Mapping the Global Research on Healthcare Management in the Context of Sustainable Development

Yana Us [1,*], Neringa Gerulaitiene [2]

[1] Kaunas University of Technology, K. Donelaicio St. 73, 44249 Kaunas, Lithuania
ORCID: 0000-0003-1451-0450
e-mail: y.us@ktu.lt

[2] Kaunas University of Technology, K. Donelaicio St. 73, 44249 Kaunas, Lithuania
e-mail: neringa.gerulaitiene@ktu.lt
ORCID: 0000-0003-0323-1333

* Corresponding author: Yana Us, y.us@ktu.lt

Abstract

The aim of this paper is to enhance the comprehension of the worldwide landscape of scientific publications centred on healthcare management within the framework of sustainable development to discern potential opportunities for undertaking more influential and substantial future research within the examined domain. This study employs scientific articles published within the scientific journals indexed in the Scopus database. Relevant documents were sought by utilising the keywords 'sustainab*', 'healthcare', and 'management' in the titles of articles. A total of 740 articles published from 2000 to 2023 (up to August 8) were selected for analysis. The study employed various bibliometric methods to analyse and visually represent the collected data. Biblioshiny, VOSviewer 1.6.16 software toolkits, and Scopus analytical tools were utilised for the bibliometric analysis. The acquired outcomes were integrated, and potential avenues for future research were discussed. The bibliometric analysis disclosed a noticeable upward trend in research concerning healthcare management in the context of sustainable development. The theoretical implications of this paper encompass a more profound comprehension of patterns and developments in the scientific literature. The practical implications extend to guiding the execution of bibliometric analyses and offering insights for prospective research endeavours. It is important to note that the conclusions drawn from this study are confined to data derived from the Scopus database. Future studies should consider incorporating a broader range of data sources for a more comprehensive analysis.

Key words

bibliometric analysis, biblioshiny, healthcare management, sustainability, scientific output.

Cite as:

Us, Y., & Gerulaitiene, N. (2024). Mapping the Global Research on Healthcare Management in the Context of Sustainable Development. *Forum Scientiae Oeconomia*, *12*(1), 8–38. https://doi.org/10.23762/FSO_VOL12_NO1_1

Received: 13 August 2023

Revised: 20 December 2023

Accepted: 10 February 2024

Introduction

Human rights encompass a comprehensive collection of fundamental entitlements inherent to all individuals. These rights are categorised into two main groups: civil and political. In the context of healthcare, human rights are closely linked to advocating for equitable opportunities, healthcare access, and the advancement of sustainable and responsible conduct. The realisation of numerous human rights, such as the right to life and healthcare, requires a sustainable environment (Hussain et al., 2021; Kwilinski, 2023; Letunovska et al., 2023; Polcyn et al., 2022; Arefieva et al., 2021). It stands to

mention that sustainability has been defined in various ways across different contexts. Most definitions imply an emphasis on approaches that yield favourable outcomes for both the present and future human and natural environments (Chen et al., 2021; Dzwigol, 2021; Szczepańska-Woszczyna & Kurowska-Pysz, 2016; Spicka et al., 2019). Sustainability encompasses the persistent balance of social, environmental, economic, and institutional elements within human society, as well as all components of the non-human environment (Lyulyov et al., 2023). Enriquez-Puga et al. (2009) noted that sustainability is characterised by the capacity of human activity to be conducted without depleting the accessible resources and causing harm to the environment, thereby preserving the ability to meet the needs of future generations without compromise.

The United Nations Conference on Environment and Development, also known as the 'Earth Summit' (Rio de Janeiro, 3–14 June 1992), marked a pivotal moment in history as it witnessed the signing of some of the most significant global environmental agreements (UN, 2023). Notably, the event spotlighted Agenda 21, an extensive action plan on a global scale. The primary objective of Agenda 21 was to actualise the idea of sustainable development by fostering the prudent utilisation of resources while concurrently facilitating economic growth.

In 2015, world leaders embraced the United Nations' 17 Sustainable Development Goals (SDGs) to tackle global challenges such as climate change, poverty, inequality, etc. (UN, 2015a). At the same time, population health is considered to be fundamental to sustainable development. Therefore, a discernible trend is emerging wherein the utilisation of SDGs is being incorporated into strategies within the realm of healthcare services (Schwartzman and Zucchi, 2021; Dementyev et al., 2021). This integration allows for the alignment of performance metrics with multiple SDGs, emphasising SDG 3, "Health and Well-being". SDG 3 focuses explicitly on ensuring healthy lifestyles and promoting well-being. It entails ambitious objectives encompassing the mitigation of diseases and mortality rates and enhancing health access and pharmaceutical provisions.

Within the WHO European Region, the role of health in sustainable development is delineated by three fundamental documents: the 2030 Agenda for Sustainable Development (UN, 2015b), Health 2020 – the European policy for health and well-being (WHO, 2013), and the roadmap adopted in 2017 by the WHO Regional Office for Europe to execute the 2030 Agenda (WHO, 2017). These documents establish a structure for national leaders to develop collaborations with development partners, domestic stakeholders, and civil society. This collaborative effort aims to achieve universal health and well-being and advance prosperous societies.

Healthcare systems serve as primary barriers in safeguarding populations against different hazards. Although healthcare facilities are susceptible to environmental strains, they could also contribute to adverse environmental effects, consequently impacting health. Healthcare, being one of the significant sources of environmental pollution, yields adverse effects on health due to its contribution to environmental degradation. According to the statistical data (WHO, 2023), healthcare accounts for over 4.4% of total global climate emissions. In turn, India generated over 33 ths. tonnes of medical waste during the seven months of the COVID-19 pandemic (Narang & Vij, 2021), in the United States, the collective greenhouse gas emissions produced by healthcare organisations saw a rise of around 6% between 2010 and 2018 (Eckelman et al., 2020), in the previous decade, the annual carbon footprint of the National Health Service England has surged to 21 million tonnes (NHS, 2010). Therefore, the healthcare sector must exhibit proactive leadership in decarbonisation, reshaping its growth trajectory to attain zero emissions, enhancing resilience, and fulfilling worldwide health objectives. Indeed,

environmentally sustainable healthcare facilities are prepared to anticipate, respond to, manage, recover from, and adjust to climate-induced shocks and pressures. Concurrently, they mitigate detrimental environmental consequences while capitalising on prospects to rehabilitate and enhance the environment, safeguarding the health and well-being of future generations.

Healthcare sectors worldwide may differ due to historical, economic, and cultural factors, but they share common functions related to service delivery, resource development, financing, and management (WHO, 2017). Ensuring the efficient and effective delivery of healthcare services is crucial in mitigating emerging diseases and fostering the health and well-being of populations. Numerous healthcare systems worldwide are dedicated to optimising resource utilisation and enhancing processes by fostering collaborative and integrated operations among all relevant stakeholders. Therefore, given today's social and economic challenges, the effective performance of these functions requires a strong focus on effective management.

In the past few decades, research on healthcare management has grown exponentially. However, the preliminary scientific literature review showed that until recently, only a limited number of systematic literature review papers have addressed the intersection of healthcare management and sustainability issues. Thus, the availability of reviews centred on healthcare management in the context of sustainable development is scarce. Therefore, considering the available literature gap and building upon the knowledge from existing scientific studies, the aim of this paper is to deepen the understanding of the global profile of scientific publications focusing on healthcare management in the context of sustainable development to identify the opportunities for conducting more impactful future research in the investigated field. The initial data for this study were collected from the extensive multidisciplinary Scopus database. The search for relevant publications was conducted using the keywords 'sustainab*', 'healthcare', and 'management' in the titles of articles. The research provides a comprehensive overview of academia's interest in developing this study area. The study's theoretical contributions lie in identifying future research directions to advance the theory of healthcare management in the context of sustainable development.

This paper is structured as follows: the introduction section presents the research problem and the importance of analysing the scope of scientific literature concerning healthcare management in the context of sustainable development; the literature review section presents the initial findings of the scientific literature analysis on the subject under investigation; the methodology section outlines the materials and methods used to achieve the research aim; result section provides the findings of the bibliometric analysis; conclusion section discusses the main conclusions derived from the study and offers suggestions for future research directions.

1. Literature review

Recently, there has been a resurgence of interest among both practitioners and researchers in examining the influence of management on the performance of health systems and organisations (Dzwigol, 2022a; Miśkiewicz, 2019). Healthcare management is considered to be a scientific discipline offering guidance to the leadership of healthcare facilities (Cevik Onar et al.,2017). It encompasses various research fields, where the main ones are healthcare systems, public health systems, hospitals, and their networks. Noteworthy here, healthcare managers encompass a range of individuals, including senior doctors, nurses, allied specialised health professionals, and those responsible for overseeing general practitioner practices and hospitals (Wyatt, 2015).

Within healthcare facilities, a diverse array of challenges arises. Concerning the literature on these issues, Dwivedi et al. (2003) noted that the conversion of raw clinical data into contextually pertinent information stands as a prominent challenge in healthcare. Progress in information technology and telecommunications has enabled healthcare institutions to address the complex task of translating substantial volumes of medical data into clinically relevant insights. From a managerial standpoint, the above challenges have compelled healthcare stakeholders to explore alternative healthcare management concepts to mitigate information overload (Dzwigol, 2022b).

Prompted by the economic crisis, political decision-makers and managers strive to re-establish control over healthcare system costs by refocusing efforts on managing inputs (Smiianov et al., 2020; Dzwigol, 2019). Health organisations face imposed limitations on staff recruitment or replacement, adjusted purchasing policies, and explorations of new technologies. However, this renewed focus on inputs and resource management carries certain drawbacks (Lega et al., 2013). Firstly, cost-containment strategies do not inherently lead to significant structural changes in the operational methods adopted by healthcare professionals and administrative personnel within these organisations. Secondly, cost management policies could impact both high- and low-performing organisations within the same healthcare system (Dacko-Pikiewicz, 2021; Szczepańska-Woszczyna & Gatnar, 2022). Furthermore, if these cost-cutting measures are applied uniformly, it could significantly undermine the principle of universality. Without fundamental shifts in the approach to delivering healthcare services, these cuts may predominantly affect factors such as access, equitable treatment, and overall service quality. Considering the above, Lega et al. (2013) indicated that any healthcare system, whether predominantly funded through taxes, social insurance or operates in a market-based model, has grappled with the sustainability challenge. In this context, sustainability refers to the ability to uphold quality and comprehensive service provision while ensuring affordability.

