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Bibliometric Analysis of Artificial Intelligence for Sustainability Accounting

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ABSTRACT

This study utilizes bibliometric analysis to delineate the convergence of Artificial Intelligence (AI) and sustainability, offering an overview of AI's impact on sustainability practices across diverse sectors. The paper analyzes the increasing significance of AI in carbon management, decision support systems, sustainability reporting, and energy optimization through the analysis of research trends, major th emes, and new technologies. The findings highlight the multidisciplinary aspect of AI in sustainability, providing insights into its application in environmental management and finance. The study identifies research deficiencies and suggests future avenues, u nderscoring the significance of AI in promoting sustainable development and improving transparency in sustainability reporting. This study provides actionable insights for stakeholders aiming to utilize AI in their sustainability initiatives.

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1. INTRODUCTION

In recent years, corporations worldwide have progressively adopted sust ainability as a fundamental strategic priority. Environmental, Social, and Governance (ESG) factors, beyond normative or reputational issues, are increasingly recognized as catalys ts for long-term value generation and risk reduction [1] Simultaneously, accounting and reporting frameworks have progressed from solely financial disclosures to integrated, sustainability-focused disclosures that encompass multidimensional performance. The integration of sustainability and accounting necessitates rigorous assessment, improved transparency, and reliable reporting systems [2]. In this changing envi ronment, technology innovation is crucial in transforming the generation, processing, and communication of sustainability information, with Artificial Intelligence (AI) serving as a significant facilitator.

The emergence of artificial intelligence (AI) has created disruptive possibilities across various domains, including banking, auditing, decision-support systems, and information analytics. In accounting research, artificial intelligence methodologies, including machine learning, natural language processing, pattern recognition, and predictive modeling, have started to transform conventional practices in data

input, audit sampling, risk assessment, and fraud detection. Recent bibliometric analyses of artificial intelligence in accounting indicate a notable rise in publications from 2018 onwards, categorized into three primary thematic clusters: enhancement of accounting processes, the impact of auditing and financial reporting, and academic viewpoints on the in tegration of AI in accounting [3]. These advancements indicate that AI serves not merely as an auxiliary instrument but p otentially as a catalyst for transformative c hanges in the execution of accounting operations.

Integrating artificial intelligence with sustainable accounting presents significant potential. Sustainability accounting prioritizes not just historical performance but also prospective measures and the control of externalities. The intricacy of sustainability data (environmental footprints, social impacts, governance measures) poses challenges related to volume, variety, validity, and velocity—issues for which AI is particularly adept [4]. Organizations can utilize AI to identify anomalies (such as greenwashing), reveal concealed trends, deliver real-time insights, and facilitate integr ated decision-making [5]. A bibliometric analysis centered on AI and sustainable accounting provides a relevant perspective to delineate academic trends, pinpoint knowledge deficiencies, and outline future research directions.

Research has commenced on AI's function in ESG measurement; for example, one study examined the influence of Big Data and AI on ESG performance assessment, emphasizing themes such as anomaly detection, algorithm transparency, and the incorporation of alternative data sources [6]. However, the precise relationship between AI technologies and sustainable accounting—specifically, the application of AI in the m easurement, reporting, auditing, or verification of sustainability-oriented accounting information—remains inadequately examined in a systematic, b ibliometric context. A literature study indicates that although research on AI in accounting is increasing and sustainable accounting literature is also expanding, the intersection of both fields is little explored [7]. In light of the accumulation of related literatures, it is both opportune and significant to conduct a bibliometric analysis that concentrates on the role of AI in sustainable accounting. This endeavor can a ssist researchers and practitioners by elucidat ing the intellectual framework, delineating major authors and institutions, finding geographic and thematic concentrations, and identifying research deficiencies at this nascent confluence.

Furthermore, in the expansive domain of accounting and sustainability, bibliometric analyses are increasingly being utilized to offer organized summaries of developing topics. A bibliometric assessment of green accounting has recorded the rise of environmental accounting research and indicated potential future trajectories [8]. In light of the increasing number of research on AI and sustainability accounting, a bibliometr ic mapping exercise is essential to comprehensively examine the evolution of AI applications in sustainability accounting, their impact on the discipline, and the un derexplored areas in the literature.

