Health research information systems for responsible innovation and sustainable health ecosystems: a bibliometric analysis

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Abstract

Purpose – The health research information system (HRIS) is a continuous process and an important factor for the visibility of higher educational institutions. Here is an attempt to analyze the worldwide research context on HRIS by focusing on its contribution to responsible innovation and sustainable health ecosystems. It attends to the intellectual structure, communities of practice and thematic evolution of HRIS research, emphasizing its relationship to ethical data governance and sustainability. It searches for the intellectual structure, nodes of collaboration and theme evolution of HRIS and highlights its fit with ethical data governance and sustainability.
Design/methodology/approach – A bibliometric study was carried out on the published documents indexed in Scopus and the PubMed database during 2015–2025. Performance analysis (annual publication output, citations, h-index, preferred sources, authors, institutions and countries) was further enriched by science mapping techniques, including co-authorship, co-citation, bibliographic coupling and keyword co-occurrence. For theme analysis, motor, basic, niche and early research themes were selected based on the use of thematic maps and evolution analysis.
Findings – The study identified 5,588 eligible publications from 2015–2025, showing a 44.65% annual growth rate. The documents averaged 32.07 citations, 10.3 co-authors and 40.37% international collaboration. Keyword analysis revealed strong links between innovation, sustainability and HRIS, reflecting robust academic engagement and evolving global research trends in health information systems.
Practical implications – The analysis has implications for both policymakers, health institutions and research managers to optimize the use of HRIS in advancing inclusion, transparency and shared value creation and for developing links between health research and societal benefits.
Originality/value – This is the first bibliometric analysis that placed HRIS between the dual perspectives of responsible innovation and sustainable health ecosystems. It adds to the literature by reviewing the knowledge body, identifying research frontiers and prescribing a future agenda for ethically based, impact-focused HRIS.

Keywords Health research information system, Sustainable health ecosystems, Bibliometric analysis, Data governance, SDGs, Science mapping

Paper type General review

1. Introduction

Health research information systems (HRIS) have been incorporated as an essential part of the contemporary health system to support effective management, consolidation and retrieval of health information from different entities (Wamba and Queiroz, 2021). HRIS can support the

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transition of healthcare institutions towards digital and data-driven operations by facilitating evidence-based decision-making, fostering research collaboration and establishing an evidence-informed culture (Epizitone *et al*., 2022). These systems have incorporated a wide range of technologies, including at the more commonplace end of the spectrum database management models and across to advanced technologies, e.g. ontologies, knowledge graphs and semantic web-based technology to support improved interoperability, access and scale in health research (Pradhan *et al*., 2025; Wan *et al*., 2024).

Consequently, there are plenty of challenges in the HRIS systems, such as data diversity, privacy concerns and how to exploit effectively multiple sources of information (Ololade *et al*., 2023). These challenging issues are compounded in cross-institutional and cross-national health research, where the smooth data have some serious problems, stemming from the communication of protocols (Langote *et al*., 2024). What is more, with the surge of new technologies – artificial intelligence (AI), machine learning (ML) or blockchain to name a few – it's even more pressing for us to control and govern our data in such a way as to make sure that ethical and privacy values are taken into account and to see responsible innovation happen" (Jada and Mayayise, 2023).

The purpose of this paper is to analyze the development orientation, developing trends and hotspots of HRIS research as well as its relationship with classic literature and emergent literature. With a citation analysis, keyword co-occurrence and trend of topics from Scopus-indexed journals, the aim is to shed light on the degree HRIS has contributed to responsible innovation in terms of sustainable health systems. At the same time, this review will trace blind spots in current work that go hand-in-hand with our coverage limitations by proposing directions for future research for HRIS as it evolves ethically and responsibly, establishes links to other disciplines and maintains its long-term prospects.

2. Materials and methods

In this research, our empirical analysis is conducted by using the bibliometric overview on scientific literature, which addresses topics of health research information systems (HRIS) in the context of ML concerning sustainable behavior in health ecosystems (Senthil *et al*., 2024). The study uses secondary data analysis, according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)-2020 Statement directives, so that results would be systematic and reproducible (Haddaway *et al*., 2022).