According to the Alliance for Natural Health (2010), sustainable healthcare could be defined as an intricate system encompassing various approaches to restore, manage, and enhance human health. This system is ecologically rooted, economically, socially, and environmentally viable over the long term. It operates in harmony with both human well-being and the broader environment, ensuring fairness and minimising disproportionate impacts on key components of the healthcare system (Kharazishvili & Kwilinski, 2022; Kwilinski et al., 2020; Szczepańska-Woszczyna et al., 2022; Zhanibek et al., 2022). Recently, the scientific literature has been expanding the scope of research on sustainability in healthcare management. There is an avenue of research in sustainable healthcare management that has centred on facilitating organisational change within the dynamic healthcare landscape (Szczepańska-Woszczyna, 2018; Trushkina et al., 2021; Trzeciak et al., 2022; Szczepanska-Woszczyna & Bogaczyk, 2023). This application of management theories and practices has explored the ways in which an organisation's vision, mission, and strategy can be realigned to align with a sustainability agenda (Punnakitikashem & Hallinger, 2019; Szczepańska-Woszczyna & Gajdzik, 2016; Dacko-Pikiewicz, 2019; Dzwigol, 2023).

Certain initiatives aimed at reshaping healthcare organisations to align with a sustainability agenda have prominently focused on embracing the triple bottom line framework, which encompasses the social, environmental, and economic dimensions of sustainable development (Szczepańska-Woszczyna et al., 2021; Kwilinski et al., 2023; Chen et al., 2023). These programs emphasise the necessity of involving various healthcare stakeholders in defining and attaining sustainability objectives that cover all three dimensions (Ramirez et al., 2013).

The acknowledgement of the interrelated nature of sustainability challenges has prompted increased attention towards how the healthcare system influences sustainability on community and organisational levels. An illustration of this is the emergence of 'disinvestment' as a subject of interest, largely spurred by policy initiatives undertaken by the National Health Service in the UK (Daniels et al., 2013). In the context of the bibliometric review conducted in this paper, the authors acknowledge the existence of previous bibliometric reviews in related fields. These reviews have covered topics such as green and sustainable healthcare (Berniak-Woźny & Rataj, 2023; Moskalenko et al., 2022b; Lyulyov et al., 2015), healthcare sustainability (Singh et al., 2023), sustainable business models in healthcare (Rashdan & Csepy, 2019; Dzwigol et al., 2023a, 2023b; Kwilinski et al., 2022; Letunovska et al., 2022), measuring sustainability in healthcare systems (AlJaberi et al., 2017), role of management in increasing the performance and sustainability of healthcare (Lega et al., 2013; Melnychenko, 2019; Moskalenko et al., 2022a; Spicka, 2018), creating continuous improvement in healthcare sector (Morell-Santandreu et al., 2020), telemedicine in healthcare sustainability (Kwilinski, 2019; Palozzi et al., 2020a; Palozzi et al., 2020b; Kwilinski et al., 2019; Melnychenko, 2021), technology for sustainable healthcare (Nti et al., 2023). However, it's noteworthy that, to the authors' knowledge, only one of the previous reviews has examined the healthcare management literature for 1994-2018 through the lens of sustainability (Punnakitikashem & Hallinger, 2019). This gap in the existing literature serves as the impetus for the current bibliometric review, allowing for a broader exploration of healthcare management in the context of sustainability.

2. Methodology

This section presents the procedures used for reviewing and analysing the investigated scientific documents.

2.1 Research design

Utilising data sourced from the Scopus scientific database, this study analysed publications on healthcare management within the framework of sustainable development until August 8, 2023. The choice of using the data from the Scopus database is due to its extensive recognition and influence as a multidisciplinary citation database. According to Elsevier (2022), the Scopus database encompasses a vast repository of over 84 million documents and engages roughly 18 million researchers worldwide, associated with approximately 95 thousand institutions. Hence, the utilisation of data from Scopus enables a comprehensive evaluation of worldwide research productivity, offering a crucial perspective on healthcare management in the context of sustainable development.

In this study, bibliometrics and knowledge visualisation techniques were employed to explore the interrelation between articles and keywords, presenting a comprehensive analysis of emerging trends and potential research prospects in the examined research area (Soliman et al., 2021; Dubina et al., 2020; Ziabina et al., 2023). The study encompassed an examination of the dynamic of publication activity, key research trends, influential scholars and their collaborations, as well as the contributions of journals, affiliations, and countries towards the development of the investigated subject. It stands to be mentioned that the principal advantage of employing bibliometric analysis lies in its capacity to offer a quantitative and unbiased literature assessment, thereby minimising subjective influences from the authors. The bibliometric R package and VOSviewer 1.6.16 software toolkit were utilised to carry out the bibliometric analysis. The initial stage involved searching, collecting, and preprocessing relevant articles about the research theme (Figure 1). Subsequently, various bibliometric techniques were

employed to scrutinise and visually represent the findings. Ultimately, the outcomes were synthesised, and future avenues for research were deliberated upon.

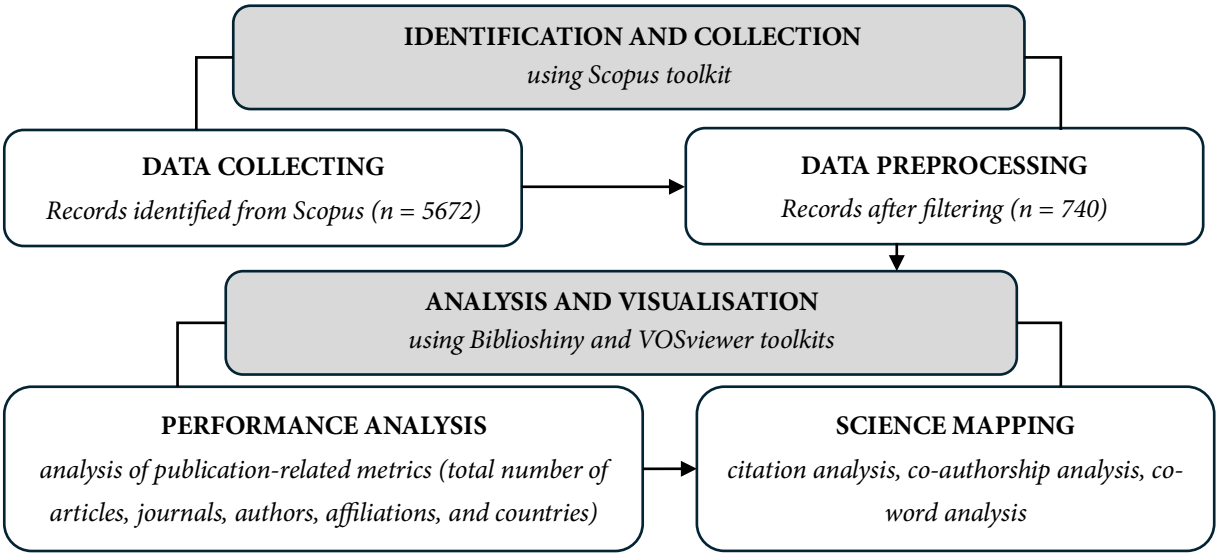

Figure 1. Research design
Source: developed by the authors.

2.2 Identification and collection of data

This study undertook an extensive bibliometric analysis of worldwide scholarly publications centred on healthcare management in the context of sustainable development. The primary dataset was sourced from the interdisciplinary Scopus database, with the latest access performed on August 8, 2023. The selection of the Scopus database was driven by its comprehensive coverage of scientific journals spanning diverse subject fields (Falagas et al., 2008). After choosing the databases, the subsequent phase involves refining the research criteria. The data search procedure is detailed in Table 1, illustrating a multi-stage process.

Table 1. Data collection steps in Scopus database

№	Query	Description	No. of articles
1	TITLE	healthcare AND management AND sustainab*	5672
2	PUBYEAR	1999 > PUBYEAR < 2023 (till August 8)	5431
3	LIMIT-TO SUBJAREA	Business, Management and Accounting AND Social Sciences AND Economics, Econometrics and Finance	1337
4	LIMIT-TO DOCTYPE	Article	1302
5	LIMIT-TO PUBSTAGE	Final	775
6	LIMIT-TO LANGUAGE	English	740

Source: developed by the authors.

The search was executed using the keywords 'healthcare,' 'management,' and 'sustainab*'. The Boolean operator 'AND' was employed to encompass all of the keywords mentioned above and their compounds, while the '*' operator was used to encompass various word endings such as sustainable, sustainability, etc. To ensure the inclusion of pertinent publications, the search outcomes were confined to distinct subject fields: 1) Business, Management and Accounting, 2) Social Sciences, and 3) Economics, Econometrics, and Finance. The research encompassed publications spanning from the year

2000 to August 8, 2023. Notably, the initial dataset consisted of 5,672 publications. However, after applying filtering criteria, the number of publications for the subsequent bibliometric analysis was reduced to 740 (Table 1).

Table 2. The main characteristics of the filtered dataset

Description	Results
Timespan	2000-2023 (up to August 8)
Documents (articles)	740
Single-authored documents	101
Multi-authored documents	639
Average citation per document	13.39
Document average age	5.54
Annual growth rate, %	15.94
References	34766
Sources	376
Authors' keywords	2300
Authors	2279
Authors of single-authored documents	98
Co-authors per document	3.33
International co-authorship, %	23.38

Source: developed by the authors.

After the filtering procedure, the analysis was carried out on a comprehensive sample of 740 articles, comprising 101 single-authored articles and 631 articles with multiple co-authors (Table 2). These articles originate from 376 distinct sources. The dataset involves a cumulative count of 2279 authors, with 98 authors contributing solely to single-authored articles. The occurrence of international co-authorship stands at 23.38%. On average, each article is authored by approximately 3 scholars. The average age of the documents is calculated to be 5.54 years, while the annual growth rate amounts to 15.94%. The average citation per article is 13.39. In turn, the total number of references of considered documents is 34766.

3.3 Data analysis and visualisation

Following Casado-Belmonte et al. (Casado-Belmonte et al., 2021), the performance analysis centres around productivity (publication-related metrics), primarily gauged by the number of publications. In order to assess the primary trends associated with the subject under investigation, this study employed productivity metrics. The productivity metrics encompassed the annual growth rate of publication activity. To calculate the annual growth rate of publication activity, the formula established by Shi et al. (2019) was utilised:

$$AGR_{ij} = \frac{N_i - N_j}{N_j} \times 100\% \quad (1)$$

where AGR_{ij} – the annual publication growth rate, N_i – the number of articles within the current year; N_j – the number of articles in the previous year (i-1).