Notwithstanding the increasing interest in AI and sustainable accounting, the academic intersection of these two fields remains disjointed and insufficiently examined. A comprehensive bibliometric mapping that systematically delineates the application of AI technologies in sustainability accounting—encompassing important publication trends, topic clusters, author networks, institutional collaborations, and emergent research fronts—does not exist. In the absence of such a map, scholars may replicate efforts, neglect promising subfields, and fail to recognize methodological or conceptual deficiencies that require focus. As a result, the discipline lacks a comprehensive perspective on its historical trajectory, current status, and future direction.

This study intends to provide a bibliometric analysis of the academic literature at the convergence of artificial intelligence and sustainability accounting. The objectives are: (1) to chart the temporal

evolution of publications, encompassing growth rates, publication venues, prominent authors, and institutions; (2) to delineate thematic clusters and knowledge frameworks via keyword co-occurrence, citation networks, and co-authorship networks; (3) to investigate geographic and institutional contributions and collaborations; and (4) to identify research deficiencies and suggest future research trajectories. This study will provide a systematic assessment of the intellectual landscape and guide both academic and practical initiatives in the field of AI-driven sustainability accounting.

2. METHODS

This research use bibliometric analysis to investigate the convergence of Artificial Intelligence (AI) and sustainable accounting. Bibliometric analysis is aprevalent method for investigating the structure, evolution, and trends in academic literature using quantitative methodologies. This methodology fundamentally involves the systematic analysis of publishing patterns, citation networks, keyword co-occurrences, and author partnerships, providing insights into research growth, significant contributions, and developing topics [9]. This study extracts data from many bibliographic databases, including Scopus, Web of Science, and Google Scholar, which offer extensive coverage of pertinent articles, books, and c onference proceedings. The dataset encompasses the past twenty years to doc ument recent progress in artificial intelligence and its utilization in sustainability accounting.

We utilize bibliometric software tools, including VOSviewer and Bibliometrix, to do the bibliometric study. VOSviewer facilitates the visualization of bibliometric networks, offering insights into co-authorship, citation, and keyword co-occurrence links that elucidate topic pro gression and collaboration patterns within the discipline [10]. Bibliometrix is employed to perform thorough statistical assessments of publishing trends, encompassing annual growth rates, citation analysis, and the ide ntification of prominent journals and authors. These techniques enable the identification of research clusters, pivotal research issues, and institutional contributions, so providing a better organized comprehension of the intellectual landscape pertaining to AI in sustainable accounting. The incorporation of both software tools guarantees a comprehensive and multifaceted method for literature mapping.

The concluding phase of the study involves identifying research deficiencies and proposing future trajectories based on the patterns detected in the data. Through the analysis of citation links and keyword clusters, we can identify under-researched domains and nascent ideas that necessitate additional investigation. Moreover, bibliometric network analysis facilitates the identification of the most impactful authors, institutions, and nations within the field, emphasizing collaboration areas and the global research distribution. This thorough methodology enables us to derive significant insights into the progression of AI in sustainable accounting, its influence on the domain, and the future trajectory of research in the ensuing years.