2.1 Eligibility criteria

The following were the inclusion criteria of this review: peer-reviewed papers, conference papers and review articles published by reputable journals during 2015–2025. Particular emphasis was placed on HRIS studies as well as examinations of data sharing and management in health, utilization of digital health technologies and semantic interoperability, along with other aspects of digital health work. In this paper, only articles in English to ensure uniformity. Non-health studies, predatory journal publications and non-peer-reviewed documents were also excluded in this review (Jeilani and Hussein, 2025).

2.2 Source of information

Two prominent academic databases, i.e. Scopus and PubMed, characterized by their broad coverage of high-impact peer-reviewed journals with an interdisciplinary nature, were investigated. These databases were chosen as they can yield strong and extensive data sets across a range of fields, which are important for understanding diverse aspects of health research information systems (Gusenbauer and Gauster, 2024).

2.3 Search strategy

A comprehensive search strategy was developed to find relevant HRIS literature. The key terms were "health research information systems", "health research system," "responsible research" and their different forms. Boolean operators were attached to these terms to obtain related articles. The search strategy was restricted to manuscripts available in Scopus and PubMed from 2015 through 2025. The search string was used as follows in Table 1.

2.4 Data management

Data were processed by structuring the entire set of metadata (title, authors, abstracts, keywords, access to full text, etc.) in a database. It then becomes easy to fetch and operate on the data. A citation manager (EndNote or Zotero) was used for organization and automatic referencing. The duplicated records were excluded by the Excel software, and the data were more consistent.

2.5 Selection process

The Scopus and PubMed databases were chosen to be the main databases for data collection, which was performed in this bibliometric study. The inclusion of these two databases achieved a high degree of sensitivity regarding health, medical and interdisciplinary literature on HRIS (Vaquero-Álvarez *et al*., 2020). Scopus was preferred due to its wide indexing of international journals across all fields and domains, including health informatics and management, whereas PubMed had more focused access to peer-reviewed biomedical and clinical research literature. Other databases like Web of Science and Google Scholar were scanned but were not included since Scopus and PubMed provided good enough depth, quality and compatibility for a bibliometric study in this research (Shaikh *et al*., 2023).

2.6 Data collection process

Studies were selected by retrieving articles that met the above inclusion criteria from Scopus and PubMed. The data were classified using theories while working and then arranged systematically. Mirroring records were eliminated, and all articles were assessed for credibility with the HRIS topic. Information on author collaboration, journal quality, institutional contribution and country participation was collected (Patino and Ferreira, 2018).

2.7 Data elements

Key data elements collected included the article title, authors, publication year, journal name, keywords, abstract and full text where accessible (Pottier *et al*., 2024). These elements were organized in a structured database for easier retrieval and processing during analysis.

2.8 Assessment of the risk of bias of the study

The general limitations of bibliometric analysis were well taken into account. Publication bias, in which studies with positive findings are more likely to be published, was one of the major potential biases identified (Thelwall *et al*., 2023). Another limitation is database bias; we only

Table 1. Search strategy used for PubMed and Scopus databases

Database	Search strategy
Scopus	(ALL (health research information system) OR ALL (health research system) AND ALL (responsible innovation) OR ALL (responsible research AND innovation) AND ALL (sustainable health ecosystems) OR ALL (health ecosystem)) AND PUBYEAR >2015 AND PUBYEAR <2025 AND (LIMIT-TO (PUBSTAGE, "final")) AND (LIMIT-TO (DOCTYPE, "ar")) AND (LIMIT-TO (LANGUAGE, "English"))
PubMed	(Health Research Information System) OR (health research system) AND (Responsible Innovation) OR (responsible research AND innovation) AND (Sustainable Health Ecosystems) OR (health ecosystem) Filters: Free full text, Full text, Network Meta-Analysis, English, MEDLINE, from 2015–2025

took into account studies indexed in Scopus, which might not have been representative of those that are relevant to our study but were not indexed. Language bias was also recognized as only the English language studies were included. These biases were minimized by a large and extensive search strategy and through careful assessment of the relevance of each paper prior to inclusion (Mengist *et al*., 2019).

