Journal of International Conference Proceedings (JICP)
Vol. 9 No. 2, pp. 163-181, July, 2026
E-ISSN: 2621-993X P-ISSN: 2622-0989
https://ejournal.aibpmjournals.com/index.php/JICP/index

Smart Decision Systems in Healthcare Sustainability Toward Global Research Trends and Sustainability Strategy Implications

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ARTICLE INFORMATION

Publication information

Research article

HOW TO CITE
Adiatma, T., Irianto, O., & Manik, M. E. (2026). *Smart decision systems in healthcare sustainability: Toward global research trends and sustainability strategy implications*. *Journal of International Conference Proceedings*, 9(2), 163–181.

DOI:
https://doi.org/10.32535/jicp.v9i2.4734

Received: 18 May 2026
Accepted: 21 June 2026
Published: 24 July 2026

ABSTRACT

The rapid proliferation of smart decision systems within healthcare settings has emerged as a pivotal force in advancing global sustainability agendas, yet a comprehensive understanding of the field's intellectual trajectory remains elusive. This study employs a systematic bibliometric analysis that conducted through Biblioshiny using data retrieved from the Scopus database to map the evolving landscape of research at the intersection of smart decision systems, healthcare, and sustainability. The analysis encompasses publication trends, citation networks, co-authorship patterns, keyword co-occurrence structures, and the most influential contributing countries, institutions, and journals. Findings reveal a marked acceleration in scholarly output since 2018, with artificial intelligence, clinical decision support, and sustainable health systems constituting the dominant thematic clusters. Emerging research frontiers include the integration of machine learning into resource allocation frameworks and the application of Internet of Things technologies in sustainable hospital management. These results underscore the strategic significance of interdisciplinary collaboration and evidence-informed policy formulation. The study ultimately provides researchers, healthcare administrators, and policymakers with a data-driven roadmap for directing future investments and aligning smart health technologies with long-term sustainability goals.

Keywords: Smart Decision Support System; Healthcare Sustainability; Sustainability Strategy

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INTRODUCTION

Healthcare systems across the world are confronted with an accelerating convergence of structural pressures, including aging demographics, the increasing burden of chronic and non-communicable diseases, constrained public financing, and the intensifying demand for accountability in both clinical and managerial performance(Andrieiev et al., 2024). Strategic management is becoming increasingly important for sustainable management in healthcare, as the growing complexity, dynamics, and uncertainty of health system environments necessitate long-term strategic thinking capable of navigating institutional, financial, and regulatory challenges simultaneously(Adiatma et al., 2023). The COVID-19 pandemic exposed profound vulnerabilities within global healthcare systems, catalyzing an urgent need for strategic management frameworks capable of sustaining resilience under extraordinary pressure, and revealing that existing organizational structures were insufficiently equipped to manage systemic disruption at scale. The imperative to develop smarter, more adaptive, and more sustainable models of healthcare governance has never been more urgent, and the scholarly and managerial communities are increasingly converging on intelligent decision systems as a foundational mechanism for achieving this transformation(Aarninkhof-Kamphuis et al., 2024). These intersecting pressures establish an unambiguous imperative: healthcare organizations can no longer rely on reactive or short-term interventions, but must adopt intelligent, evidence-based frameworks that embed sustainability into the core of their strategic decision-making (Huebner & Flessa, 2022).

Sustainability strategy in healthcare has consequently emerged as a critical organizational priority, demanding the coherent integration of environmental, social, and economic objectives into the governance and operational structures of health institutions. Smart Decision Systems (SDS) have emerged as a pivotal class of intelligent, data-driven technologies designed to enhance the quality, speed, and evidence base of strategic and operational decision-making within healthcare institutions. Research findings reveal a significant and sustained increase in scholarly interest in intelligent systems applied to healthcare, highlighting themes such as data-driven healthcare, artificial intelligence in clinical decision support, and the growing importance of interdisciplinary collaboration between healthcare providers, technologists, and policymakers as key forces shaping the field.

The absence of a rigorous bibliometric synthesis mapping the convergence of smart decision systems and healthcare sustainability strategy constitutes the central knowledge gap that motivates this study. Bibliometric analysis in healthcare management provides an objective overview of a research area, enabling researchers and policymakers to identify influential contributors, innovative solutions, and the intellectual trajectory of the field, making it a methodologically rigorous and appropriate instrument for addressing this gap. Understanding current development, primary research focuses, and key contributors through bibliometric analysis is essential for identifying knowledge gaps, mapping the intellectual trajectory of a field, and providing a consolidated evidence base for future research and institutional practice. The purpose of this study is to produce a comprehensive bibliometric analysis of the global literature on Smart Decision Systems in Healthcare Sustainability, utilizing data retrieved from the Scopus database without year restriction and analyzed through Biblioshiny via the bibliometrix R-package, in order to map research trends, uncover the intellectual structure of the field, and derive implications for healthcare sustainability strategy (Aria & Cuccurullo, 2017).

The novelty of this study lies in its exclusive and systematic focus on the convergence of smart decision systems and healthcare sustainability strategy as a unified domain, a synthesis that prior bibliometric investigations have not undertaken. Bibliometric study help to analyse the data (Donthu et al., 2021). The significance of this work resides in its capacity to provide healthcare managers, technology strategists, scholars, and policymakers with an evidence-based foundation for understanding where this interdisciplinary field stands and where scholarly and institutional attention is most urgently needed. The contribution of this study is threefold: it consolidates a fragmented body of interdisciplinary literature into a coherent intellectual map; it identifies the structural and thematic foundations of the domain; and it proposes a forward-looking research agenda that positions smart decision systems as strategic instruments of sustainable healthcare governance.