Additionally, the performance analysis incorporates the number of citations and the h-index, further enhancing the evaluation of performance at the journal, author, and affiliation levels. The

overarching objective is to offer an up-to-date portrayal of the research domain by identifying the pivotal works that constitute its intellectual foundation.

The science mapping of the scrutinised literature was established through a distance-based technique called co-citation analysis. This approach facilitated the visualisation of collaborative ties between scholars on a global scale, shedding light on the collaborative patterns within the research area. The citation analysis was employed to identify the most influential articles and explore the interconnections among the analysed articles. Meanwhile, the co-authorship analysis unveiled the social interactions among authors across different countries. The co-citation analysis was instrumental in delineating the most extensively developed research themes by authors. In contrast, the co-word analysis facilitated trend analysis of these themes and the exploration of their interrelationships.

The utilisation of co-word network analysis and clustering methodologies enabled the delineation of thematic categories associated with the investigated keywords. The study discerned discrete themes within the research area by scrutinising the connections and co-occurrences among keywords.

These themes were visually presented in a two-dimensional diagram, organised into four quadrants (upper-right, upper-left, lower-left, and lower-right) (Corte et al., 2019). The examination of the two-dimensional diagram yields the following interpretations for each quadrant:

1) upper-right quadrant possesses the keywords with substantial significance and influence in the subject area (motor themes). These keywords correspond to well-established and crucial focal points within the research field.
2) upper-left quadrant keywords indicate the niche themes with limited significance when considered in the broader context of the entire research field.
3) lower-left quadrant keywords display emerging or waning research-related themes. These keywords reflect areas that are currently gaining traction or diminishing in relevance within the research field.
4) lower-right quadrant comprises keywords that represent fundamental and foundational themes essential to the analysed scientific domain (basic themes). They may serve as core concepts or key focal points of research.

The authors employed the keyword-based method as the analytical framework to generate the thematic map that visually portrays the prominent themes identified within the analysed scientific literature.

3. Research results

This section presents the findings of the bibliometric analysis conducted on the knowledge base pertaining to healthcare management in the context of sustainable development. The subsequent discussion sequentially addresses the research questions outlined above.

3.1 Descriptive trends in the investigated scientific literature

Table 3 presents the main annual productive indicators of published articles, such as the number of articles, the annual publication growth rate, the relative growth rate of publication activity, the average total citations per article, and the average total citations per year. The expansion rate of considered articles on healthcare management within the framework of sustainable development from 2000 to 2023 (up until August 8) is proved in Table 3. Considering the number of articles, the increasing trend of publication activity in the investigated field has been noticed since 2015, which could be caused by adopting the UN 17 SDGs in 2015. Thus, the annual publication growth rate indicator shows

that the number of articles in 2015 increased by 118% compared to 2014 (37 and 17 articles, respectively). Moreover, upon examining the citation count, it became evident that the year 2020 recorded the highest citation count (1473), accompanied by an average citation ratio of 20.2 per article.

Table 3. Analysis of publication activity on healthcare management in the context of sustainable development in Scopus database (2000-2023)

Year	NA	AGR (%)	NC	MTCA	MTCY
2000	2	-	102	51.0	2.1
2001	6	200	121	20.2	0.9
2002	3	-50	51	17.0	0.8
2003	1	-67	1	1.0	0.1
2004	7	600	87	12.4	0.6
2005	4	-43	64	16.0	0.8
2006	7	75	79	11.3	0.6
2007	12	71	429	35.8	2.1
2008	9	-25	160	17.8	1.1
2009	14	56	358	25.6	1.7
2010	16	14	168	10.5	0.8
2011	15	-6	352	23.5	1.8
2012	26	73	344	13.2	1.1
2013	22	-15	354	16.1	1.5
2014	17	-23	342	20.1	2.0
2015	37	118	612	16.5	1.8
2016	47	27	1067	22.7	2.8
2017	37	-21	472	12.8	1.8
2018	53	43	860	16.2	2.7
2019	86	62	1208	14.1	2.8
2020	73	-15	1473	20.2	5.0
2021	85	16	786	9.3	3.1
2022	101	19	327	3.2	1.6
2023	60	-41	94	1.6	1.6

Notes: *NA* – Number of articles; *AGR* – the annual publication growth rate, %; *MTCA* – Average total citations per article; *MTCY* – Average total citations per year.

Sources: developed by the authors.

The findings showed the scholarly inclination toward selecting esteemed journals for disseminating their research results on healthcare management in the context of sustainable development. Table 4 presents the TOP-5 most productive sources of investigated articles, such as the Switzerland journal 'Sustainability' and the UK journals 'Journal of Cleaner Production', 'International Journal of Health Care Quality Assurance', 'Facilities', and 'Journal of Health Organization and Management'.

It is notable for highlighting that all the journals under consideration possess a substantial impact factor (ranging between Q1 and Q2), signifying their credibility and trustworthiness. Journal of Cleaner Production, Facilities, and Sustainability are some of the most prestigious journals within a subject area 1) environmental science (miscellaneous), 2) architecture, and 3) geography, planning and development, respectively. Journal of Health Organization and Management and International Journal of Health Care Quality Assurance present 25-50% group in the subject area of business, management and accounting. Among the assessed journals, the highest count of investigated articles and documents emerged in the Switzerland journal 'Sustainability', which was included in the Scopus database in 2009. According to the analysis of data on SJR, Table 4 demonstrates that among the

considered journals, the average article of the Journal of Cleaner Production has the biggest scientific influence on the global scientific discussion. Moreover, in terms of CiteScore rankings for 2022, it is evident that the articles of this journal were the most frequently cited from 2019 to 2022. The International Journal of Health Care Quality Assurance had the most expanded international research collaboration network in line with the international collaboration. Thus, researchers from several countries elaborated on 33.3% of articles in this journal from 2000 to 2023 (up to August 8).

Table 4. TOP-5 most productive sources of investigated articles 2000-2023 (up to August 8)

Sources	NA	SJR 2022	Cite Score	IC	h-index	Publisher	Country	Scopus cov.years
Sustainability	78	0.664	5.8	31.5	136	MDPI AG	Switzerland	2009 to pr.
Journal of Cleaner Production	16	1.981	18.5	32.3	268	Elsevier Ltd.	UK	1993 to pr.
International Journal of Health Care Quality Assurance	14	0.529	4	33.3	54	Emerald Publishing	UK	1988 to pr.
Facilities	12	0.547	4.7	18.2	52	Emerald Publishing	UK	1983 to pr.
Journal of Health Organization and Management	11	0.417	2.6	23.4	48	Emerald Publishing	UK	2003 to pr.

Note: *NA* – Number of articles; *IC* – international collaboration, %.

Sources: developed by the authors.

3.2 Leading countries and international scientific collaborations

According to the Scopus database (Figure 2), the TOP-10 most productive countries investigating the issues of healthcare management in the context of sustainable development were the USA (360 articles), the UK (254 articles), Italy 210 (articles), India (136 articles), Australia (104 articles), China (98 articles), Malaysia (80 articles), Netherlands (66 articles), Sweden (64 articles), and Canada (60 articles).

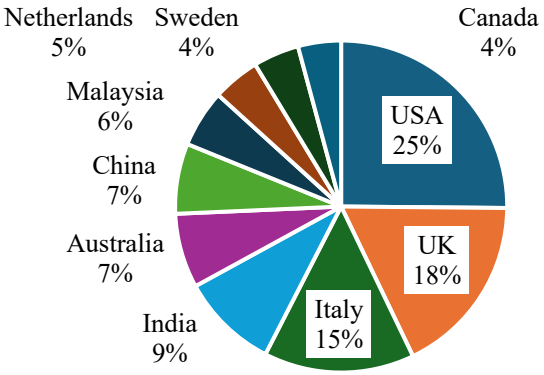

Figure 2. Network visualisation of worldwide co-authorship, 2000-2023 (up to August 8)

Sources: developed by the authors.

The co-authorship map was constructed to discern global scholarly collaborations. The primary criterion was set at a minimum of 5 documents per country. Consequently, 28 out of the total 99 countries satisfied this criterion. As a result, the co-authorship network map based on countries reveals the presence of four distinct clusters (Figure 3):

- *the first cluster (red colored)* is led by the UK, which has contributed 100 publications cited 2103 times. This cluster demonstrates strong collaboration among EU countries (France, Greece, Italy, Netherlands, Poland, and Portugal), the UK, and South Africa.
- *the second cluster (green colored)* encompasses 8 countries (Australia, Brazil, Canada, Denmark, Germany, Norway, Spain and Sweden). It is noteworthy that Australia stands out with the highest number of publications (35 articles cited 563 times).
- *the third cluster (blue colored)* showcases a close interconnection among scholars from China, Finland, Malaysia, Pakistan, Saudi Arabia, Taiwan, and Turkey. In turn, this cluster is headed by Malaysia, which contributed 29 documents cited 213 citations.
- *the fourth cluster (yellow colored)* is anchored by USA (136 papers cited 2279 times. This cluster underscores collaboration among researchers from India, Iran, South Korea, UAE, and USA.

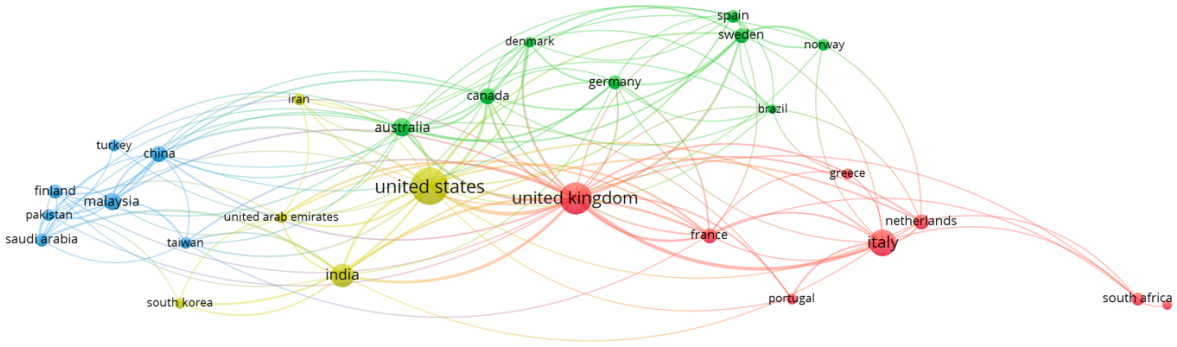

Figure 3. Visualisation of co-authorship network by countries, 2000-2023 (up to August 8)
Sources: developed by the authors using the VOSviewer tools.