2.9 Measures of effect

The individual studies were not subjected to any measures of effects like statistical tests. Nonetheless, the performance of both authors, journals and institutions and countries participating in the HRIS domain was evaluated through bibliometric measures including citation counts, h-index and journal impact factor. These indicators made it possible to measure research productivity and impact.

2.10 Synthesis methods

A synthesis of the data framework included studies was done using several bibliometric methods. As well, co-occurrence analysis revealed key themes and conceptual structures in the literature throughout different time periods. Visualization and cluster analysis of the networks in keyword co-occurrence and author collaboration were performed using programs such as VOSviewer and Bibliometrix to explore clusters and trends (Gandasari *et al*., 2024). These approaches were helpful in discovering the hidden patterns of scientific works and visualizing the evolutionary trajectory of research on ML applications for sustainability in health ecosystems.

3. Results and discussions

A total of 6,398 records were selected from databases (Scopus and PubMed) after removing duplicates (including automated tool outputs), and 810 papers were excluded in the screening process. Screening resulted in 5,588 reports, each of which was retrieved and screened for inclusion. No previous studies were included. A total of 5,588 new studies were ultimately eligible and included in the systematic review, enabling a complete synthesis using the most recent PRISMA 2020 methodology, as shown in Figure 1.

Academic research has also experienced a marked increase since 2015, with 5,588 records being published across 2,000 sources at an annual growth rate of 44.65%. Average age of documents in years: 2.82. Document citing needs citation! Mean citation per document: 32.07. The collaboration is intense: 10.3 co-authors per document and a foreign co-authorship ratio of 40.37%. All publications are in articles, with a focus on modern research across the globe.

Environmental sustainability research is also reflected in the highest international impact factors, h-index, g-index and other citation-based measures of leading journals. *Sustainability* (Switzerland) is on the top with an h-index of 54 and g-index of 88, reflecting its high impact, 11,560 TC and 420 published articles in the period from 2016. Also, the *Journal of Cleaner Production* has a h-index and g-index of 47 and 81, respectively, indicating considerable academic impact with 7,277 citations. Others, such as T*echnological Forecasting and Social Change and Science of the Total Environment*, make substantial contributions (but with smaller indices), indicating that sustainability research is becoming increasingly diverse in Table 2.

Top 10 organizations by published research articles consumed aggregate count/average number of supplements in a unique publication are as follows: Mae Fah Luang University (278 articles), Wageningen University (216), Nanjing Agricultural University (211), University of California (140), University of Chinese Academy of Sciences (131), CSIRO (90), Nanjing Normal university (79), University of Queensland and Lanzhou and Universiteit Gent (all three has 73) (see Figure 2).

The three-field plot represents the ties between cited references (CR), authors (AU) and keywords (KW_Merged) in the research field of environmental sustainability. This