LITERATURE REVIEW

Smart Decision Systems in Healthcare

Smart Decision Systems (SDS) represent an advanced generation of intelligent, data-driven tools that integrate artificial intelligence, machine learning, and real-time analytics to support complex decision-making processes across clinical and managerial domains in healthcare organizations (Marinescu et al., 2025). Integrating AI-based Clinical Decision Support Systems into healthcare can improve diagnostic accuracy, optimize clinical workflows, and support evidence-based medical decision-making; however, the adoption of such systems remains uneven, influenced by technological, organizational, and perceptual factors that vary substantially across institutional contexts. Despite significant advances in artificial intelligence, blockchain, and cloud computing within smart hospital ecosystems, key gaps remain related to interoperability, real-world implementation, governance, and cross-layer integration, underscoring the need for coordinated governance frameworks and scalable infrastructure strategies to ensure sustainable and effective digital health transformation. The evolution of SDS from isolated analytical tools toward integrated strategic platforms reflects a fundamental shift in how healthcare organizations conceptualize the relationship between technology, management, and institutional sustainability (Stoumpos et al., 2024).

Healthcare Sustainability

Healthcare sustainability constitutes a multidimensional organizational imperative that extends beyond environmental stewardship to encompass the long-term economic viability, social equity, and institutional resilience of health service delivery systems(Tran et al., 2023) Hospitals face significant challenges in implementing sustainability practices in the post-pandemic era, with sustainability performance metrics aligned with the triple bottom line framework revealing the complex interactions between environmental, social, and economic dimensions that healthcare organizations must navigate simultaneously. Five core drivers underpin the transformation of hospitals into sustainable institutions: circular economy principles, sustainable infrastructure development, organizational knowledge management, structured management systems, and technological innovation, each of which contributes to reducing environmental impact, enhancing workforce well-being, and securing long-term financial viability. The list of sustainability issues posing risks to healthcare organizations has grown steadily over the last decade, with hospitals and related industries responsible for greenhouse gas emissions, pollutants, and unsustainable practices that carry a substantial disability and mortality footprint, making structured institutional responses both ethically and operationally necessary.

Sustainability Strategy in Healthcare Organizations

Sustainability strategy in healthcare represents the deliberate and coordinated organizational effort to embed environmental, social, and economic objectives into the core governance, planning, and operational frameworks of health institutions(Bawale et al., 2025)**.** Strategic management is becoming increasingly important for sustainable management in healthcare as the growing complexity, dynamics, and uncertainty of health system environments necessitate long-term strategic thinking capable of navigating institutional, financial, and regulatory challenges simultaneously.

RESEARCH METHOD

This study employs a bibliometric analysis approach to systematically map and evaluate the intellectual structure, thematic evolution, and global research trends pertaining to *Smart Decision Systems in Healthcare Sustainability*. The dataset was retrieved exclusively from the Scopus database on Mei 7, 2026, using a structured keyword search strategy incorporating terms directly relevant to the research topic, applied across titles, abstracts, and author keywords to ensure maximum retrieval comprehensiveness. Scopus was selected as the sole data source owing to its superior multidisciplinary coverage, standardized metadata structure, and widespread adoption in bibliometric research. No restriction was imposed on the publication year, thereby capturing the full temporal trajectory of scholarly output from the earliest available records through to the data collection date. The retrieved bibliometric data were subsequently processed and analyzed using Biblioshiny, the interactive graphical interface of the bibliometrix package developed within the R programming environment. A comprehensive suite of analytical techniques was applied, encompassing annual scientific production, most relevant authors analysis, co-authorship network mapping, keyword co-occurrence analysis, thematic mapping, thematic evolution, trend topic identification, Bradford's Law, and Lotka's Law. Publications were included only if they were written in the English language and published in peer-reviewed journals or conference proceedings, while editorials, letters, errata, and retracted documents were systematically excluded to maintain the quality and integrity of the analytical dataset.

RESULTS

The data underpinning this bibliometric analysis were systematically retrieved from the Scopus database on June 7, 2026, employing a structured keyword search strategy designed to capture the most relevant and comprehensive body of literature pertaining to *Smart Decision Systems in Healthcare Sustainability*. Scopus was selected as the sole data source on the grounds of its extensive coverage of peer-reviewed journals, conference proceedings, and scholarly publications across multidisciplinary domains, thereby ensuring the reliability, consistency, and academic credibility of the dataset. The retrieved records were subsequently processed and analysed using Biblioshiny, an interactive web interface of the R-based bibliometrix package, which facilitated the systematic examination of publication trends, authorship patterns, keyword co-occurrence structures, thematic evolution, and collaborative networks. The number of articles each year shown in Figure 1. The data shown that the article that related to the theme founded start in 2008, and has peak above 40 in 2025. The data also depict that the trend of the issues improve each year.

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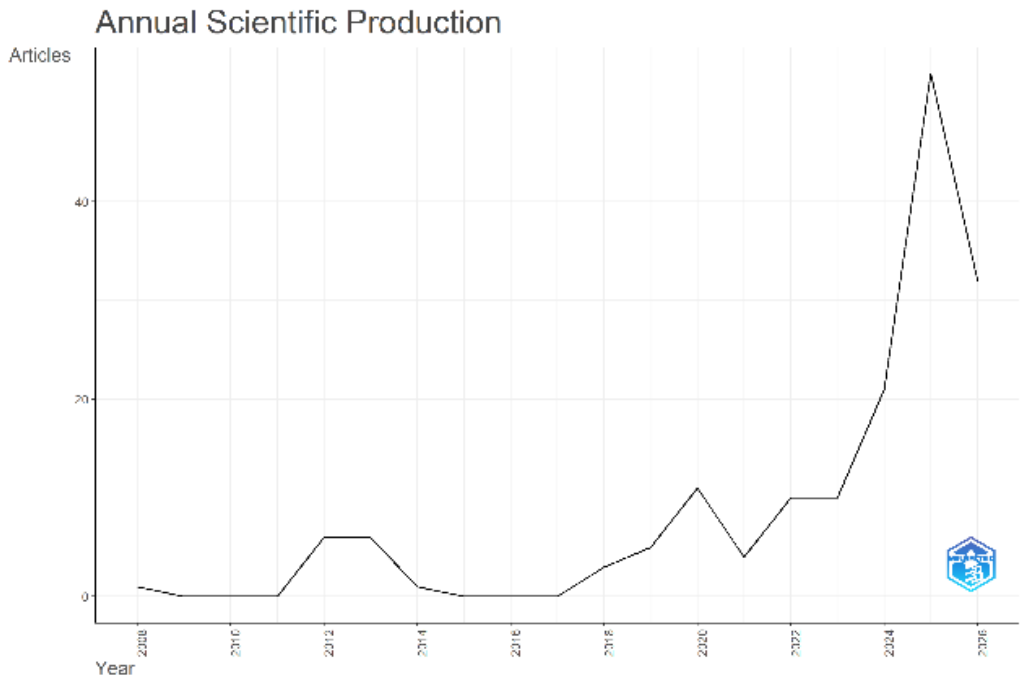
Figure 1. Annual Scientific Production