3.3 Analysis of influential authors, affiliations and documents

Regarding the most productive authors who have significantly contributed to the advancement of the examined subject between 2000 and 2023 (up to August 8), it is relevant to highlight authors who have authored a minimum of four publications. Table 5 shows seven authors most significantly contributed to the development of the analysed topic. These authors represent six affiliations (University of Ferrara, Institute for Sustainability and Innovation in Structural Engineering, Aston Business School, Faculty of Medical Sciences of the University of the West Indies, Universidade do Minho, and Università degli Studi di Salerno), four countries (Italy, Portugal, UK, and Jamaica) and two regions (Europe and Caribbean).

With regard to the number of articles, up to 2023 (August 8), the Italian scholar Vagnoni Emidia had published the biggest number of articles on the investigated topic among the others (5 articles cited 121 times). It stands to be mentioned that the research on healthcare management in the context of sustainable development consists of 10% of the scholar's publication background. On the other hand, the author mostly specialising in this topic is Cavicchi Caterina, who devoted 25% of publications to the issues of healthcare management in the view of sustainable development. In this view, it's appropriate to mention that all authors have a great scientific interest in research on sustainability.

Table 5. The most influential scholars, according to Scopus, 2000-2023 (up to August 8)

№	Authors	NA/TP	NC/TC	h-index	Country / Affiliation
1	Vagnoni Emidia	5/50	121/819	16	University of Ferrara / Italy

2	Bragança Luís	4/126	99/1830	23	Institute for Sustainability and Innovation in Structural Engineering / Portugal
3	Cavicchi Caterina	4/16	94/182	7	University of Ferrara / Italy
4	Dey Prasanta Kumar	4/213	40/5910	46	Aston Business School / UK
5	Hariharan Seetharaman	4/119	40/1052	19	Faculty of Medical Sciences of the University of the West Indies / Jamaica
6	Mateus Ricardo	4/102	99/1595	25	Universidade do Minho / Portugal
7	Saviano Marialuisa	4/35	105/645	17	Università degli Studi di Salerno / Italy

Notes: NA – Number of articles; TP – Total number of publications; NC – Number of citations; NC – Total number of citations.
Sources: developed by the authors based on the Scopus data.

In general, the most productive scholar on the global scientific stage is Dey Prasanta Kumar from Aston Business School in the UK. Dey Prasanta Kumar published 213 publications that were cited 5910 times. However, the investigated topic took up less than 2% of the research.

Considering scholars' h-indexes, it could be supposed that the most influential researcher is Dey Prasanta Kumar (46 points), followed by Mateus Ricardo (25 points) and Bragança Luís (23 points). Besides, it is noteworthy to point out that most of the authors commenced their publications on the investigated subject within the first two, starting from 2015. This trend serves as an indicator of the increasing recognition and popularity of the field of sustainability in healthcare management among academics after world leaders embraced UN SDGs.

Table 6. The most relevant affiliations, 2000-2023 (up to August 8)

№	Affiliation	NA/TP	No. of authors	Dom. sub. area	Country
1	Università degli Studi di Salerno	10/39252	4731	Engineering	Italy
2	University of Ferrara	7/41399	6666	Medicine	Italy
3	Bucharest University of Economic Studies	7/7097	2458	Business, Management and Accounting	Romania
4	The University of Manchester	6/211922	33477	Medicine	UK
5	Tilburg University	6/23891	2584	Social Sciences	Netherlands
6	Università degli Studi di Napoli Federico II	6/135174	23692	Medicine	Italy
7	Monash University	6/175552	23874	Medicine	Australia
8	Erasmus Universiteit Rotterdam	6/43600	4984	Medicine	Netherlands
9	Sapienza Università di Roma	6/211771	39064	Medicine	Italy
10	Aston Business School	6/3359	348	Business, Management and Accounting	UK

Notes: NA – Number of articles; TP – Total number of publications.
Sources: developed by the authors based on the Scopus data.

The number of articles generated by a specific affiliation serves as an indicator of the level of scientific engagement and proficiency in tackling healthcare management in the context of sustainable development. Consequently, this study's subsequent stage involved examining the documents based on their affiliations of origin. The findings indicate the involvement of 160 affiliations in the exploration of healthcare management in the context of sustainable development. In turn, the TOP-10 most prolific affiliations based on the count of documents dedicated to studying the issue are presented in Table 6. As determined by the count of published documents within the refined Scopus dataset, the field of medicine holds a prominent position as the dominant subject area for 6 out of the TOP-10 most significant affiliations globally. It is noteworthy to mention that four out of the ten organisations are based in Italy (Università degli Studi di Salerno, University of Ferrara, Università degli Studi di

Napoli Federico II, and Sapienza Università di Roma), per two from the Netherlands (Tilburg University and Erasmus Universiteit Rotterdam), and UK (Aston Business School and The University of Manchester), per one from Romania (Bucharest University of Economic Studies) and Australia (Monash University).

Table 7. TOP-10 representative papers, 2000-2023 (up to August 8)

№	Title	Author(s)	NC	Year
1	The impact of green human resource management practices on sustainable performance in healthcare organisations: A conceptual framework (Mousa and Othman, 2020)	Mousa, S.K., Othman, M.	206	2020
2	Progressing in the change journey towards sustainability in healthcare: The role of 'Green' HRM (Pinzone et al., 2016)	Pinzone, M., Guerci, M., Lettieri, E., Redman, T.	206	2016
3	Emergence of Big Data Research in Operations Management, Information Systems, and Healthcare: Past Contributions and Future Roadmap (Guha and Kumar, 2018)	Guha, S., Kumar, S.	129	2018
4	A hybrid multi-criteria decision making method approach for selecting a sustainable location of healthcare waste disposal facility (Chauhan and Singh, 2016)	Chauhan, A., Singh, A.	127	2016
5	Blockchain technology, improvement suggestions, security challenges on smart grid and its application in healthcare for sustainable development (Khan et al., 2020)	Alam Khan, F., Asif, M., Ahmad, A., Alharbi, M., Aljuaid, H.	119	2020
6	Sustainable healthcare and environmental life-cycle impacts of disposable supplies: A focus on disposable custom packs (Campion et al., 2015)	Campion, N., Thiel, C.L., Woods, N.C., ...Landis, A.E., Bilec, M.M.	101	2015
7	AMEE Consensus Statement: Planetary health and education for sustainable healthcare (Shaw et al., 2021)	Shaw, E., Walpole, S., McLean, M., ... Tun, S., Woollard, R.	99	2021
8	Exploration of social sustainability in healthcare supply chain (Hussain et al., 2018)	Hussain, M., Ajmal, M.M., Gunasekaran, A., Khan, M.	99	2018
9	Healthcare supply chain management; strategic areas for quality and financial improvement (Kwon et al., 2016)	Kwon, I.-W.G., Kim, S.-H., Martin, D.G.	89	2016
10	The healthcare sustainable supply chain 4.0: The circular economy transition conceptual framework with the corporate social responsibility mirror (Daú et al., 2019)	Daú, G., Scavarda, A., Scavarda, L.F. , Portugal, V.J.T.	76	2019

*Note: NC –Number of citations.
Sources: developed by the authors.

To identify the most impactful articles within the research scope addressing healthcare management in the context of sustainable development, this study pinpointed the most cited articles within the Scopus database (Table 7). Delving into the more specific research domains of the most impactful articles within the research scope, it is appropriate to mention a common interest among these articles in budling the sustainable healthcare system. Moreover, Shaw et al. (2021) highlighted that the education of the interprofessional healthcare workforce plays a significant role in promoting sustainable development and planetary well-being. Daú et al. (2019) noted that the convergence of the triple bottom line, Industry 4.0, and corporate social responsibility facilitates the shift from a linear model to a circular model. This convergence can potentially enhance the sustainability of the healthcare supply chain within the context of Industry 4.0. According to the findings, the article titled 'The impact of green human resource management practices on sustainable performance in healthcare organisations: A conceptual framework' (Mousa & Othman, 2020) holds significant importance in investigating the analysed subject, with a citation count of 206 in the Scopus database. This study extends the analysis of the importance of applying green human resource management practices at healthcare

facilities. This paper offers scholars a deeper comprehension of green human resource management practices within the context of developing countries and provides empirical evidence regarding the impact of these practices on employee behaviour, aiming to promote sustainable performance. Moreover, in this line, the second most cited article (206 citations) titled 'Progressing in the change journey towards sustainability in healthcare: The role of 'Green' HRM' (Pinzone et al., 2016) found that green human resource management practices play a significant role in fostering voluntary environmentally conscious behaviours at a collective level. Guha and Kumar (2018) focused their study on analysing the utilisation of big data analytics within the realms of information systems, operations management, and healthcare, delving into the existing applications of big data and exploring the prospective future potentials in these domains. On the other hand, while blockchain technology has garnered significant attention from various stakeholders, largely attributed to its robust implementation in the realm of digital currencies, blockchain technology finds myriad applications across various sectors, including healthcare, the automation industry, the energy sector, and security. In this line, Khan et al. (2020) found out that the contribution of custom four-layered blockchain models has been remarkable in areas like precision medicine and clinical trials within the healthcare domain. Kwon et al. (2016) delved into strategic domains through which the healthcare supply chain could enhance operational efficiency. The scholars assert that foundational supply chain principles should be harnessed to establish a "supply chain community surplus," thus leveraging resources to enhance the quality of care. In this line, Hussain et al. (2018) verified that while focusing on individual stakeholder groups is crucial, conducting a comprehensive analysis encompassing the perceptions of all stakeholders regarding the components of a socially sustainable supply chain would yield greater advantages. This approach would aid hospital managers in effectively addressing the expectations of all parties involved and achieving a balanced outcome. Among the TOP-10 most cited articles, two articles were dedicated to analysing healthcare waste disposal in terms of sustainable development. Thus, Chauhan and Singh (2016) focused on the problem of locating healthcare waste, while Campion et al. (2015) highlighted that healthcare institutions can make informed efforts to streamline disposable custom packs by employing tools and strategies such as life cycle assessment and design for the environment.