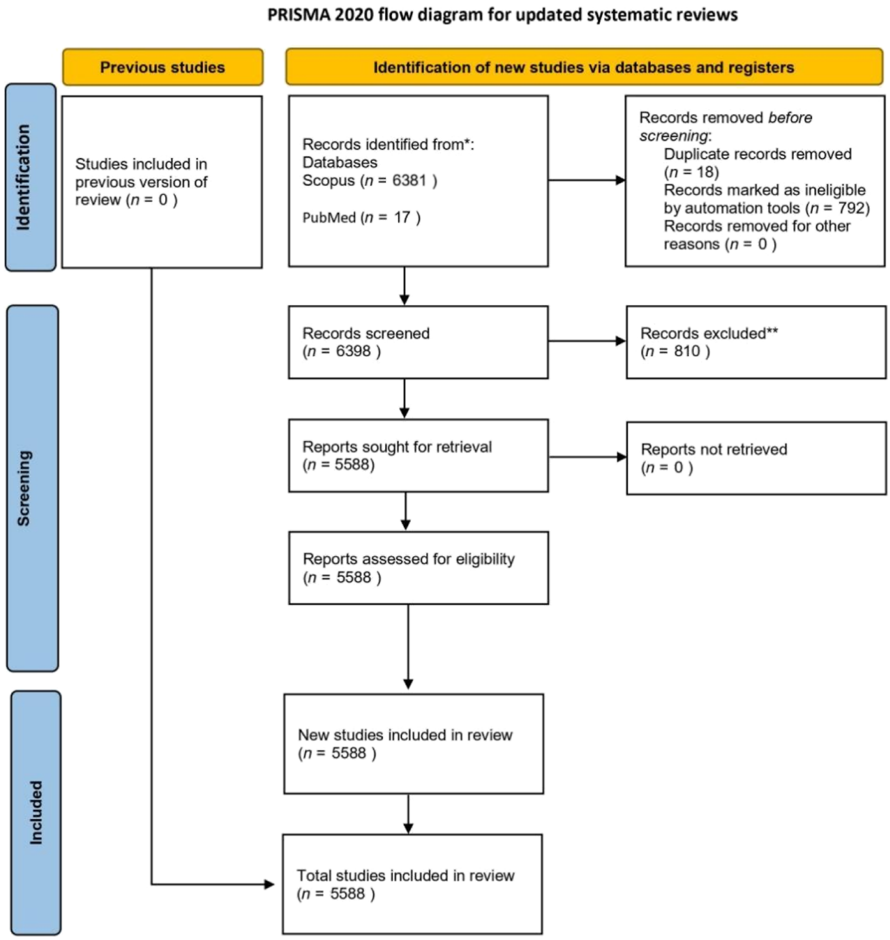

Figure 1. PRISMA flow diagram of the study selection process

Table 2. Sources' local impact based on h-index and citation metrics

Source	h_ index	g_ index	m_ index	TC	NP	PY_ start
Sustainability (Switzerland)	54	88	5.4	11,560	420	2016
Journal of Cleaner Production	47	81	4.7	7,277	142	2016
Technological Forecasting and Social Change	35	64	3.5	4,184	78	2016
Science of the Total Environment	28	44	2.8	2,188	82	2016
Journal of Business Research	25	38	3.125	3,355	38	2018
Chemosphere	22	44	2.75	2,076	44	2018
Business Strategy and the Environment	21	42	2.1	1,979	42	2016
International Journal of Environmental Research and Public Health	20	29	2.857	1,016	52	2019
Journal of Environmental Management	19	41	2.375	1,786	49	2018
Energies	17	25	2.429	645	28	2019

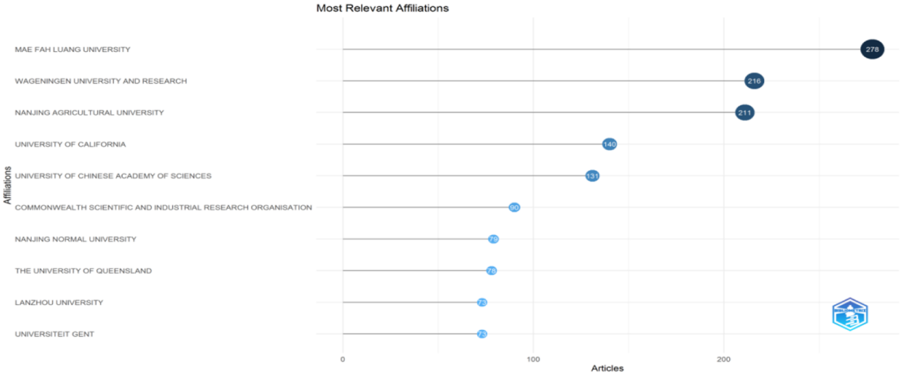

Figure 2. Top 10 organizations by published research articles and average contribution per publication

visualization realizes the connections between groundbreaking work, principal authors and significant research areas such as sustainability, human influence, AI, ecosystem administration and environmental preservation. The plot also reveals contributions as though a network of the most influential articles, as well as how they represent an evolution towards focus on hot topics such as climate change and sustainable development, providing a global snapshot of research tendencies and thematic connections within it Figure 3.