The Trend Topics visualization reveals a progressive and strategically significant evolution in the thematic orientation of the research domain, spanning from 2020 to 2026, with term frequency represented by the proportional size of each bubble across three reference scales of 20, 40, and 60 occurrences. During the earliest phase of the observed period, foundational technical topics including environmental protection, feedback control loops, data acquisition, and data communication systems dominated the landscape, reflecting the field's initial preoccupation with infrastructure-level concerns and early-stage digital systems.

Figure 2. Trend Topic

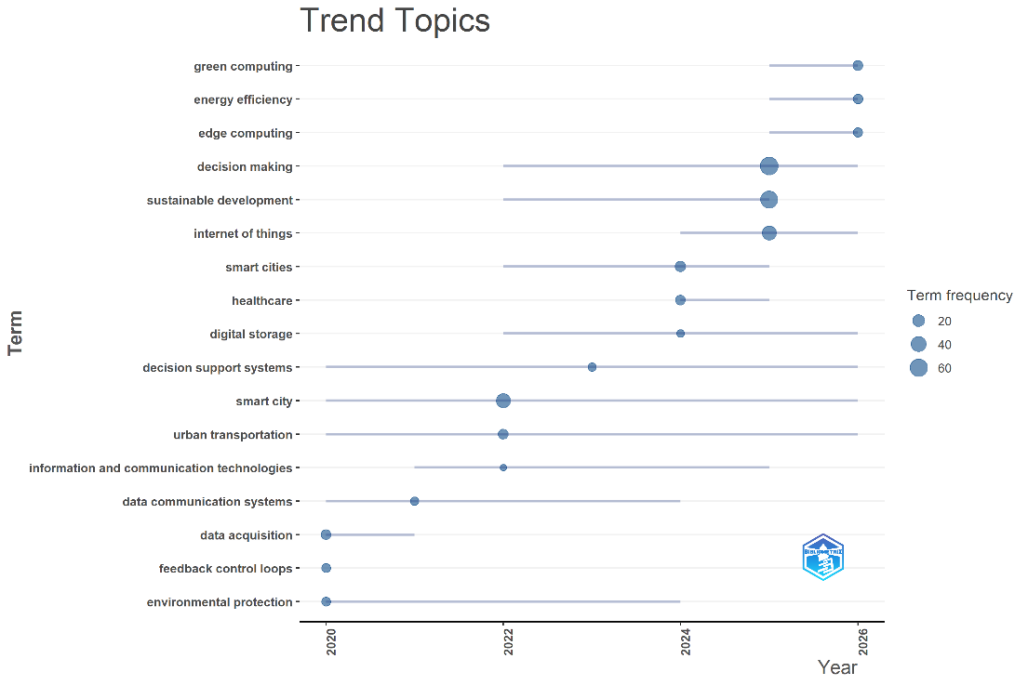


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Figure 3. Thematic Map

The thematic map in Figure 3 was generated using Biblioshiny (R bibliometrix package) and illustrates the structural development of research themes based on two dimensions: Centrality (Relevance Degree) on the horizontal axis and Density (Development Degree) on the vertical axis. The map is divided into four quadrants, each representing a distinct thematic category.

Figure 4. Word Cloud

The word cloud visualization produced through Biblioshiny provides an intuitive and frequency-weighted representation of the most prominent keywords across the entire corpus of analyzed publications, with font size directly proportional to the relative frequency of each term's occurrence within the dataset.

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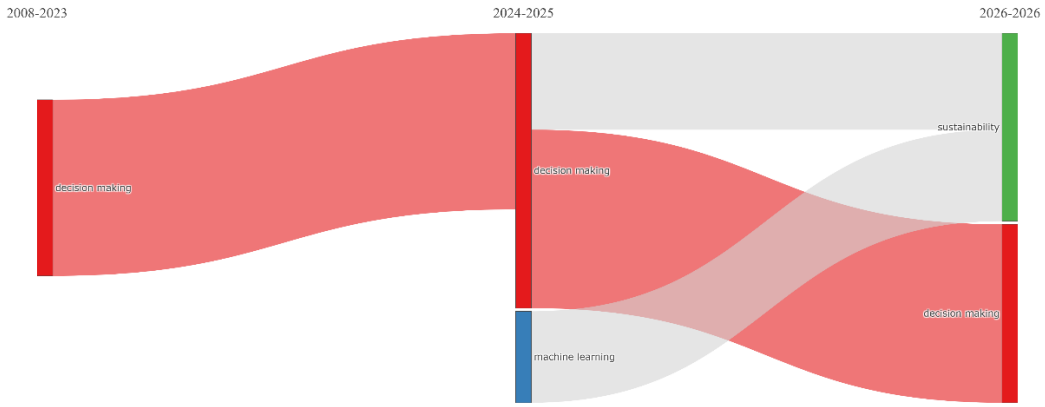
Figure 5. Thematic Evolution