3. RESULTS AND DISCUSSION

3.1 Network Visualization

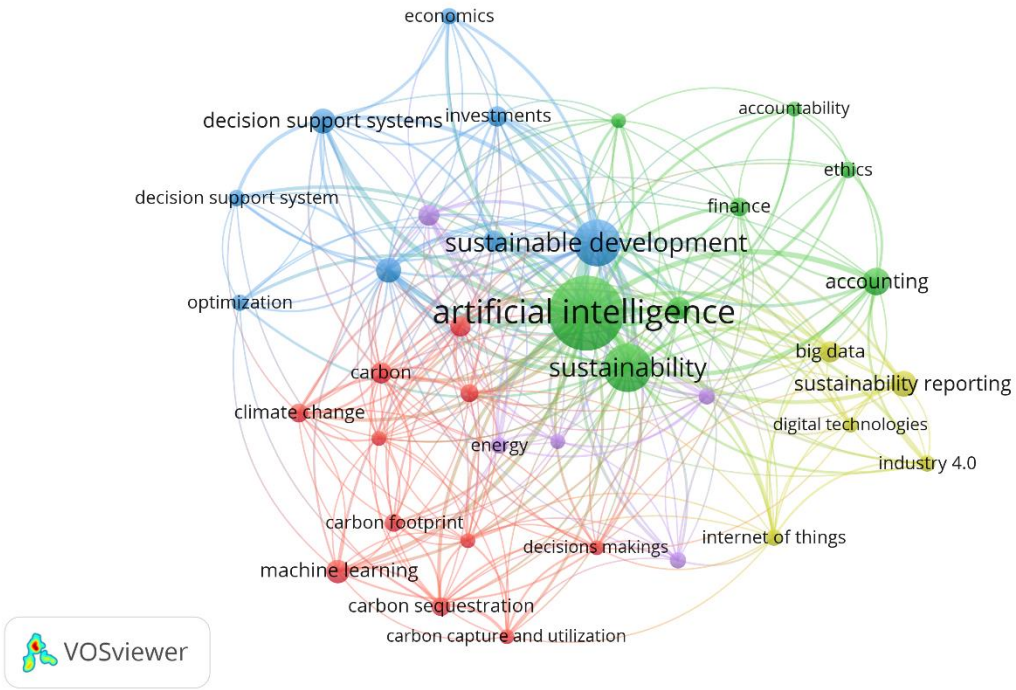

Figure 1. Network Visualization
Source: Data Analysis Result, 2025

Figure 1 presents the bibliometric network map illustrates the increasing incorporation of Artificial Intelligence (AI) in sustainability studies. The map prominently features the concepts of Artificial Intelligence (AI) and Sustainability, highlighting the growing importance of AI in tackling environmental, social, and governance (ESG) challenges. The proximity of these terms underscores AI's pivotal role in sustainability initiatives, especially in enhancing energy efficiency, diminishing carbon emissions, and alleviating climate change. A notable aggrega tion of terms in red, such as machine learning, carbon, climate change, carbon sequestration, and carbon footprint, highlights AI's pivotal role in environmental sustainability. This cluster indicates that AI technologies are utilized to augment climate change mitigation efforts, refine carbon management systems, and optimize environmental monitoring, positioning AI as a pivotal contributor to important environmental concerns.

The blue cluster, encompassing concepts such as decision support systems, optimization, and sustainable development, illustrates AI's capacity to enhance decision-making processes for sustainability. AI's capacity to analyze extensive datasets, identify trends, and provide optimum solutions is markedly improving decision-making for sustainable development, facilitating more effective resource allocation and superior strategic planning. This views AI not merely as a tool for automation but as a crucial facilitator of enhanced sustainability practices across diverse sectors. The green cluster, which includes terms such as accounting, finance, big data, and sustainability reporting, illustrates AI's influence on financial and accounting processes on sustainability. Artificial intelligence is revolutionizing sustainability reporting by augmenting transparency and bolstering accountability through the utilization of big data analytics to incorpora te environmental and social variables into financial reporting standards.

The purple and yellow clusters, representing digital technologies, Industry 4. 0, and the Internet of Things (IoT), exemplify AI's contribution to the digital transformation of industries. These interrelated technologies, enhanced by AI, provide intelligent product

ion, real-time sustainability assessment, and optimized industrial operations. This signifies that AI is not merely an automation tool but a disruptive catalyst promoting sustainable practices across all industries. The network map delineates the complex role of AI in advancing sustainability, demonstrating its transdisciplinary impact across environmental, financial, and industrial domains, and underscoring its capacity to expedite global sustainability objectives.