Research in environmental sustainability follows Bradford's Law of Scattering (Figure 4) wherein you have core journals that receive the most attention and so forth until one reaches 90% or more of their reading list. The base cluster is formed by *Sustainability* (Switzerland) (420 articles), *Journal of Cleaner Production* (142) and *Science of the Total Environment* (82), which are in charge to publish most of the research. The "zone of dispersion" features journals including *Technological Forecasting and Social Change* and *Environmental Science and*

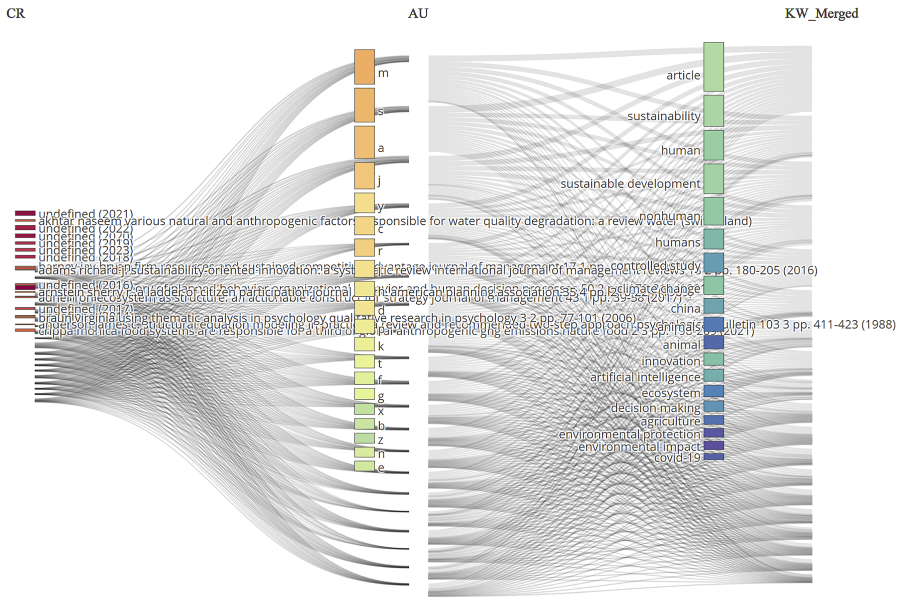

Figure 3. Three-field plot of cited references, authors and keywords

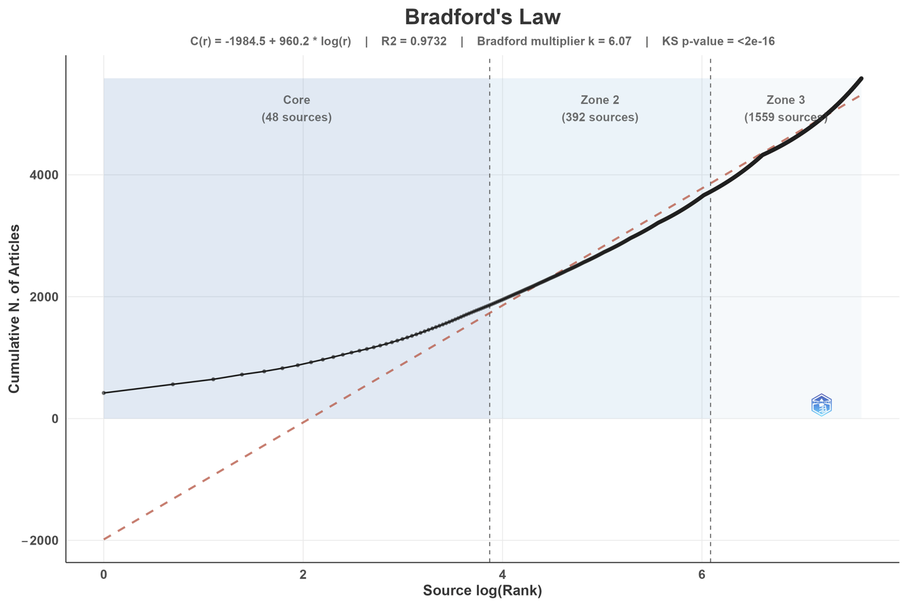

Figure 4. Distribution of research in environmental sustainability based on Bradford's law of scattering