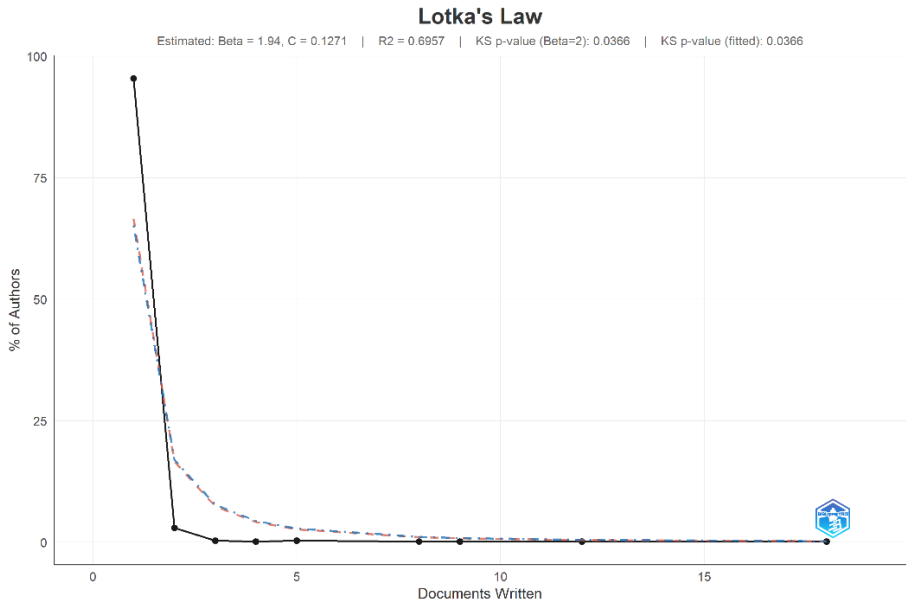


The diagram above illustrates the thematic evolution of research topics across three distinct time periods: 2008–2023, 2024–2025, and 2026.

The analysis of author productivity using Lotka's Law yielded an estimated value of Beta = 1.94 with a constant of C = 0.1271, a value closely approximating the ideal Beta = 2 as established in the classical Lotka's Law. This indicates that the distribution of author productivity in this study closely follows the Lotka pattern, although not entirely identical. The coefficient of determination $R^2 = 0.6957$ indicates that the Lotka model is capable of explaining approximately 69.57% of the variation in author productivity distribution within this dataset. This suggests that the model performs reasonably well in representing authorship patterns; however, approximately 30% of the variation remains unexplained, likely attributable to the specific characteristics of this research topic.

The Kolmogorov-Smirnov (KS) test yielded a p-value = 0.0366 (for both Beta = 2 and fitted), which falls below the threshold of $\alpha = 0.05$. This statistically indicates a significant difference between the observed distribution and the theoretical Lotka distribution, suggesting that the data does not perfectly conform to Lotka's Law.

Figure 6. Lotka's Law



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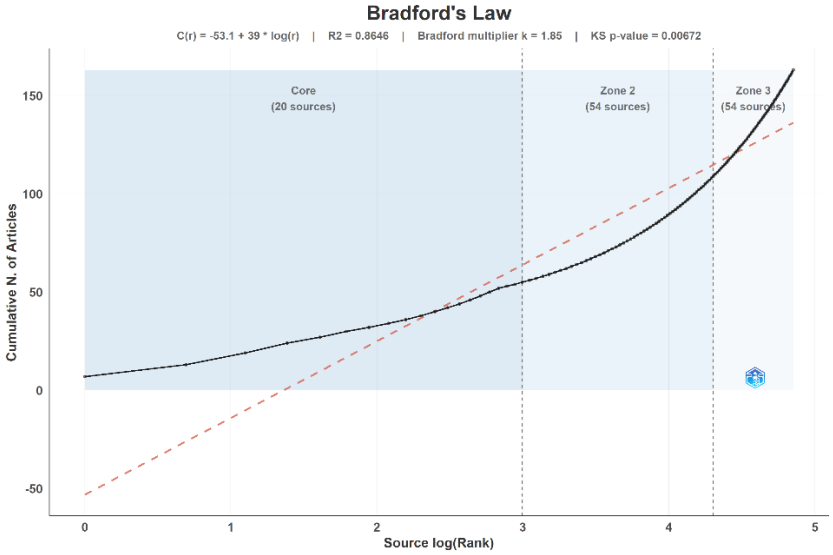
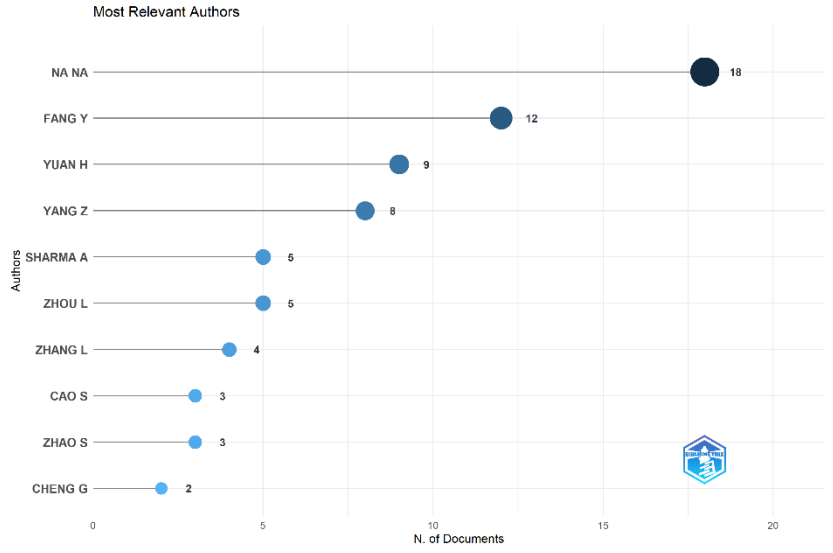
Visually, the graph demonstrates that the majority of authors (>75%) contributed to only a single document, while very few authors produced more than five documents. This pattern is consistent with the common phenomenon in bibliometrics, namely the dominance of occasional authors over highly productive ones within the topic of Smart Decision Systems in Healthcare Sustainability.