3.2 Overlay Visualization

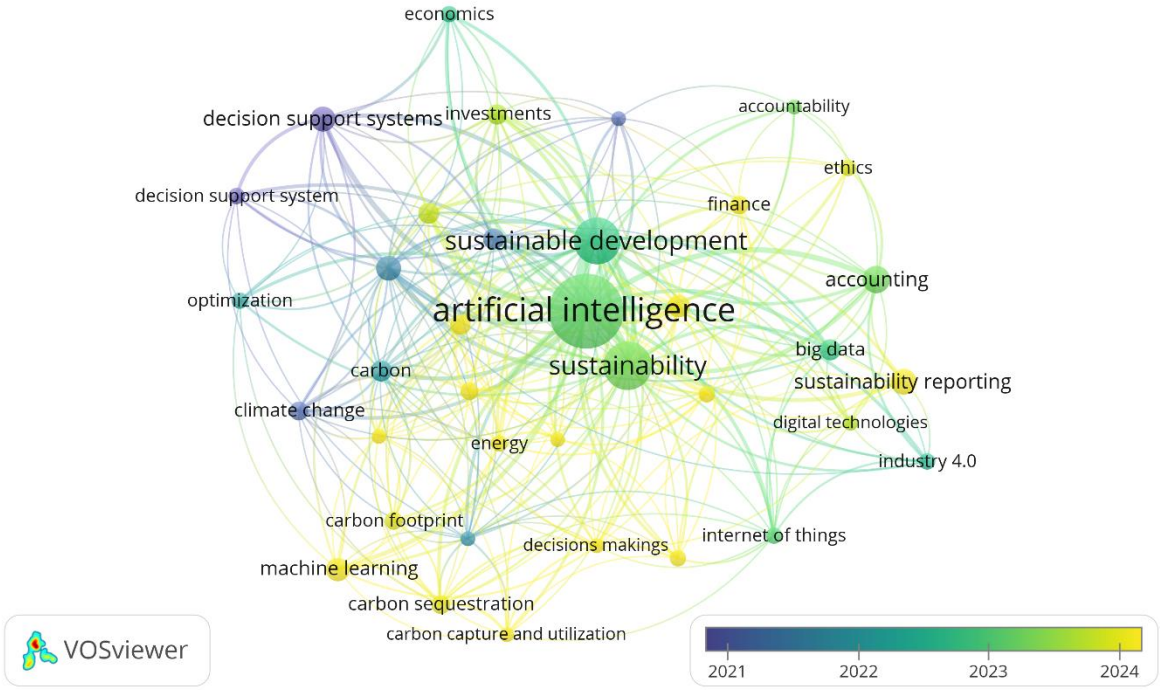

Figure 2. Overlay Visualization
Source: Data Analysis Result, 2025

Figure 2 illustrates The overlay network map illustrates the developing academic trends at the convergence of Artificial Intelligence (AI) and sustainability from 2021 to 2024. The map's colors denote various years, with darker blue signifying earlier years (2021) and lighter green denoting more current studies (2024). The major nodes, symbolizing critical subjects like AI, sustainability, and sustainable development, have consistently maintained prominence, indicating a persistent and escalating interest in the application of AI to sustainability issues.

The map indicates a trend towards an increasing emphasis on machine learning, carbon footprint, and carbon sequestration over time. The yellow and green clusters adjacent to these terms signify that contemporary research has progressively integrated AI methodologies, such as machine learning, to tackle environmental issues, including the reduction of carbon emissions and the improvement of energy efficiency. The inclusion of concepts such as decision support systems, optimization, and energy in this developing cluster indicates how AI is enhancing resource allocation and energy management for sustainability. This indicates that AI's function in sustainability is evolving beyond environmental monitoring to intricate decision-making and optimization responsibilities.

The map underscores the increasing significance of finance, accounting, and sustainability reporting, as these words have been more prominent in recent years. The shift towards greener hues in these phrases

signifies an increasing emphasis on the incorporation of AI in financial reporting and the evolution of accounting standards that integrate ESG metrics. The emergence of di gital technologies, Industry 4.0, and the Internet of Things (IoT) indicates the growing confluence of artificial intelligence with techn ological progress in digital infrastructure, facilitating intelligent systems for sustainability monitoring and management. This transition to advanced technology signifies a wider trend in which AI is integrated into sustainable industrial processes and commercial operations.

3.3 Citation Analysis

A plethora of papers has appeared in sustainability accounting and AI integration, indicating an increasing academic interest in how AI technology may promote sustainable behaviors. The subsequent table delineates a compilation of pivotal publications that investigate several dimensions of AI's contribution to sustainability, encompassing carbon emissions monitoring, supply chain decarbonization, and the overarching effects of AI on the promotion of sustainable development objectives. These articles are substantial contributions that connect AI, accounting, and sustainability, presenting varied viewpoints on the utilization of AI to attain sustainability objectives across multiple sectors.