Pollution Research, which publish fewer articles but broaden the range of research. This trend reveals a centrality of content in mainstream journals and diffusion in complementary ones.

The publishing trend from 2015 to 2025 for the journals on environmental sustainability indicates an exponential increase of research output. *Sustainability* (Switzerland) increased by 4 articles in 2016 to 420 records in 2024, with a significant increase in contributions. The *Journal of Cleaner Production* and *Science of the Total Environment* also increased steadily (up to 142 and 82 in 2024). Other journals, such as *Technological Forecasting and Social Change* and *Environmental Science and Pollution Research*, demonstrated upward trends; Figure 5 reflects the increasing importance of global sustainable, environmentally wise practices and innovations (Petrosillo *et al*., 2024).

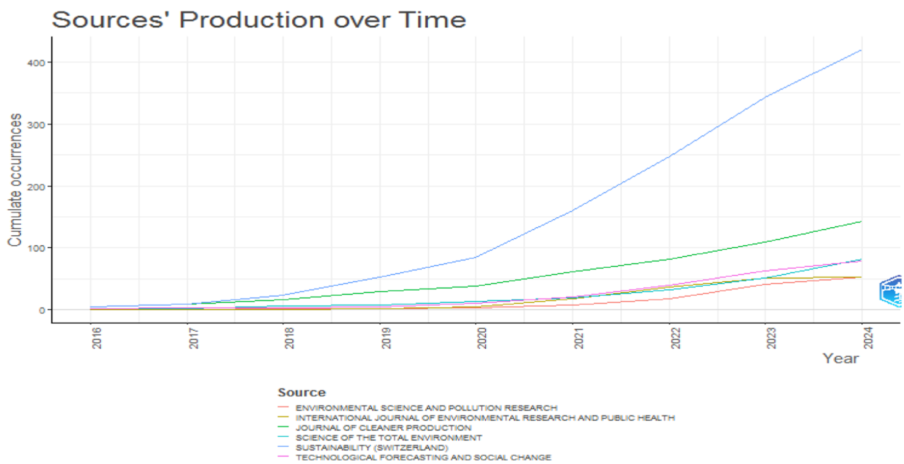

Figure 5. Research production over time

Through a global perspective on the bibliometric analysis of global health literature (Figure 6), it is indicated that China has been at the top with 4,852 articles, followed by the USA (2,640), the UK (1768) and India (1,516). Other noteworthy donors were Australia (1,296), Italy (1,295), Germany (939), Spain (815), the Netherlands (770) and Brazil (757). This distribution highlights the importance of emerging economies such as India and China in the development of health research, especially when it comes to responsible innovation and sustainable health ecosystems. The rising productivity of publications from these countries reflects a strengthened commitment to tackling global health problems in creative, sustainable ways.

Co-authorship-network analysis drawn with VOSviewer in Figure 7 illuminates strong collaborative links among key scholars of sustainability. Gareth Jones and the late Evan Benjamin would sit squarely at the intersection amongst these scholars, highlighting substantive interdisciplinary collaboration. Zhang Wei shines as a key collaborator who links clusters and connects to Zhang Li, among others. The visualized clusters reveal active collaborations across different countries and capabilities, leading to mutual improvements and development in the field.