Figure 7. Bradford's Law



The analysis of publication source distribution using Bradford's Law produced the equation C(r) = -53.1 + 39 × log(r) with a value of $R^2 = 0.8646$, indicating that the Bradford model is capable of explaining 86.46% of the variation in the cumulative distribution of articles against source journal rankings. This level of fit is considered good and robust, suggesting that the distribution pattern of publications on this topic follows Bradford's Law with reasonable consistency. The Bradford multiplier k = 1.85 reflects a relatively moderate zone expansion ratio, meaning that each zone transition requires approximately 1.85 times more journals to produce an equivalent number of articles.

Figure 8. Most Relevant Author



The figure above shown the top 10 most relevant author of the article that analyzed using biblioshiny.

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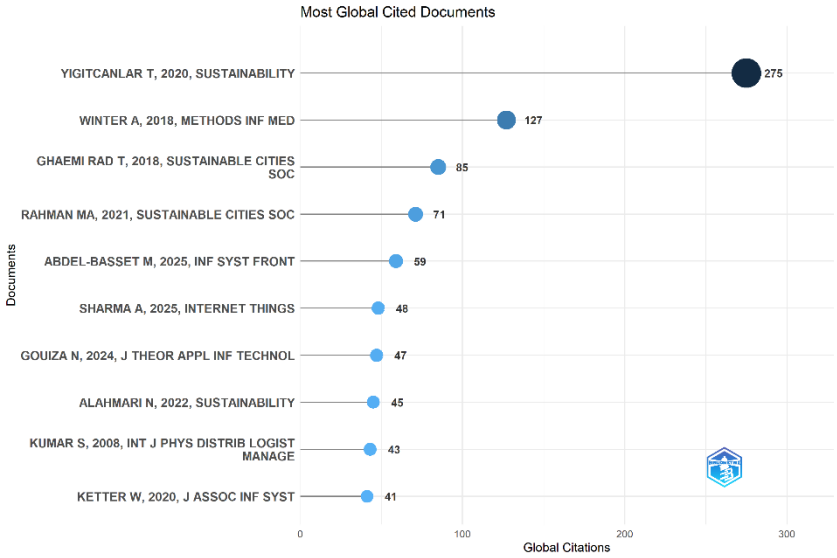
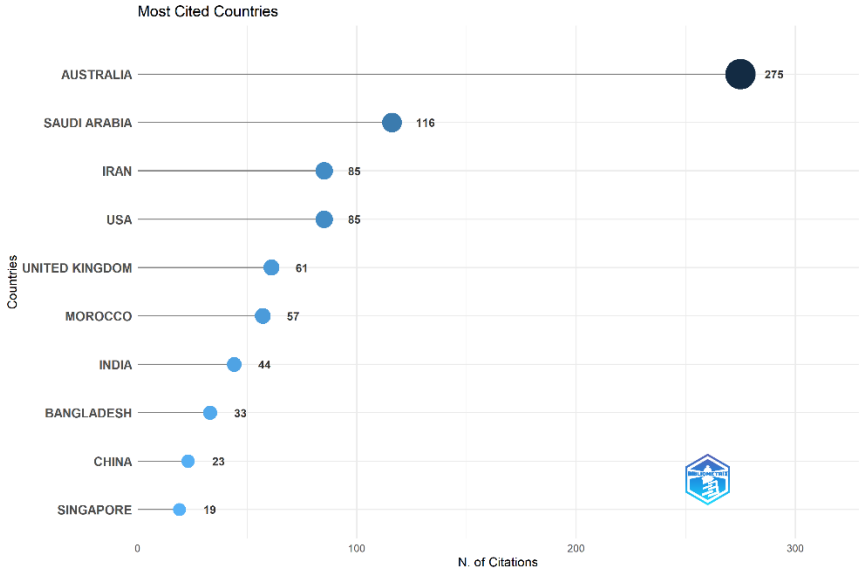
Figure 9. Most Global Cited Documents



Data above shown the most global cited document related to the topics.

Figure 10. Most Global Cited Countries



The data show the top 10 most cited countries of the related article.

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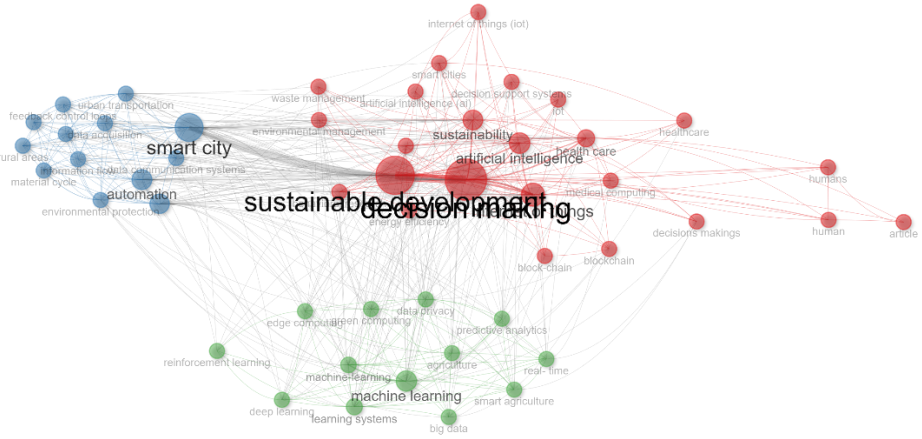
Figure 11. Co-occurrence Network



The keyword co-occurrence network reveals three distinct thematic clusters within the literature on *Smart Decision Systems in Healthcare Sustainability*. The red cluster (center-right) is the most dominant, featuring two large central nodes that serve as the primary intellectual hubs of the field, reflecting the highest keyword frequency and the strongest interconnections across the dataset. The blue cluster (left) represents a specialized sub-domain that, while internally cohesive, maintains strong linkages to the central red cluster through several cross-cluster connections. Meanwhile, the green cluster (bottom) constitutes an emerging thematic stream with moderate internal connectivity, suggesting these topics are still in a developmental phase. The network demonstrates a well-structured yet evolving knowledge landscape, where the dominant central cluster drives the core discourse, while the peripheral clusters contribute complementary and emerging dimensions to the broader research field.