3.4 Keyword co-occurrences in the investigated topic

This study delves into the core co-occurring terms by leveraging cluster identification, aiming to restructure and amalgamate the existing literature more effectively. Figure 4 visualises keyword co-occurrence, generating a map that delineates the primary scientific clusters within the scope of the analysed literature from 2000 to 2023 (up to August 8). The network map of keyword co-occurrences was constructed by analysing the links, total link strengths, and the number of occurrences of authors' keywords. A minimum co-occurrence threshold of 5 was applied, resulting in the inclusion of 77 keywords out of a total of 2307. This map highlights the connections among various keywords, offering insights into the principal themes and focal points within the scientific literature concerning healthcare management in the context of sustainable development. A comprehensive exploration of the clusters and their interconnections enhances the comprehension of pivotal scientific research trends and the interrelationships among different subject matters within the investigated scientific literature.

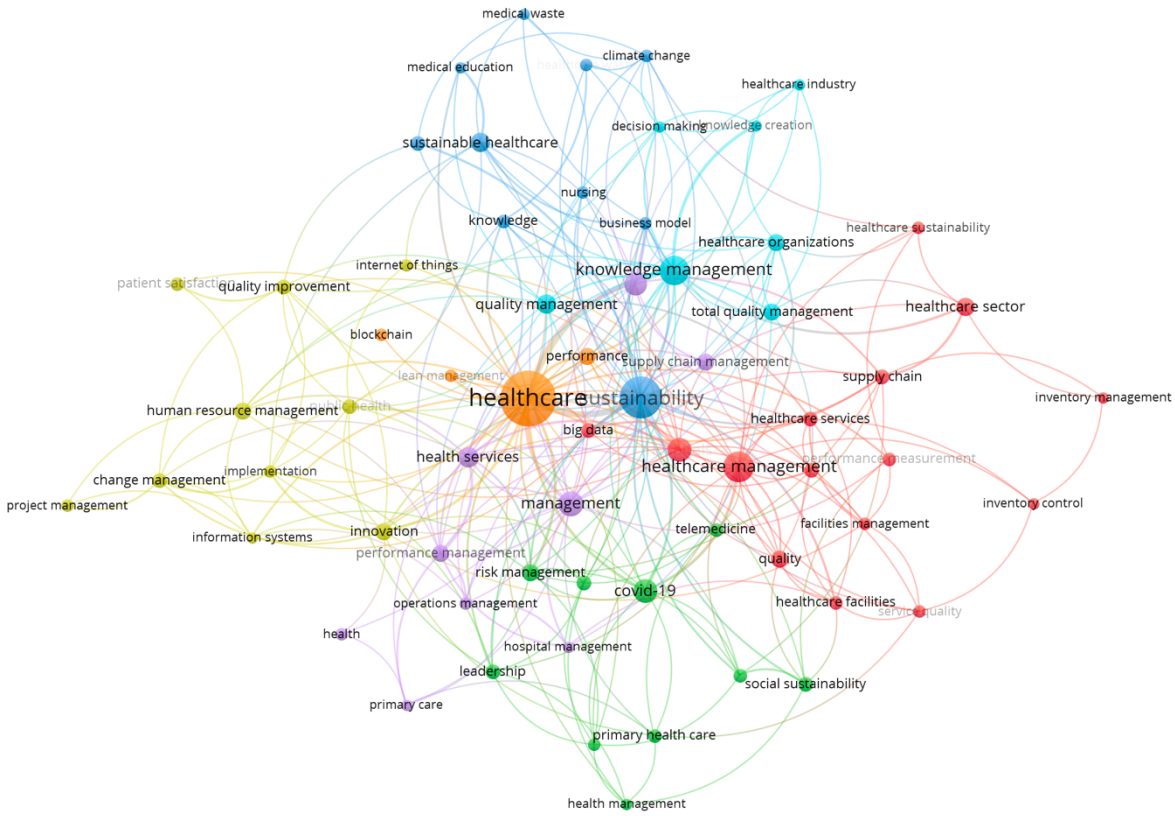

Figure 4. Network visualisation of keyword co-occurrences according to Scopus data, 2000-2023 (up to August 8)

Source: developed by the authors.

Thus, Figure 4 presents a network visualising of seven thematic clusters that aggregate the authors' keywords. The foremost clusters identified are as follows: 1) red – healthcare management; 2) green – COVID-19; 3) blue – sustainability; 4) yellow – innovation; 5) purple – management; 6) cyan – knowledge management; 7) orange – healthcare. It is appropriate to mention that the cluster names were designed based on the keyword situated within the central node, which exhibits stronger connections with the other keywords within the cluster.

The biggest (red) cluster is titled 'healthcare management', since this keyword is characterised by the biggest number of links, occurrences and highest total link strength. Considering other pertinent nodes within this cluster, 'healthcare services', 'service quality', 'big data', 'hospitals', and 'healthcare sustainability' emerge as significant and interlinked keywords.

Indeed, the quality of healthcare services considerably impacts both patient satisfaction and value of healthcare delivery. Boakye et al. (2017) concluded that the influence of perceived value on satisfaction and behavioural intention is evident in the fact that enhancing perceived benefits and minimising perceived costs results in repeated actions and lays the foundation for a retention strategy in healthcare management.

Evolution and shifts within health services underscore the significance of competition, fostering a drive to elevate the quality standards across healthcare facilities. Throughout these processes, the system's foremost requisites involve attaining the desired quality and upholding the integrity of the

system's environment. In this context, the measurement and ongoing enhancement of service quality hold paramount importance for healthcare centres in their endeavour to deliver superior service to patients. Erdebilli and Özdemir (2022) highlighted that the assessment of performance and the execution of corresponding measures significantly impact the service quality within a hospital that is in a critical state, especially during COVID-19.

Concerning the literature on big data in healthcare management, Dash et al. (2019) noted that to offer effective solutions for enhancing public health, healthcare providers need comprehensive infrastructure to collect and analyse big data systematically. Effectively managing, analysing, and interpreting this extensive data can be transformative, ushering in new possibilities for modern healthcare. Through robust integration of biomedical and healthcare data, contemporary healthcare organisations have the potential to revolutionise medical treatments and personalised medicine approaches. Moreover, big data has the potential to contribute significantly by reducing the complexity of supply chain stages, broadening economic margins, and simplifying the sustainable strategising of intelligent healthcare investments (Moro Visconti and Morea, 2019).

Fang et al. (2023) noted that the sudden surge in COVID-19 cases has placed immense pressure on the healthcare system, subjecting it to unprecedented challenges. In this scenario, healthcare management emerges as a complex yet vital process to oversee and coordinate all information and resources effectively. Therefore, there is an increasing need to enhance the capabilities of urban systems and establish an open data city framework to ensure dependable information and data sharing, particularly in areas like medical and testing data. This endeavour will bolster public awareness and elevate healthcare services to a more effective level.

The second (green) cluster is designed around the keyword COVID-19. Other noteworthy keywords that garner attention within this cluster are risk management, social sustainability, telemedicine, and healthcare supply chain.

The unexpected outbreak of COVID-19 has triggered scientific interest in this topic worldwide. Mishra et al. (2021) highlighted that efficient healthcare management has played a pivotal role in fostering a healthier society. Taking affirmative steps within distinct research, technology, and management domains holds significant potential to strengthen the worldwide response to healthcare burdens such as COVID-19. Sun et al. (2021) suggested that it is improbable that healthcare delivery will revert entirely to its pre-COVID state. Therefore, there is a need to swiftly enact measures to safeguard patients and healthcare providers from infections. One of the possibilities to improve healthcare efficiency is considered to be telemedicine. However, the successful deployment of telemedicine requires robust evidence, including findings from clinical trials, to effectively inform the smooth integration of telemedicine into standard healthcare practices (Maiga and Arinaitwe, 2017). It is crucial for ensuring the safety and quality of virtual care provided. The outlined guidelines offer indispensable elements for policymakers, researchers, and the informatics community to consider. These guidelines represent a vital phase within a broader initiative to evaluate the ethical, regulatory, and operational dimensions of telemedicine as a healthcare delivery platform.

Kanokphanvanich et al. (2023) emphasised that the pandemic crisis and its ensuing global uncertainties have undoubtedly inflicted substantial repercussions on the healthcare supply chain. It has prompted scholars, healthcare executives, and policymakers to intensify their attention on ensuring the sustainability of the healthcare supply chain. Healthcare supply chains constitute a distinct realm, as their primary aim is to preserve lives rather than maximise profits (Senna et al., 2020). Borgonovi

(2017) underscored that discussions about sustainability challenges often focus primarily on the economic dimension, overlooking the equally crucial social and political aspects. However, the healthcare systems are strained not solely due to their cost but because scientific and technological advancements are expanding opportunities for a more significant population segment. Considering risk management in healthcare, Ferrari et al. (2017) emphasised the significance of risk managers, who are accountable for ensuring the quality and safety of healthcare services, gaining paramount importance within both public and private hospitals.

The third (blue) cluster is built around the keyword 'sustainability'. Assessing sustainability in healthcare systems is a multifaceted and intricate matter, encompassing numerous criteria and subcriteria (AlJaberi et al., 2017). This complexity demands deconstructing the issue into a series of components organised within a multi-level hierarchical framework.

Other salient keywords that draw attention within this cluster are 'healthcare waste management', 'sustainable healthcare', and 'education'. Considering the keyword 'healthcare waste management', Puška et al. (20220 emphasised that the proper disposal of healthcare waste stands as a critical concern for global environmental sustainability. Since the volume of healthcare waste is growing daily, it underscores the imperative of appropriately managing and disposing of this type of waste.

It stands to be mentioned that the third cluster has a close relation to the sixth (cyan) cluster titled 'knowledge management'. Other pertinent nodes within this cluster are 'knowledge creation', 'decision making', 'healthcare organisation', 'healthcare industry', 'quality management', and 'totally quality management'.

Gonçalo and de Borges (2010) distinguished two types of healthcare organisations: traditional organisations (using information) and learning organisations (resting on knowledge creation). Herewith, the scholars pointed out that organisational knowledge is considered a strategic asset for healthcare services characterised by high complexity. Therefore, medical specialities are expected to collaborate harmoniously and be willing to exchange knowledge.