Table 1. The Most Impactful Literatures

Citations	Authors and year	Title
156	Tiwari, K., Khan, M.S. (2020)	Sustainability accounting and reporting in the industry 4.0
112	Budennyy, S.A., Lazarev, V.D., Zakharenko, N.N., ... Kosterina, A.A., Zhukov, L.E. (2022)	eco2AI: Carbon Emissions Tracking of Machine Learning Models as the First Step Towards Sustainable AI
107	Lenny Koh, S.C., Genovese, A., Acquaye, A.A., ... Kuylenstierna, J., Gibbs, D. (2013)	Decarbonising product supply chains: Design and development of an integrated evidence-based decision support system-the supply chain environmental analysis tool (SCEnAT)
85	de Villiers, C., Dimes, R., Molinari, M. (2024)	How will AI text generation and processing impact sustainability reporting? Critical analysis, a conceptual framework and avenues for future research
67	Ghobakhloo, M., Asadi, S., Iranmanesh, M., ... Mubarak, M.F., Yadegaridehkordi, E. (2023)	Intelligent automation implementation and corporate sustainability performance: The enabling role of corporate social responsibility strategy
63	Peng, Y., Ahmad, S.F., Ahmad, A.Y.A.B., ... Daoud, M.K., Alhamdi, F.M.H. (2023)	Riding the Waves of Artificial Intelligence in Advancing Accounting and Its Implications for Sustainable Development Goals
63	Anvari, S., Turkay, M. (2017)	The facility location problem from the perspective of triple bottom line accounting of sustainability

Citations	Authors and year	Title
61	Hong, Z., Xiao, K. (2024)	Digital economy structuring for sustainable development: the role of blockchain and artificial intelligence in improving supply chain and reducing negative environmental impacts
60	Han, H., Gu, X. (2021)	Linkage Between Inclusive Digital Finance and High-Tech Enterprise Innovation Performance: Role of Debt and Equity Financing
54	Khare, V., Chaturvedi, P. (2023)	Design, control, reliability, economic and energy management of microgrid: A review

Source: Scopus, 2025

These studies offer significant insights into the ongoing evolution of companies via AI technologies, especially regarding their impact on sustainability reporting, carbon management, and enhanced supply chain systems. As AI advances, it increasingly contributes to transparency, efficiency, and innovation in sustainability accounting, generating new chances to tackle environmental and social issues. The variety of subjects addressed in these publications illustrates the extensive relevance of AI across several industries, emphasizing its potential to catalyze systemic transformations in sustainable development approaches.