DISCUSSION

This study was principally designed to conduct a comprehensive bibliometric analysis of the existing literature on *Smart Decision Systems in Healthcare Sustainability*, with the overarching aim of mapping the intellectual structure, identifying global research trends, and deriving meaningful sustainability strategy implications from the accumulated body of scholarly knowledge.

Research Trend Related to Smart Decision Systems in Healthcare Sustainability

Based on Trend Topic Analysis as the timeline progressed into the 2022–2024 transition phase, a discernible conceptual shift emerged, with topics such as smart city, urban transportation, information and communication technologies, digital storage, and decision support systems gaining traction, signalling the growing intersection between intelligent infrastructure and strategic organizational management. It also related to the healthcare even though it looks far from the topic, but micro analysis find this related to the topic such as an article explain how applying AHP to Smart City Development including in Healthcare sector (Simjanović et al., 2023). The most intellectually prominent cluster of the entire visualization, characterized by the three largest bubbles in the dataset, comprises decision making, sustainable development, and internet of things, all peaking around 2024–2025, which collectively affirm that evidence-based decision-making and sustainability imperatives have converged into the dominant intellectual preoccupations of the field. For example research on green healthcare in smart cities harnessing internet of things for sustainable transformation (Kaur, 2024). healthcare appears as an active and growing term within this same mid-to-late period, reinforcing the contextual relevance of this study's focus. The most contemporaneous frontier of the field, occupying the rightmost position along the temporal axis, is defined

by green computing, energy efficiency, and edge computing, whose emergence in 2025–2026 indicates a forward-looking trajectory wherein smart decision systems are increasingly being examined through the lens of sustainable digital infrastructure and energy-conscious technological governance, directly corroborating the theoretical and strategic significance of the research domain addressed by the present study.

Thematic Map related on four quadrant. First, Quadrant 1 Motor Themes (Top Right). This quadrant is empty in the current dataset. The absence of themes in this quadrant indicates that no research cluster has yet achieved the status of a dominant and well-developed driving force within the literature on Smart Decision Systems in Healthcare Sustainability. This suggests the field has not yet reached full academic maturity, and a leading thematic engine is yet to be established. Second, Quadrant 2 Niche Themes (Top-Left). This quadrant contains two thematic clusters. Cluster 1 related to Healthcare & Human Focus with keywords: *health care, human, article.* This cluster reflects a group of themes that are internally well-developed within the literature but maintain limited connectivity to the broader research network. Topics surrounding *healthcare* and *human factors* are deeply explored within their own subdomain, yet remain relatively isolated from the central discourse of the field. Cluster 2 related to Smart Systems & Automation *(Blue Cluster)* with keywords: *smart city, information management, automation.* This cluster sits near the boundary between Niche and Motor Themes, suggesting it is a specialized but internally cohesive research stream. The themes of *smart city*, *information management*, and *automation* are well-connected within themselves but have yet to achieve broader relevance across the entire research landscape, positioning them as advanced niche contributors rather than mainstream drivers. Third, Quadrant 3 Emerging or Declining Themes (Bottom-Left). This quadrant is also empty in the current dataset. The absence of themes here implies that no research topic is currently fading from relevance or newly emerging at a marginal level. This is a positive indicator, suggesting the field does not carry significant intellectual "dead weight" and that past themes have either matured or transitioned into more established positions. Last, Quadrant 4 Basic Themes (Bottom-Right). This quadrant is the most populated and contains two distinct clusters. Cluster 3 related to Technological Enablers *(Green Cluster) with* Keywords: *Internet of Things, machine learning, learning systems.* These themes exhibit high centrality, meaning they are strongly connected to the broader research field, but their density remains relatively low, indicating that while they are widely referenced, their internal thematic development is still ongoing. *IoT*, *machine learning*, and *learning systems* serve as critical technological pillars supporting the overarching research topic, with significant potential for further depth and specialization. Cluster 4 related to Strategic & AI Foundations *(Pink/Red Cluster)* with Keywords: *decision making, sustainable development, artificial intelligence.* Positioned at the far bottom-right, this is the most central cluster in the entire map. The themes of *decision making*, *sustainable development*, and *artificial intelligence* are highly relevant and extensively cross-referenced across the literature. However, their relatively low density suggests that despite their widespread presence, these themes have not yet been explored with sufficient depth or internal cohesion. This represents the greatest research opportunity in the field, these foundational themes urgently require more focused, in-depth scholarly development.

Related to Word Cloud result the two most visually commanding terms, *sustainable development* and *decision making*, occupy the gravitational center of the visualization, affirming their status as the twin conceptual pillars around which the intellectual structure of this research domain is organized, and directly validating the theoretical premise of the present study. Positioned at the second tier of prominence are *machine learning*, *artificial intelligence*, *internet of things*, and *sustainability*, whose substantial visual weight signals the field's deep and sustained engagement with intelligent technological

systems as enabling mechanisms for sustainable organizational outcomes. A third cluster of moderately frequent terms, including *smart city*, *health care*, *learning systems*, *information management*, *automation*, *deep learning*, and *agriculture*, reveals the inherently interdisciplinary character of the domain, spanning urban governance, clinical management, and agricultural sustainability as interconnected application contexts. The periphery of the visualization is populated by a diverse constellation of specialized terms such as *green computing*, *predictive analytics*, *data privacy*, *reinforcement learning*, *blockchain*, *waste management*, *urban transportation*, *energy efficiency*, *environmental management*, and *decision support systems*, which collectively indicate that the field draws from a broad and continuously expanding intellectual base. The co-presence of *healthcare* and *decision support systems* alongside *sustainable development* and *artificial intelligence* within the same visualization confirms that smart decision systems applied to healthcare sustainability constitute an emerging and strategically significant niche within this larger interdisciplinary research landscape, thereby reinforcing the novelty and timeliness of the present bibliometric investigation.