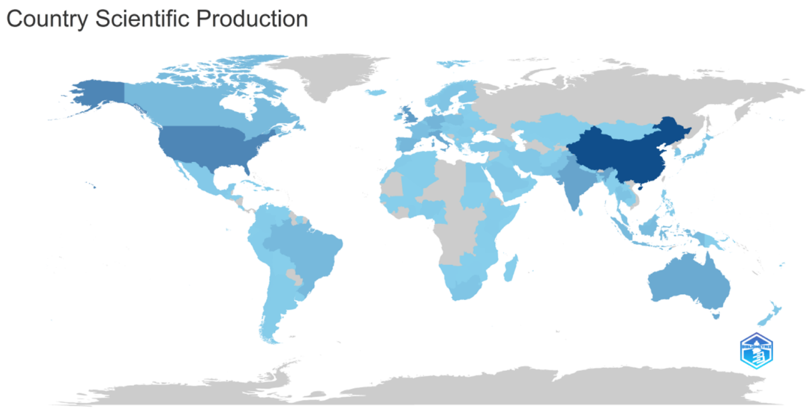

Figure 6. Country-wise scientific production

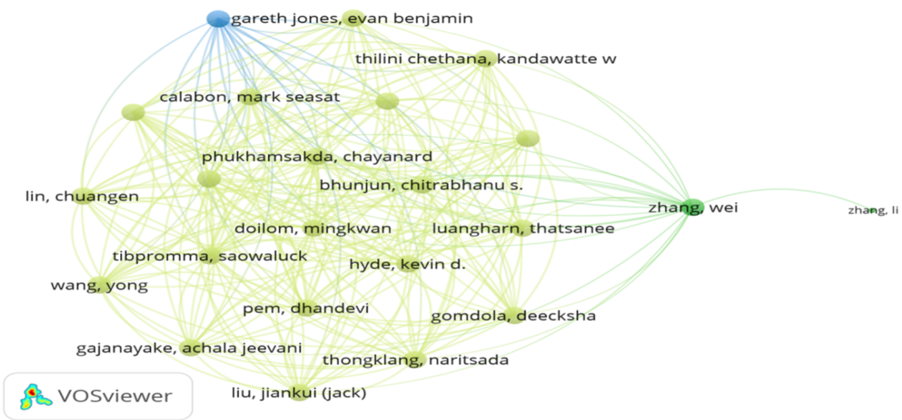

Figure 7. Network map of author collaborations

The co-authorship network is shown above, which shows the cooperation among representative studies in the policy and sustainable development field. The two clusters of the graph are easily identifiable: on the left, a blue cluster of articles that concentrate on “Clean Production and Sustainable” (e.g. Han and Koing) and on the right, an orange cluster, centered on Land use policy and Food (Angelsen and Nabavi). The interconnections between the clusters (drawn as gray lines) also indicate that research in these areas, including food systems, agriculture and environmental policy, is becoming more interdisciplinary after being siloed over time. Figure 8 further reflects the increasing associations between sustainability research and different kinds of policy and environmental themes.

The article focuses on highly frequent research themes: sustainability (778), sustainable development (706), human (535), nonhuman (380), climate change (347), innovation (347), humans (340), AI (292) and China (275). These themes reappear, and they demonstrate an emphasis on environmental and technological innovation, as well as social, ethical and policy dimensions, which are interdisciplinary in the recent scholarly literature about sustainability and development trends, as shown in Figure 9.

This VOSviewer visualization presents keyword co-occurrence networks (Figure 10) from some of the latest articles published on sustainability and AI. Larger clusters draw attention to