3.4 Density Visualization

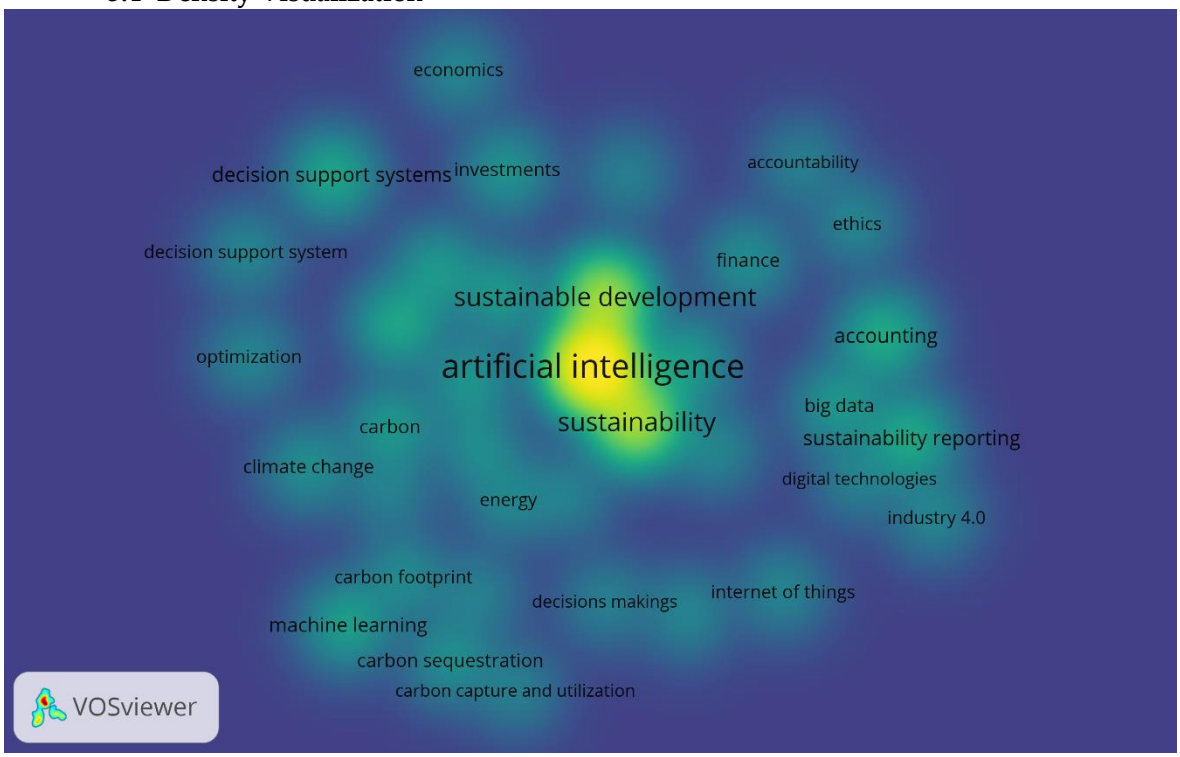

Figure 3. Density Visualization
Source: Data Analysis Result, 2025

The density map illustrates a focused depiction of academic research trends at the convergence of Artificial Intelligence (AI) and sustainability. The heatmap underscores the pivotal significance of AI and sustainability as fundamental issues in this research domain, with the most concentrated clusters (shown by the yellow and green regions) encircling both concepts. The pr oximity and concentration of terms such as sustainable development, carbon, energy, and machine learning indicate that artificial

intelligence is predominantly utilized in environmental sustainability, especially concerning carbon emissions reduction and energy efficiency. The integration of these concepts highlights AI's transformational capacity in tackling urgent global sustainability issues.

The map indicates significant co-rrelations with concepts such as sustainability reporting, accounting, big data, and digital technologies, highlighting AI's increasing influence on enhancing transparency and effi ciency in sustainability accounting and reporting. The connections among AI, decision-making, optimization, carbon sequestration, and carbon capture demonstrate how AI is augmenting resource management, enabling more informed decis ions for sustainable practices, and refining carbon management systems. The emergence of technologies such as Industry 4.0 and the Internet of Things (IoT) signifies that AI serves not merely as a tool for sustainability reporting but is actively facilitating the digital transformation of industries towards more sustainable practices. This heatmap clearly illustrates the increasing significance of AI in promoting sustainable development across multiple sectors.