Related to the Thematic Evolution, during the earliest and longest period of 2008–2023, the research landscape was almost entirely dominated by a single overarching them, decision making, represented by a massive singular red band occupying virtually the entire width of the flow, indicating that for well over a decade, scholarly discourse was overwhelmingly concentrated on decision-making frameworks with little to no thematic diversification. Transitioning into 2024–2025, the thematic structure begins to show the first signs of divergence, wherein machine learning emerges as a distinct secondary stream represented by a notably smaller blue band, signalling that the integration of computational intelligence and data-driven approaches was beginning to gain meaningful traction alongside the long-established decision-making discourse. By 2026, the thematic landscape undergoes a more pronounced transformation, as the flow visibly bifurcates into two prominent converging streams such as decision making retaining its dominant position while sustainability asserts itself as a newly significant and independently recognized theme, represented by a green band emerging at the upper-right portion of the diagram. This progressive thematic diversification strongly reflects the research community's growing commitment to embedding sustainability as a core theoretical and applied dimension of the field, complemented by the continuing rise of machine learning as a methodological enabler for a trajectory that is entirely consistent with the evolving global research agenda surrounding smart decision systems and healthcare sustainability.

Author Productivity and Distribution Resources

Author productivity can be seen from the Lotka’s Law. This pronounced hierarchical gradient in publication volume is entirely consistent with the principles of Lotka's Law, which predicts that a disproportionately small number of authors will account for the vast majority of scholarly output, thereby reaffirming that the research community surrounding this topic remains relatively concentrated and has yet to attract the breadth of contributor diversity that would characterize a fully mature academic discipline.

The analysis of the most relevant authors reveals a distinctly uneven distribution of scholarly output within the literature on *Smart Decision Systems in Healthcare Sustainability*. NA NA leads the field overwhelmingly with 18 documents, a figure that dwarfs the contributions of all other authors and firmly establishes this individual as the foremost intellectual contributor to the discipline. But after checking it was title from a document Not Available, Name of Author because the data is conference review. Fang Y follows as a strong second with 12 documents, while Yuan H and Yang Z contribute 9 and 8 documents respectively, together forming a small but highly productive core of researchers whose cumulative output constitutes the backbone of the existing literature.

A middle tier comprising Sharma A, Zhou L, and Zhang L, with 5, 5, and 4 documents respectively, demonstrates a secondary layer of consistent scholarly engagement, whereas Cao S, Zhao S, and Cheng G, contributing 3, 3, and 2 documents respectively, represent the periphery of active authorship in this field. The sample of Fang Y such as evaluation of smart healthcare systems (L. Zhang et al., 2020), the other sample is about evaluation for Dementia care(K. Zhang et al., 2022). Yuan H talk about smart humanity, (Cao et al., 2020), Yang Z explain about smart energy management (Yang et al., 2020).

Distribution of resources related to Bradford Law. Based on the zoning results, the source distribution is divided into three Bradford zones as follows in Table 1.

Table 1. Bradford Zone

Zone	Number of Sources	Description
Core	20 journals	Most productive & highly relevant journals
Zone 2	54 journals	Moderate-contribution journals
Zone 3	54 journals	Peripheral journals

The core zone, comprising only 20 journals, serves as the backbone of the literature within this topic. Journals in this zone represent the most dominant and relevant sources, and should be considered the primary references as well as preferred submission targets for researchers in the fields of *Smart Decision Systems* and *Healthcare Sustainability*. The KS p-value = 0.00672, which is substantially below α = 0.05, statistically confirms a significant deviation from the ideal Bradford model. This is a common finding in bibliometric analyses of interdisciplinary and cross-domain topics, such as the present research topic, which simultaneously spans the domains of healthcare, information technology, and sustainability.

Most cited document related to sustainability of artificial intelegence(Yigitcanlar & Cugurullo, 2020) with 275 citation, smart medical information technology for healthcare (SMITH) written by (Winter et al., 2018) get 127 citates, then research on methodological framework for assessment of ubiquitous cities using ANP and DEMATEL methods (Ghaemi Rad et al., 2018) get third rank citation about 85 citates. (Abdel-Basset et al., 2025) explain on multi-criteria of decision-making framework, other article talk about 5G-IoT focus on Healthcare monitoring for a Smart City(Sharma et al., 2025). Another article also get more than 40 citation include that written by (Gouiza et al., 2024), (Alahmari et al., 2022), (A. Kumar & Sharma, 2019), and (Ketter et al., 2020).

The analysis of the most cited countries reveals a pronounced concentration of research influence within a select group of nations, with Australia emerging as the overwhelmingly dominant contributor, accumulating 275 citations, a figure more than double that of the second-ranked country, Saudi Arabia, with 116 citations, a disparity that underscores Australia's exceptional scholarly productivity and impact within this research domain. Iran and the United States share an equal citation count of 85, positioning both nations as significant yet comparatively moderate contributors, followed by the United Kingdom at 61 citations and Morocco at 57, the latter's presence reflecting a growing engagement with smart decision systems and sustainability research from the African continent. India, Bangladesh, China, and Singapore complete the top ten with citation counts of 44, 33, 23, and 19 respectively, indicating meaningful but still developing research footprints in this field.