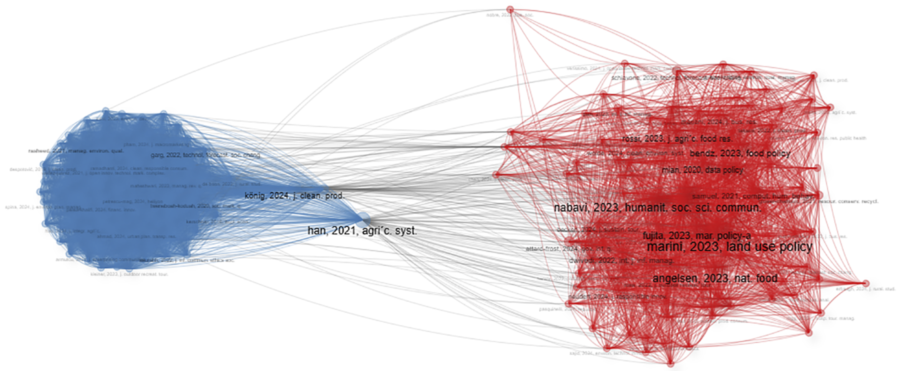

Figure 8. Cluster visualization of the co-authorship network

Figure 9. Frequently occurring research themes

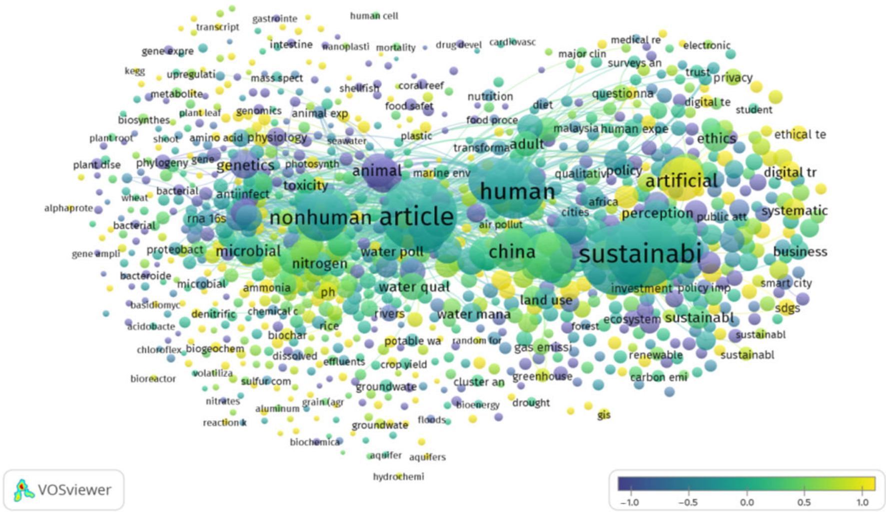

Figure 10. Keyword co-occurrence network visualization using VOSviewer

more frequent terms such as “human,” “nonhuman,” “article” and “sustainability”, which are indicative of the main topics. The color intensity represents the topic of evolution and diversity, interconnected nodes indicating interdisciplinary cooperation in genetics, microbial studies and ethics as well as smart city development between environmental aspects and technological domain for the dynamic scholarly interest of integration.

4. Conclusions and future work

The bibliometric analysis allowed interesting findings related to the evolution of HRIS and their contribution to responsible innovation and sustainable health ecosystems. Findings show a substantial growth of HRIS research, largely cited, indicating the burgeoning role of HRIS in health research. The survey also reports strong international collaboration with a large percentage of studies showing country partnerships. The analysis highlights that innovation, sustainability and multidisciplinarity in HRIS are an integral part of health systems’ evolution.

In conclusion, HRIS are integral to the responsible deployment of innovative technologies and the development of sustainable health ecosystems. Future research should focus on the practical applications of these systems, exploring their potential to improve healthcare delivery and promote equity in global health initiatives.

Further research should address the practicality and scalability of HRIS in a range of healthcare contexts, including low-resource settings. Priority areas include the integration of new technologies, data governance and ethical considerations, improvements in health equity and analysis of international collaborations. Such endeavors will drive HRIS towards increasingly efficient, resilient and fairer health systems around the world.

CRediT authorship contribution statement

Ajit Kumar Pradhan: Conceptualization, literature review, data collection, formal analysis and drafting of the original manuscript. Susama Nanda: Supervision, methodology design, validation and critical review of the manuscript. Manoj Mishra: Project administration, technical guidance and final approval of the version to be published. All authors read and approved the final manuscript.

Ethical approval

This study did not involve human participants or animals. Hence, ethical approval was not required.

Data availability statement

The datasets generated during and/or analyzed during the current study are available from the corresponding author on request.

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