3.5 Co-Authorship Network

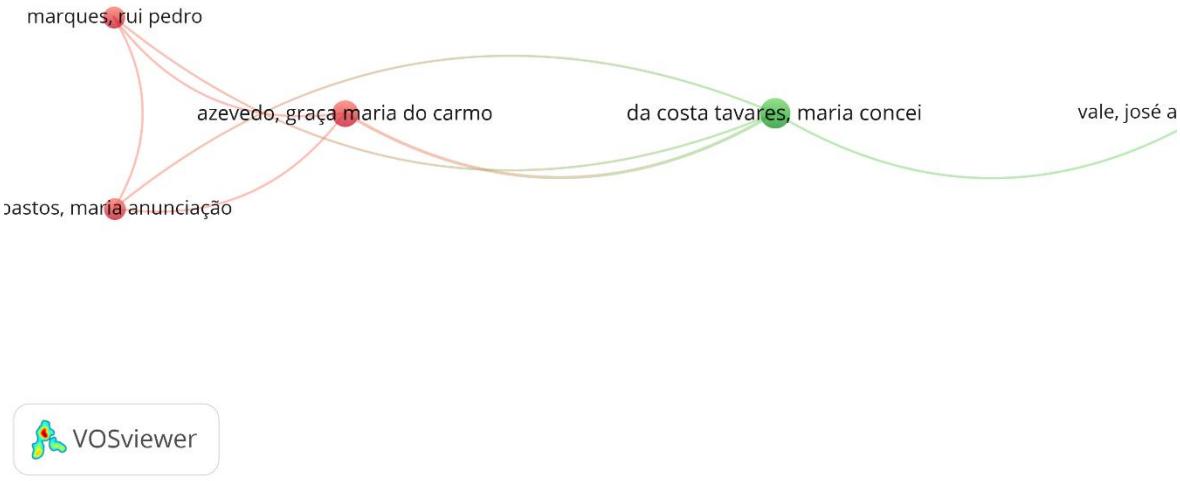

Figure 4. Author Visualization
Source: Data Analysis Result, 2025

The image you submitted is a co-authorship network visualization, which is likely to have been produced using VOSviewer. It illustrates the connections between various authors in a particular research field. Individual authors are represented by the nodes, while the connections (edges) between them suggest collaborative endeavors or co-authorship. The strength of the collaboration is indicated by the color gradient and intensity of the connections. Authors in the greenish area of the network have more recent or stronger connections, while those in the reddish areas are associated with earlier or more fundamental collaborations. Maria Conceição da Costa Tavares and José Azevedo are central figures in this specific network, as evidenced by the visualization. They have numerous connections to other authors,

including Rui Pedro Marques, Maria Anunciação Bastos, and Maria do Carmo Azevedo. The structure suggests a group of scholars who are relatively small but closely linked, with collaborations that span multiple studies over time. This may indicate a research concentration that has been making significant contributions to the field, with fre quent interactions between authors, particu larly in the context of sustainability, artificial intelligence, or related interdisciplinary subjects.

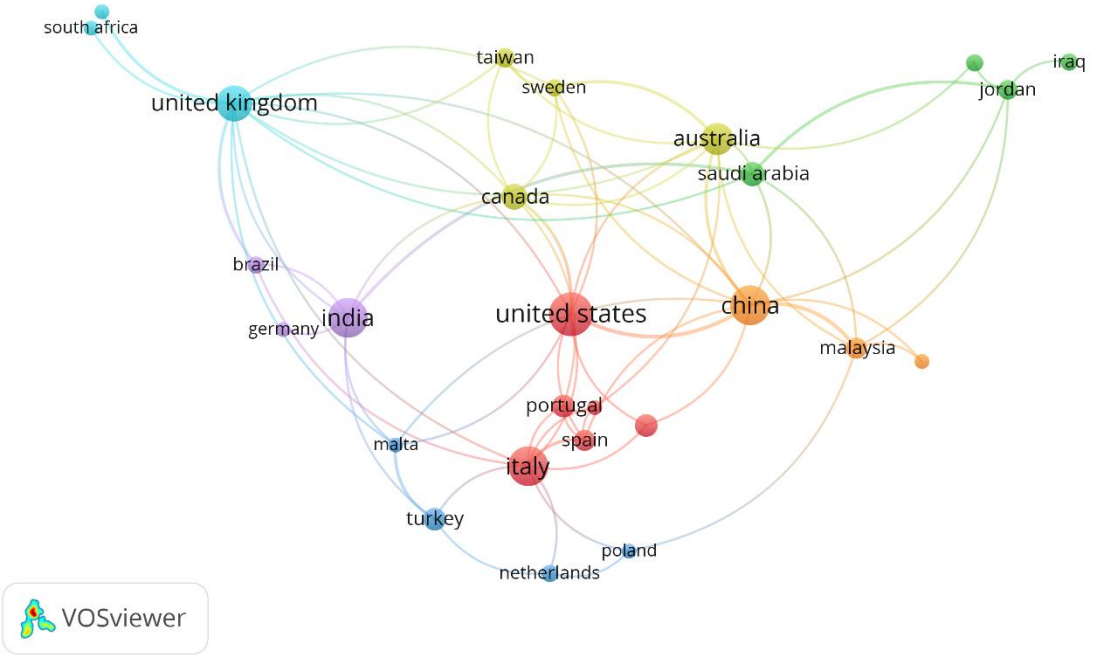

Figure 5. Country Visualization
Source: Data Analysis Result, 2025

Figure 5 The image supplied illustrates a network of co-authorship among countries, emphasizing their collaboration in scholarly research. The United States is represented by the central node, which is surrounded by numerous connections to other countries, including the United Kingd om, Italy, China, and India. This suggests arobust collaborative presence. These connections are indicative of international academic partnerships, in which countries are connected through collaborative research endeavors. The network exhibits a unique color coding, with key centers such as the United States, China, and India depicted by their larger, brighter nodes. This suggests that these countries are actively engaged in the production of research in the area under study.