Considering the decision-making in healthcare, Suha and Sanam (2023) noted that healthcare decision-making is a complex process that necessitates collaboration among different stakeholders. Therefore, ensuring the sustainability of these decisions is crucial for meeting the needs of healthcare facilities. Moreover, Harris et al. (2017) highlighted the necessity of providing health service personnel with access to education, training, expertise, and support to facilitate evidence-based decision-making. It is crucial for effectively implementing and evaluating the changes resulting from such decisions.

The fourth (yellow) cluster is designed around the keyword 'innovation', including other important keywords such as 'human resource management', 'public health', and 'change management'. In the contemporary landscape, innovation has become an integral component of any service, crucial for maintaining competitiveness. The effectiveness and acceptability of innovation development in hospitals hinge on the effectiveness of its management, which must be aligned with the context of healthcare quality (Tonjang & Thawesaengskulthai, 2022). This alignment is crucial since quality serves as a guiding philosophy in life-related environments, including healthcare.

Healthcare organisations face persistent pressure to adjust to evolving circumstances and various internal and external burdens. In this view, job proactivity and vitality assume significance in dynamic environments. For instance, Tummers et al. (2015) mentioned that employees with high vitality are better equipped to handle change due to their increased energy levels. Nevertheless, it is still unclear the means by which organisations can foster proactivity and vitality. Therefore, the above triggers

scholars to bridge human resource management and change management by examining how human resource management practices can encourage job proactivity and vitality.

The fifth (purple) cluster is focused on the keyword 'management'. The keywords with high link strength included in this cluster are as follows: 'health services', 'operations management', 'performance management', and 'sustainable development'. Comprehending customers' service expectations, formulating processes, establishing standards to fulfil those expectations, delivering accurate service communication, and recruiting and training suitable front-line staff all shape perceptions of service quality (Parasuraman et al., 1985). These efforts collectively aim to minimise the gap between expectations and experiences and foster positive customer experiences. In this line, performance management is widely recognised as one of the most pivotal functions within human resource management (Kennedy et al., 2019). The foundation of performance management lies in establishing consistent and dependable hiring processes to identify front-line staff who possess a strong commitment to service, exceptional customer service skills, and a positive outlook on receiving feedback to enhance their performance. Considering the keyword 'operations management', Villa (2021) highlighted the growing role of operations management in healthcare. It is indispensable for effectively managing the movement of both patients and supplies with efficiency, responsiveness, and adaptability. Thus, a new wave of scholars specialising in healthcare operations management is investigating current and relevant healthcare subjects through the utilisation of modern methodological approaches (Dai & Tayur, 2020).

At last, the smallest (orange) cluster titled 'healthcare' includes three more keywords: 'blockchain', 'lean management', and 'performance'. Lean healthcare management is considered to be an innovative approach to process healthcare management. Lean management acts as a foundational framework for harnessing innovation across healthcare projects (Abuhejleh et al., 2016). Therefore, more lean experts explore the feasibility of applying the established principles of lean management, known for enhancing efficiency and process-oriented quality assurance in industries, to the control, support, and core processes within the healthcare sector (Helmold et al., 2022; Abuhejleh et al., 2016). Another keyword requiring consideration is 'blockchain'. Villarreal et al. (2023) noted that blockchain technology is emerging as a prominent solution in the healthcare ecosystem, offering a means to achieve equilibrium and enhance various aspects of the industry. Blockchain technology is well-suited for open-source interoperability beyond the financial sector, but the intricate interplay between technological intricacies and practical outcomes remains uncertain (Usharani et al., 2022). Therefore, blockchain has garnered significant attention from both scholars and practitioners across various business domains. In turn, scholarly academics in the healthcare sector try to explore the potential of blockchain technologies, focusing particularly on their diverse applications in the field of medicine.

3.5 Research trends

To enhance the analysis of the keyword evolution, the analysed period of publication activity was divided into three sub-periods (2000-2014 – before embracing UN SDGs (the initial period provided a baseline for understanding pre-SDG research trends), 2015-2019 – since embracing UN SDGs till COVID-19 (this phase offered insights into how the global agenda for sustainable development influenced research themes within healthcare management and sustainable development, 2020-2023 (up to August 8) – the modern period capturing the most recent developments in research). This subdivision allows for a more detailed examination of how keyword trends have evolved over time within specific time intervals. By doing so, the study can capture nuances and shifts in the usage and relevance of keywords within different phases of the chosen period, providing a more comprehensive

understanding of the development trends in healthcare management in the context of sustainable development.

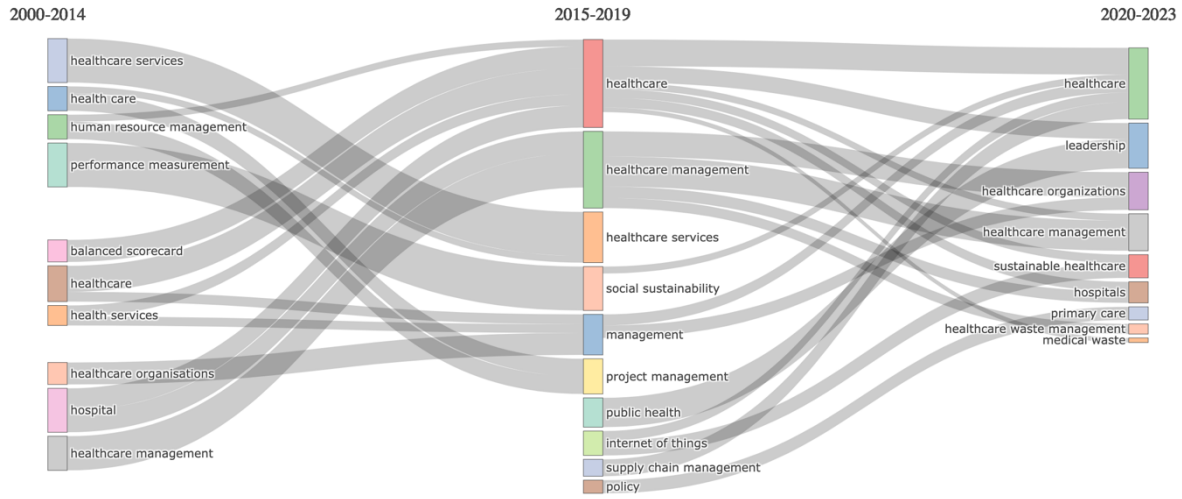

Figure 5. Thematic evolution of the investigated keywords, 2000-2023 (up to August 8)
Source: developed by the authors.

Figure 5 presents the evolution of keywords of the analysed articles in three different stages (2000-2014, 2015-2019, and 2020-2023). Thus, the findings show that before the UN SDGs were embraced, the analysed articles on healthcare management in the context of sustainable development were focused on healthcare services, human resource management, performance measurement, healthcare organisations, etc. From 2015 to 2019, the research topics shifted slightly to the analysis of social sustainability, project management, public health, the Internet of Things, supply chain management, etc. Since 2020, scholars have investigated healthcare management issues considering healthcare waste management, leadership, sustainable healthcare, hospitals, primary care, medical waste, etc.

Table 8 presents the thematic evolution of the investigated keywords by sub-periods. The thematic evolution table is designed using the authors' keywords. The thematic development of the researched keywords was conducted by categorising and arranging the keywords into specific themes, thereby visually depicting the primary subjects covered in the analysed literature in the particular sub-period. The thematic map showcases various topic areas within the research field, offering a comprehensive view of the research landscape and aiding in comprehending the breadth of the research being conducted. The map's structure assists in identifying essential, motor, emerging or declining, and niche themes, contributing to a deeper understanding of the overall field of study. Thus, Table 8 shows that during the first sub-period (2000-2014), the primary themes in the studied scope of scientific literature were healthcare services and healthcare. The well-established and significant themes within the research field were human resources management, health care, and health management. While considering the broader context of the entire research field, the themes with limited significance were hospital and sustainability. In turn, the emerging research-related themes were healthcare management and performance measurement.

Table 8. Thematic evolution table of the investigated keywords by sub-periods, 2000-2023 (up to August 8)

Period	Themes		Period	Themes	
2000-2014	*Niche themes* Hospital Sustainability	*Motor themes* Human resource management Health care Health management	2020-2023	*Niche themes* Primary healthcare	*Motor themes* Hospitals Public health Climate change Medical waste Sustainable healthcare Blockchain Big data Artificial intelligence Smart healthcare
	Emerging/declining themes Healthcare management Performance measurement	*Basic themes* Healthcare services Healthcare			
2015-2019	*Niche themes* Internet of Things Case management Primary healthcare Healthcare services	*Motor themes* Supply chain management Social sustainability Corporate social responsibility		*Emerging/declining themes* Innovation Healthcare management Healthcare waste management Quality improvement	*Basic themes* Telemedicine COVID-19 Sustainability Sustainable development Knowledge management Risk management
	Emerging/declining themes Information management	*Basic themes* Healthcare management Public health Sustainability Quality management Sustainable development			

Source: developed by the authors.

After embracing the UN SDGs and till COVID-19 (2015-2019), the primary themes were expanded into healthcare management, public health, sustainability, quality management, and sustainable development. The widely recognised and substantial themes were supply chain management, social sustainability, and corporate social responsibility. The themes with marginal significance were the Internet of Things, case management, primary healthcare, and healthcare services. In turn, information management presents the emerging research-related themes in the investigated scope of scientific literature. In the current period of scientific activity (from 2020 till 2023, August 8), the central themes in the examined domain of scientific literature are telemedicine, COVID-19, sustainability, sustainable development, knowledge management, and risk management. The extensively recognised and momentous themes are hospitals, public health, climate change, medical waste, sustainable healthcare, blockchain, big data, artificial intelligence, and smart healthcare. On the other hand, the themes related to primary healthcare lose their significance. Herewith, progressive research-linked themes within the scoped-out scientific literature are innovation, healthcare management, healthcare waste management, and quality improvement.

Conclusions

The findings underscore the upward trajectory of research concerning healthcare management within the realm of sustainable development. To comprehensively investigate this trend, this study harnessed bibliometric methodologies. A distinct advantage of bibliometrics is its capacity to deliver a quantitative, unbiased evaluation of global scholarly discourse, mitigating the subjective inclinations of individual authors. This approach ensures a meticulous and structured literature examination fortified by rigorous bibliometric scrutiny. Furthermore, the study integrated visualization techniques to

holistically appraise emergent patterns and potential avenues for future research in the studied domain. Merging bibliometric analysis with visualization, the study offers a comprehensive methodology for scrutinizing scientific output in healthcare management within the realm of sustainable development, providing objective insights and delineating uncharted trajectories for further exploration.

