, focusing on growing patterns in the research and subjects adopted by writers who share a comparable bibliography. Numerous studies assert that BC is more suitable for examining emerging domains and contemporary research subjects, enhancing outcomes' precision. In general, co-citation focuses on how papers are related throughout time, whereas BC focuses on connecting papers through shared citations. This strategy does not entail an examination of the cited documents but instead exploring the expanding sub-fields inside the literature. This study utilizes a bibliographic assessment of 1879 papers cited by the SBM papers in this collection to examine important works and categorize articles into separate groups.

In light of the extensive volume of papers related to SBM, the author imposed a criterion of a minimum of 25 citations per article to improve the network's comprehension and focus on noteworthy publications, yielding a sample of 532 reputable works. As explained in the co-citation evaluation section, 25 citations indicate the ideal balance among knowledge loss attributable to a criterion that is too high. The BC assessment of the papers produced 16 clusters. The research analyzes the top six in peace size; the other nine were relatively small and distant.

Coupling Group (CG) 1: The Circular Economy (CE) and its possibilities within sustainable company structures

It has 34 publications, with an average year of release of 2020, featuring the most significant studies on SBM. The cluster primarily focuses on the CE and its possibilities within SBM. The CE prioritizes process improvement and recycling of materials, resulting in more SBM. CE is a contemporary theory addressing ecological and socio-economic concerns. The circular economic system aims to transform garbage into commodities while closing the divide between manufacturing and consumption. Compelling research examines how the IoT facilitates the shift to a CE by endorsing circular SBM and design methods.

CG 2: Value generation in SBM and sustainable supplier networks

It has thirty papers focused on evolutionary studies of SBM. A group primarily focuses on 'value generation in BM and sustainable SC networks.' An article seeks to develop an SBM that integrates sustainability ideas into the firm's core motivations and decision-making processes. Several publications also examine the product-service structure, particularly within the fashion business. The clothing industry is a resource-intensive market with multiple chances to mitigate environmental impacts and SBM. The investigation examines creative BM in the fashion industry, which uses sustainability as a key differentiator, especially regarding the value offering. The development of SBM could be enhanced by considering customer behavior in addition to the SC, therefore supporting environmentally friendly manufacturing and consumption.

CG 3: Advancements in SBM

It has twenty-four papers featuring works by notable writers with significantly advanced research on SBM. The group primarily focuses on advances in SBM. The paper presents the 'BM for Sustainability Innovation (SI) paradigm,' utilized to examine the substantial impact of BM on sustainable innovation and the commercial motivations for the environment. This cluster of articles advocates for a study on SI using a BM framework. By embedding sustainability into the essence of their business activities, firms attain an equilibrium of ecological, social, and financial benefits. Studies on SI have often undervalued the significance of organizations integrating a value argument, the configuration of the upstream and downstream value chains, and an economic framework to commercialize sustainable concepts effectively. SI identifies current deficiencies and prospective research avenues to tackle the enduring difficulties of introducing a new BM.

CG 4: Entrepreneurs and Business Social Responsibility

It comprises 17 papers focused on the investigation of SBM. The group primarily deals with 'business ownership and CSR. Companies progressively implement sustainability initiatives to enhance CSR while sustaining and improving profits.

CG 5: Collaborative economy

It has ten articles focused on the investigation of SBM. The cluster primarily focuses on 'expressing economics.' The study examines an innovative SBM based on Peer-To-Peer (P2P) resource sharing facilitated by online platforms. The study examines the possibility of sustained wealth creation across several collaborative BM. The research offers an analytical structure to

explore BM's capacity for long-term value creation. One of the prevailing concerns in blockchain and Web 3.0 is the importance of blockchain, or distributed databases, in creating SBM such as computer money, independent financial actors, and decentralized entities.

CG 6: SBM and AI Integration

It comprises ten papers investigating SBM of technology and AI. The group primarily focuses on 'the role of technology and AI' in SBM. The study examines the relationships among AI, rapid advancements in Machine Learning (ML), and sustainable growth. AI has demonstrated potential for development in the business industries, establishing it as an essential resource for the future.