Sustainability Strategy Implications

The findings of this bibliometric study yield several strategically significant implications for the sustainable advancement of smart decision systems within the global healthcare landscape. The consistent dominance of decision making, artificial intelligence, and

sustainable development as the three most central themes across the entire dataset, reinforced by the most cited document on AI sustainability by(Yigitcanlar & Cugurullo, 2020) with 275 citations, strongly affirms that healthcare institutions and policymakers must treat smart decision systems not as peripheral digital tools, but as foundational strategic infrastructure that drives long-term sustainability outcomes. As AI and healthcare sustainability become increasingly intertwined, new AI models promise unprecedented diagnostic precision and personalized therapies, yet these advancements will require ever-greater computing power if not carefully managed, making energy efficiency a key strategic priority.

The emergence of green computing, energy efficiency, and edge computing as the newest trending topics in 2025–2026 further signals that sustainability strategy in healthcare must now explicitly incorporate green technology governance frameworks. Energy-efficient AI models, the implementation of green computing, and the use of renewable energy have been identified as specific solutions to mitigate the environmental impacts of AI systems in the medical field, constituting important guidelines for medical institutions, policymakers, and AI developers. Simultaneously, the geographic concentration of research influence in high-income nations such as Australia, Saudi Arabia, and the United States, while emerging economies including India, Bangladesh, and China maintain comparatively modest citation footprints, underscores the strategic necessity of ensuring equitable global access to smart healthcare technologies. The unequal distribution of computing and educational resources worldwide means that the growing economic significance of AI technology may lead to wider disparities globally, a risk that sustainability strategy frameworks must actively address through inclusive governance and international research collaboration.
The complete absence of Motor Themes in the Thematic Map, alongside the classification of the three dominant themes as Basic Themes that remain internally underdeveloped, presents the most actionable strategic implication of this study. This structural gap confirms that the intellectual architecture of smart decision systems in healthcare sustainability remains fragmented, and that the greatest strategic opportunity lies in developing integrative frameworks that synthesize decision intelligence, environmental sustainability, and healthcare governance into a unified and operationally coherent agenda to achieve SDG.

Co-occurent Network shown some keyword such as sustainable development, sustainability, decision making, smart city, artificial intelligence, machine learning and big data. Several research that related to the topic such as data-diven decision making in smarth health and emergency management(Sudharson et al., 2025), climate-smart diagnostic medical imaging(Shokoohi et al., 2025), big data and intelligence application related to healthcare services(Upreti et al., 2025), sustainable supply chain also important in healthcare industries(Manoharan et al., 2023), healthcare decision making factor to ensuring sustainability using artificial intelligence(Suha & Sanam, 2023), it also used for smart blood inventory management(EL Gharbi et al., 2026). Healthcare future also related to the keyword (Christodoulou & Zoulias, 2025), public hospital sustainability using innovation culture(Tessema, 2025), the use of smart energy system in hospital(Mojaver & Izadi, 2026). Digital dementia an application based on IoT(Ghamari & Sundaram, 2025). The other article also explain about digitalization in healthcare sector to support the supply chain strategy(Bvuchete et al., 2022), biosmartsense (Roy et al., 2019). AI also important to this topic such as an article about AI-Driven Health Scoring(Nayel & Hemdan, 2026) This related also to the topic of sustainability management strategies which talk about operational sustainability management strategies (Adiatma, 2025).Along with another article about smart hospital purchasing decision related to supply chain(S. Kumar et al., 2008). Sustainable healthcare can be achieve by integrating technology (Al-Barazie & Mohamed, 2025), multi-criteria decision

analysis also can be implemented such as in Kuwait(Abdullah et al., 2019), IoT devices also can be personalized as smart healthcare system(Sethi & Verma, 2025).

CONCLUSION

This study conducted a comprehensive bibliometric analysis of the global literature on Smart Decision Systems in Healthcare Sustainability, revealing a field in active transition from singular preoccupation with decision-making frameworks toward an increasingly pluralistic intellectual landscape in which machine learning and sustainability have emerged as independently significant and mutually reinforcing research streams. The twin conceptual pillars of decision making and sustainable development, consistently identified as the most central themes across all analytical layers, confirm that smart decision systems and healthcare sustainability are no longer parallel concerns but converging imperatives within the global health management agenda.

The complete absence of Motor Themes in the thematic map, combined with the structural fragmentation of core clusters and the disproportionate concentration of scholarly output among a limited number of contributors and high-income nations, collectively signals that the field has yet to reach intellectual maturity and that substantial opportunities for deeper, more integrative scholarly development remain unrealized. The emergence of green computing, energy efficiency, and edge computing as the most contemporaneous trending topics further affirms that sustainability strategy in healthcare must now explicitly incorporate green technology governance and energy-conscious digital infrastructure as non-negotiable institutional priorities.

The most actionable contribution of this study lies in its identification of decision intelligence, environmental sustainability, and healthcare governance as foundational themes urgently requiring unified theoretical development. Future research is encouraged to construct integrative frameworks that synthesize these dimensions into operationally coherent models of sustainable healthcare governance, empirically validated across diverse national and institutional contexts, in pursuit of the health-related Sustainable Development Goals.

LIMITATION

This study is limited by its exclusive reliance on the Scopus database as the sole source of bibliographic data, which may have excluded relevant publications indexed in alternative databases such as Web of Science, PubMed, or Google Scholar, potentially introducing selection bias into the dataset. Future research is encouraged to adopt a multi-database retrieval strategy to produce a more comprehensive and globally representative mapping of the intellectual landscape.

ACKNOWLEDGMENT

The authors gratefully acknowledge Universitas Musamus Merauke for providing institutional financial support toward the publication of this research in the conference proceedings. The authors also extend sincere appreciation to Universitas Gadjah Mada (UGM) for providing institutional access to the Scopus database, which enabled the systematic retrieval and download of the bibliographic data upon which this study is based.

DECLARATION OF CONFLICTING INTERESTS

The authors have declared no potential conflicts of interest concerning the study, authorship, and/or publication of this article.

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