The United States and China are the most significant clusters of collaboration in the network, with Italy, Spain, and Portugal surrounding them and sharing strong connect ions. The countries are grouped into clusters. This suggests that research conducted in these countries frequently transcends national boundaries, particularly in the context of significant global contributors such as the United States and China. Smaller clusters are formed by other countries, including Australia, Saudi Arabia, and Malaysia, suggesting a more regionally focused collabor ation. The visualization also illustrates connections with nations such as South Africa, Brazil, Germany, and Turkey, which have fewer direct collaborations but continue to engage in the global research network. In general, this map demonstrates the interconnectedness

of global research, as key academic centers promote collaboration across borders.

Practical Implications

This study offers significant insights for policymakers, researchers, and industry professionals seeking to utilize Artificial Intelligence (AI) to enhance sustainability initiatives across diverse industries. By delineating the academic landscape, it underscores the pivotal role of AI in tackling essential sustainability concerns, including carbon emissions reduction, energy optimization, and the creation of decision-support systems for sustainable development. The findings indicate that firms can gain advantages by implementing AI-powered solutions to augment existing sustainability practices, boost reporting transparency, and facilitate data-driven decision-making. Moreover, the identification of pivotal research clusters can inform future research agendas and collaborations, enabling stakeholders to concentrate on high-impact domains such as artificial intelligence in sustainability reporting and carbon management. Industry leaders may utilize these insights to synchronize their business plans with developing AI technology, thereby attaining environmental objectives and enhancing their competitive edge in a swiftly changing market.

Theoretical Contribution

This work theoretically enhances the understanding of the junction between AI and sustainability by providing a thorough bibliometric analysis that delineates the progression of these domains. The research enhances current theories in sustainability accounting and artificial intelligence by demonstrating how AI might act as a transformative instrument in advancing sustainability across several sectors, especially in environmental management and sustainable finance. This study enhances the theoretical comprehension of the impact of AI technology on sustainability practices, offering a conceptual framework that connects sustainability accounting with AI applications. By recognizing emergent research patterns, it also aids in the formulation of new theoretical frameworks that can direct future investigations in both AI and sustainability fields.

Limitations

This study, notwithstanding its contributions, has numerous drawbacks. The bibliometric analysis depends on data from published literature, which may not compr ehensively reflect the most recent advancements in AI and sustainability, partic ularly those arising from non-peer-reviewed sources or gray literature. The emphasis on particular databases (e.g., Scopus, Web of Science) may result in publishing bias, as publications from other repositories could be omitted. A further disadvantage pertains to the technique; whereas bibliometric analysis offers a quantitative summary, it fails to explore the qualitative dimensions of the examined studies, including the depth of study and the practical relevance of the findings. The analysis is geographically and linguistically constrained to the accessible papers, potentially failing to encapsulate the entire worldwide spectrum of AI applications in sustainability. Subsequent research may broaden its scope by integrating supplementary data sources, exploring novel non-traditional publications, and performing qualitative analysis to enhance the conclusions of this study.

4. CONCLUSION

This paper offers a thorough bibliometric examination of the convergence between Artificial Intelligence (AI) and sustainability, emphasizing AI's revolutionary capacity in tackling global sustainability issues. The investigation indicates that AI is progressively regarded as an essential instrument for promoting sustainability across several sectors, especially in environmental management, carbon reduction, energy optimization, and sustainable decision-making. The expanding literature on AI's involvement in sustainability accounting and reporting underscores its significance in improving

transparency, efficiency, and accountability in sustainability processes.

The study's findings indicate that AI's role in sustainability is diverse, enco mpassing carbon footprint reduction, machine learning models for climate change, and the creation of sophisticated decision support systems. The paper also identifies significant research clusters, such as the role of AI in big data analytics, sustainability reporting, and the incorporation of digital technologies like IoT and Industry 4.0 into sustainability practices. These insights delineate current trends and present a framework for future research, emphasizing the necessity for additional investigation into AI's capacity to revolutionize sustainability accounting practices, enhance environmental performance, and propel the global transition towards sustainable development.

The study offers practical implications for policymakers, researchers, and industry practitioners, emphasizing the significance of utilizing AI-driven technologies to improve sustainability initiatives. The findings from this bibliometric analysis can assist enterprises and governments in implementing AI-driven policies that facilitate the attainment of ESG objectives and promote long-term sustainability. Moreover, the recognition of deficiencies in existing research necessitates additional exploration into inadequately examined domains, like AI's function in sustai nable finance and the obstacles of in corporating AI within established sustainability frameworks.

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