V. CONCLUSION

The research on SBMs has effectively fulfilled its objective through descriptive and bibliometric evaluation, revealing significant insights into the domain. The increase in academic publications, especially during the last 8 to 10 years, underscores a rising worldwide interest in SBMs and emerging economies. In response to the constraints identified in existing evaluations that frequently offer narrow viewpoints, the research incorporated opinions from the AI for sustainability, covering all three dimensions: ecological, social, and financial.

Esteemed publications such as the Journal of Production for Environmental Sustainable Development, BM and Environmental Affairs, and Organization and Ecology have significantly contributed to this domain. The study identified significant trends in SBM, including incorporating the circular economy, value generation in BM, sustainable SC, breakthroughs, business ownership, CSR, the shared economy, and the influence of technology and AI in environmental leadership. These themes correspond with strategic clusters such as equitable growth, entrepreneurial sustainability, and creativity. The research offers extensive insights but recognizes limits, including its concentration on English language articles within particular database groups. These results provide a significant addition to the comprehension of SBMs, establishing a basis for future study and practical implementation in both corporate and academic spheres.

In future endeavors, the researchers will improve their study by gathering and assessing diverse papers. This will facilitate understanding any bibliometric variations or continuity in trends before and after the epidemic, considering all associated ramifications, including lockdowns. A meta-regression analysis is a crucial endpoint for quantitatively quantifying the data from these studies. This strategy will enhance the comprehension of SBMs on global issues and provide an adequate basis for evaluating their development and influence in the post-pandemic period.

As the discipline evolves, cooperation, diverse creation, and a steadfast dedication to sustainability will advance AI research toward a more equitable, significant, and resilient future. The examination of SBMs provides an extensive assessment of the present condition of ethical BM, emphasizing critical areas for growth and proposing strategic guidance for company executives and politicians. Incorporating these approaches into conventional BM tackles urgent sustainability problems and establishes a foundation for enduring financial and ecological resilience.

REFERENCES

[1] Kurniawan, T. A., Liang, X., O'Callaghan, E., Goh, H., Othman, M. H. D., Avtar, R., & Kusworo, T. D. (2022). Transformation of solid waste management in China: Moving towards sustainability through digitalization-based circular economy. *Sustainability*, *14*(4), 2374. https://doi.org/10.3390/su14042374

[2] Karuppiah, K., Sankaranarayanan, B., & Ali, S. M. (2023). A systematic review of sustainable business models: Opportunities, challenges, and future research directions. *Decision Analytics Journal*, *8*, 100272. https://doi.org/10.1016/j.dajour.2023.100272

[3] Fatima, T., & Elbanna, S. (2023). Corporate social responsibility (CSR) implementation: A review and a research agenda towards an integrative framework. *Journal of Business Ethics*, *183*(1), 105-121. https://doi.org/10.1007/s10551-022-05047-8

[4] Rana, N. P., Chatterjee, S., Dwivedi, Y. K., & Akter, S. (2022). Understanding dark side of artificial intelligence (AI) integrated business analytics: assessing firm's operational inefficiency and competitiveness. *European Journal of Information Systems*, *31*(3), 364-387. https://doi.org/10.1080/0960085X.2021.1955628

[5] Cavalcante, W. Q. D. F., Coelho, A., & Bairrada, C. M. (2021). Sustainability and tourism marketing: A bibliometric analysis of publications between 1997 and 2020 using vosviewer software. *Sustainability*, *13*(9), 4987. https://doi.org/10.3390/su13094987

[6] Negri-Ribalta, C., Lombard-Platet, M., & Salinesi, C. (2024). Understanding the GDPR from a requirements engineering perspective—a systematic mapping study on regulatory data protection requirements. *Requirements Engineering*, *29*, 523–549. https://doi.org/10.1007/s00766-024-00423-4

[7] Farrukh, M., Meng, F., Wu, Y., & Nawaz, K. (2020). Twenty-eight years of business strategy and the environment research: A bibliometric analysis. *Business Strategy and the Environment*, *29*(6), 2572-2582. https://doi.org/10.1002/bse.2521

[8] Filser, M., Kraus, S., Breier, M., Nenova, I., & Puumalainen, K. (2021). Business model innovation: Identifying foundations and trajectories. *Business strategy and the environment*, *30*(2), 891-907. https://doi.org/10.1002/bse.2660