The performance analysis evidences an observable surge in publication activity within the investigated field, particularly since 2015. The annual publication growth rate indicator indicates a significant increase in the number of articles from 2014 to 2015, with a growth rate of 118% (37 articles in 2015 compared to 17 articles in 2014). This upward trend could be attributed to the adoption of the UN SDGs in the same year. Furthermore, a comprehensive analysis of citation counts unveils that the year 2020 recorded the highest citation count, totalling 1473 citations, accompanied by an average citation ratio of 20.2 citations per article. This illustrates the increasing recognition and impact of research conducted within the realm of healthcare management in the context of sustainable development.

The Swiss journal "Sustainability" emerges as the most prolific source indexed in the Scopus database concerning the study of healthcare management within the framework of sustainable development. Based on the obtained results, the exploration of healthcare management in the context of sustainable development engaged a total of 160 affiliations. Among these affiliations, the most productive was Università degli Studi di Salerno, which published a remarkable 10 documents on the subject. On average, each affiliated institution contributed roughly 5 articles between 2000 and August 8, 2023, indicating a moderate level of participation per establishment in the domain of healthcare management research.

The analysis outcomes divulged that a cumulative 99 countries have participated in the inquiry into healthcare management within the sustainable development context. Among these countries, the TOP-10 in terms of published articles include the USA (360 articles), UK (254 articles), Italy (210 articles), India (136 articles), Australia (104 articles), China (98 articles), Malaysia (80 articles), Netherlands (66 articles), Sweden (64 articles), and Canada (60 articles). Furthermore, the co-authorship analysis classified countries into four distinct clusters of collaborative authorship: 1) among EU countries (France, Greece, Italy, Netherlands, Poland, Portugal), the UK, and South Africa; 2) among Australia, Brazil, Canada, Denmark, Germany, Norway, Spain, and Sweden; 3) among China, Finland, Malaysia, Pakistan, Saudi Arabia, Taiwan, and Turkey; 4) among India, Iran, South Korea, UAE, and the USA.

In the realm of prolific authors significantly contributing to the advancement of the subject under examination from 2000 to August 8, 2023, the findings underscore the noteworthy contributions of Italian scholar Vagnoni Emidia. With an impressive portfolio of 5 articles, her work has garnered 121 citations. However, it's worth noting that the study of healthcare management within the context of sustainable development constitutes only 10% of her publication focus. In contrast, Cavicchi Caterina emerges as a specialist extensively dedicated to this topic, with an 25% of her publications delving into healthcare management within the sphere of sustainable development. This signifies a strong commitment to research in this domain. Besides, it's worth to highlight that all the authors exhibit a pronounced scientific interest in the area of sustainability.

This study highlights the work by Mousa and Othman (2020), entitled "The impact of green human resource management practices on sustainable performance in healthcare organizations: A conceptual framework." This paper has garnered substantial recognition as a seminal contribution, evidenced by its 206 citations in the Scopus database. Such acclaim underscores its profound impact and sway

within the investigated field. This research extends the discourse on the significance of applying green human resource management practices within healthcare establishments. The paper furnishes scholars with an enriched comprehension of such practices, particularly in developing nations, and underscores their empirical significance in shaping employee behaviour and fostering sustainable performance.

In the scope of this study, a keyword co-occurrences network map was constructed by scrutinizing the connections, cumulative link strengths, and occurrences of authors' keywords. This map unveiled distinct clusters that signify diverse research trajectories within the realm of healthcare management within the realm of sustainable development.

The largest cluster highlights research avenues encompassing healthcare management intricately intertwined with healthcare services and their quality, big data applications, and the overarching concept of healthcare sustainability. A substantial portion of scholarly attention has gravitated toward this cluster. The second notable cluster echoes the profound influence of the COVID-19 pandemic on research focal points, particularly emphasizing sustainability concerns within healthcare management. This cluster delves into areas such as risk management, social sustainability, telemedicine, and the intricate dynamics of the healthcare supply chain. The third cluster revolves around the core theme of sustainability, where scholars have directed their inquiry towards topics such as healthcare waste management, sustainable healthcare practices, and education within this context. Noteworthy, this cluster shares a close relationship with the sixth cluster, titled "knowledge management," signifying a concerted exploration of issues spanning knowledge creation, decision-making processes, healthcare organization dynamics, the healthcare industry, and comprehensive quality management. The fourth cluster highlights the research on innovation in healthcare management, notably concerning facets like human resource management, public health, and change management. The fifth cluster further elucidates the academic engagement in management aspects, delving into realms of health services, operations management, performance management, and the broader framework of sustainable development. Lastly, the smallest cluster with the succinct title "healthcare" spotlights research interests that converge around blockchain technology, lean management principles, and the intricate web of performance evaluation in healthcare contexts.

To deepen the analysis of keyword evolution, the study strategically divided the period of publication activity into three distinct sub-periods (2000-2014 –prior to the adoption of the UN SDGs; 2015-2019 – encompassing the span from the adoption of UN SDGs to the onset of the COVID-19 pandemic; 2020-2023 (up to August 8) representing the contemporary period of research).

The study's findings illustrate distinct shifts in the focus of research on healthcare management within the context of sustainable development across different sub-periods. Prior to the adoption of the UN SDGs, the analysed articles primarily centred around topics like healthcare services, human resource management, performance measurement, and healthcare organizations. During the period from 2015 to 2019, there was a noticeable transition towards themes such as social sustainability, project management, public health, the Internet of Things, and supply chain management. Starting from 2020 up until August 8, 2023, the research trajectory has further evolved. Scholars have turned their attention to healthcare management issues related to healthcare waste management, leadership, sustainable healthcare, hospitals, primary care, and medical waste. This period has also witnessed a heightened emphasis on contemporary and pertinent themes, with telemedicine, COVID-19,

sustainability, sustainable development, knowledge management, and risk management emerging as central areas of scientific discourse.

During the present period of scientific activity, spanning from 2020 to August 8, 2023, the domain of scientific literature on healthcare management within the context of sustainable development has converged around several central themes. These themes include telemedicine, COVID-19, sustainability, sustainable development, knowledge management, and risk management. These concepts have garnered significant attention and are pivotal in shaping current research discourse.

Moreover, a range of themes has achieved widespread recognition and importance within the field. Notable among these are hospitals, public health, climate change, medical waste, sustainable healthcare, blockchain, big data, artificial intelligence, and smart healthcare. These themes collectively represent the forefront of discussions in healthcare management and sustainability.

Conversely, themes related to primary healthcare have experienced a decline in their significance within the current research landscape. As the field evolves, new avenues for exploration have emerged. Progressive research-linked themes, such as innovation, healthcare management, healthcare waste management, and quality improvement, are gaining prominence in the scope of scientific literature. This comprehensive analysis offers insights into the dynamics of current research trends, highlighting key areas of focus and indicating potential directions for future inquiry within the realm of healthcare management and sustainable development.

This paper carries both theoretical and practical implications by delving into the analysis and visualization of scholarly output focused on healthcare management in the context of sustainable development. The theoretical implications contribute to a heightened comprehension of patterns, interconnections, and advancements within the scientific literature concerning healthcare management healthcare management in the context of sustainable development. These insights offer valuable guidance to researchers, shedding light on potential trajectories for future investigations.

From a practical perspective, the study provides a roadmap for scholars interested in undertaking bibliometric analyses of scholarly output, encompassing evaluations of scholars, affiliations, academic journals, etc. The detailed guidelines furnished in the paper could serve as a valuable resource to facilitate similar analyses across various contexts.

Moreover, this study opens doors for researchers to broaden their current horizons by leveraging the findings and insights from the bibliometric analysis. It initiates a platform for further exploration and inquiry in the realm of healthcare management in the context of sustainable development.

Nonetheless, it's imperative to acknowledge the study's limitations stemming from its exclusive reliance on data from the Scopus database. While Scopus undeniably offers a comprehensive snapshot of worldwide research activity, a broader array of data sources should be incorporated in future investigations for a more exhaustive and resilient analysis. Encompassing a wider spectrum of data sources would fortify the integrity and applicability of the findings, ultimately culminating in a more comprehensive grasp of the subject matter. This approach would bolster the validity and generalizability of the study, facilitating a more holistic comprehension of the topic of healthcare management in the context of sustainable development.

Author Contributions: Conceptualization, Y.U. and N.G.; methodology, Y.U. and N.G.; software, Y.U. and N.G.; validation, Y.U. and N.G.; formal analysis, Y.U. and N.G.; investigation, Y.U. and N.G.; resources, Y.U. and N.G.; data curation, Y.U. and N.G.; writing-original draft preparation, Y.U. and N.G.;

writing-review and editing, Y.U. and N.G.; visualization, Y.U. and N.G. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by a grant (No. P-LU-PAR-23-44) from the Research Council of Lithuania.

Data Availability Statement: The data supporting the findings of this study are available on request from the corresponding author.

Conflicts of Interest: The authors affirm no conflict of interest.

Reference

1. Abuhejleh, A. A., Dulaimi, M., & Ellahham, S. (2016). Using lean management to leverage innovation in healthcare projects: case study of a public hospital in the UAE. *Bmj Innovations, 2*(1), 22–32.
2. AlJaberi, O. A., Hussain, M., & Drake, P. R. (2017). A framework for measuring sustainability in healthcare systems. *International journal of healthcare management*, *13*(4), 276–285. https://doi.org/10.1080/20479700.2017.1404710
3. Alliance for Natural Health International (2010). Sustainable Healthcare – Working Towards the Paradigm Shift. https://www.anhinternational.org/wp-content/uploads/old/files/100617-SustainableHealthcare_White-Paper.pdf
4. Arefieva, O., Polous, O., Arefiev, S., Tytykalo, V., Kwilinski, A. (2021). Managing sustainable development by human capital reproduction in the system of company`s organizational behavior. *IOP Conference Series: Earth and Environmental Science*, *628*(1), 012039. https://doi.org/10.1088/1755-1315/628/1/012039
5. Berniak-Woźny, J., & Rataj, M. (2023). Towards Green and Sustainable Healthcare: A Literature Review and Research Agenda for Green Leadership in the Healthcare Sector. *International Journal of Environmental Research and Public Health, 20*(2), 908.
6. Boakye, K. G., Blankson, C., Prybutok, V. R., & Qin, H. (2017). An assessment of national healthcare service delivery: a Ghanaian illustration. *International Journal of Quality & Reliability Management, 34*(5), 649–666.
7. Borgonovi, E. (2017). Healthcare system: Issues of sustainability and economic growth. *Rivista Internazionale di Scienze Sociali*, 231–248.
8. Campion, N., Thiel, C. L., Woods, N. C., Swanzy, L., Landis, A. E., & Bilec, M. M. (2015). Sustainable healthcare and environmental life-cycle impacts of disposable supplies: a focus on disposable custom packs. *Journal of Cleaner Production*, 94, 46–55.
9. Casado-Belmonte, M. D. P., Capobianco-Uriarte, M. D. L. M., Martínez-Alonso, R., & Martínez-Romero, M. J. (2021). Delineating the path of family firm innovation: mapping the scientific structure. *Review of Managerial Science, 15*(8), 2455–2499.
10. Cevik Onar, S., Oztaysi, B., & Kahraman, C. (2017). A Comprehensive Survey on Healthcare Management. *Operations Research Applications in Health Care Management*, 23–51. https://doi.org/10.1007/978-3-319-65455-3_2
11. Chauhan, A., & Singh, A. (2016). A hybrid multi-criteria decision making method approach for selecting a sustainable location of healthcare waste disposal facility. *Journal of Cleaner Production*, 139, 1001–1010.

12. Chen, Y., Kwilinski, A., Chygryn, O., Lyulyov, O., Pimonenko, T. (2021). The Green Competitiveness of Enterprises: Justifying the Quality Criteria of Digital Marketing Communication Channels. *Sustainability*, 13, 13679. https://doi.org/10.3390/su132413679.
13. Chen, Y., Lyulyov, O., Pimonenko, T., Kwilinski, A. (2023). Green development of the country: Role of macroeconomic stability. *Energy & Environment, 0*(0). https://doi.org/10.1177/0958305x231151679.
14. Chmielewska, M., Lotek-Waćkowska, R., Brzozowski, S., Tytko, Z., Dziok-Dmowska, K., & Hermanowski, T. (2023). The capacity to implement Lean Management in the healthcare system in Poland–results of a public consultation. *Medycyna Pracy, 74*(1), 1–8.
15. Corte, D., Gaudio, G., Sepe, F., & Sciarelli, F. (2019). Sustainable tourism in the open innovation realm: A bibliometric analysis. *Sustainability, 11*(21), 6114.
16. Dacko-Pikiewicz, Z. (2019). The selected aspects of strategic management in the city divided by the border in the context of the development of the cross-border market of cultural services [Wybrane aspekty zarządzania strategicznego w mieście podzielonym granicą w kontekście rozwoju transgranicznego rynku usług kulturalnych]. *Polish Journal of Management Studies, 19*(1), 130–144.
17. Dacko-Pikiewicz, Z. (2021). Reputation Management and Family Business. Routledge: London, UK.
18. Dai, T., & Tayur, S. (2020). Om Forum—Healthcare operations management: a snapshot of emerging research. *Manufacturing & service operations management, 22*(5), 869–887.
19. Daniels, T., Williams, I., Robinson, S., & Spence, K. (2013). Tackling disinvestment in health care services: the views of resource allocators in the English NHS. *Journal of health organisation and management, 27*(6), 762–780.
20. Dash, S., Shakyawar, S. K., Sharma, M., & Kaushik, S. (2019). Big data in healthcare: management, analysis and future prospects. *Journal of big data, 6*(1), 1–25.
21. Daú, G., Scavarda, A., Scavarda, L. F., & Portugal, V. J. T. (2019). The healthcare sustainable supply chain 4.0: The circular economy transition conceptual framework with the corporate social responsibility mirror. *Sustainability*, 11(12), 3259.
22. Dementyev, V., Dalevska, N., Kwilinski, A. (2021). Innovation and Information Aspects of the Structural Organization of the World Political and Economic Space. *Virtual Economics*, *4*(1), 54–76. https://doi.org/10.34021/ve.2021.04.01(3)
23. Dubina, O., Us, Y., Pimonenko, T., & Lyulyov, O. (2020). Customer loyalty to bank services: The bibliometric analysis. *Virtual Economics*, *3*(3), 53–66.
24. Dwivedi, A. N., Bali, R. K., Naguib, R. N. G., Baskaran, V., & Nassar, N. S. (n.d.). Tracking the healthcare management landscape: implications for integrated healthcare management and practice. Proceedings of the 25th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (IEEE Cat. No.03CH37439). https://doi.org/10.1109/iembs.2003.1279480
25. Dzwigol, H. (2019). Research Methods and Techniques in New Management Trends: Research Results. *Virtual Economics, 2*(1), 31–48. https://doi.org/10.34021/ve.2019.02.01(2)
26. Dzwigol, H. (2021). The Uncertainty Factor in the Market Economic System: The Microeconomic Aspect of Sustainable Development. *Virtual Economics, 4*(1), 98–117. https://doi.org/10.34021/ve.2021.04.01(5)

27. Dzwigol, H. (2022a), Comparing Idiographic and Nomothetic Approaches in Management Sciences Research. *Virtual Economics, 5*(4), 27–49. https://doi.org/10.34021/ve.2022.05.04(2)
28. Dzwigol, H. (2022b), Research Methodology in Management Science: Triangulation. *Virtual Economics, 5*(1), 78–93. https://doi.org/10.34021/ve.2022.05.01(5)
29. Dzwigol, H. (2023). The Quality Determinants of the Research Process in Management Sciences. *Virtual Economics, 6*(2), 35–54. https://doi.org/10.34021/ve.2023.06.02(3)
30. Dzwigol, H., Kwilinski, A., Lyulyov, O., & Pimonenko, T. (2023b). The role of environmental regulations, renewable energy, and energy efficiency in finding the path to green economic growth. *Energies*, *16*(7), 3090.
31. Dzwigol, H., Kwilinski, A., Lyulyov, O., Pimonenko, T. (2023a). Renewable Energy, Knowledge Spillover and Innovation: Capacity of Environmental Regulation. *Energies, 16*(3), 1117. https://doi.org/10.3390/en16031117.
32. Eckelman, M. J., Huang, K., Lagasse, R., Senay, E., Dubrow, R., & Sherman, J. D. (2020). Health Care Pollution And Public Health Damage In The United States: An Update: Study examines health care pollution and public health damage in the United States. *Health Affairs, 39*(12), 2071–2079.
33. Elsevier (2022). Scopus. https://www.elsevier.com/__data/assets/pdf_file/0017/114533/Scopus-fact-sheet-2022_WEB.pdf
34. Enriquez-Puga A., Baker R., Paul S., Villoro-Valdes R. (2009). Effect of educational outreach on general practice prescribing of antibiotics and antidepressants: A two-year randomised controlled trial. *Scandinavian Journal of Primary Health Care*, 27, 195–201. https://doi.org/10.3109/02813430903226530
35. Erdebilli, B. D. R., & Özdemir, Y. S. (2022). Performance Measurement of Healthcare: A Case Study for Pilot Hospital. In International Conference on Intelligent and Fuzzy Systems (pp. 400-408). Cham: Springer International Publishing.
36. Falagas, M., Pitsouni, E., Malietzis, G., Pappas, G. (2008). Comparison of PubMed, scopus, web of science, and google scholar: Strengths and weaknesses. *FASEB Journal, 22*(2), 338–342. https://doi.org/10.1096/fj.07-9492LSF
37. Fang, Z., Lu, Q., Chen, L., Meng, J., Ye, Z., & Pitt, M. (2023). Creating an Open Data City for Healthcare: A Critical Review of Data Management Strategy and Development in China. *Journal of Management in Engineering, 39*(2), 03122004.
38. Ferrari, A., Odone, A., Mandelli, P., & Signorelli, C. (2017). Risk management: the new normative scenario and the role of training and education. *Acta Bio-medica: Atenei Parmensis, 88*(3), 365–374.
39. Gonçalo, C. R., & Borges, M. D. L. (2010). Healthcare services based on knowledge structure. *Journal of Health Management, 12*(4), 553–572.
40. Guha, S., & Kumar, S. (2018). Emergence of big data research in operations management, information systems, and healthcare: Past contributions and future roadmap. *Production and Operations Management, 27*(9), 1724–1735.
41. Harris, C., Allen, K., Waller, C., Dyer, T., Brooke, V., Garrubba, M., ... & Farjou, D. (2017). Sustainability in Health care by Allocating Resources Effectively (SHARE) 7: Supporting staff in evidence-based decision-making, implementation and evaluation in a local healthcare setting. *BMC health services research, 17*(1), 1–19.

42. Helmold, M., Küçük Yılmaz, A., Flouris, T., Winner, T., Cvetkoska, V., & Dathe, T. (2022). Lean Management in Healthcare and Hospitals. In Lean Management, Kaizen, Kata and Keiretsu: Best-Practice Examples and Industry Insights from Japanese Concepts (pp. 221-227). Cham: Springer International Publishing.
43. Hussain, H.I., Haseeb, M., Kamarudin, F., Dacko-Pikiewicz, Z., Szczepańska-Woszczyna, K. (2021). The role of globalization, economic growth and natural resources on the ecological footprint in Thailand: Evidence from nonlinear causal estimations. *Processes*, 9, 1103. https://doi.org/10.3390/pr9071103
44. Hussain, M., Ajmal, M. M., Gunasekaran, A., & Khan, M. (2018). Exploration of social sustainability in healthcare supply chain. *Journal of Cleaner Production*, 203, 977–989.
45. Kanokphanvanich, C., Rattanawong, W., & Vongmanee, V. (2023). A New Model for a Sustainable Healthcare Supply Chain Prioritises Patient Safety: Using the Fuzzy Delphi Method to Identify Healthcare Workers' Perspectives. *Sustainability, 15*(9), 7123.
46. Kennedy, D. M., Anastos, C. T., & Genau Jr, M. C. (2019). Improving healthcare service quality through performance management. *Leadership in Health Services, 32*(3), 477–492.
47. Khan, F. A., Asif, M., Ahmad, A., Alharbi, M., & Aljuaid, H. (2020). Blockchain technology, improvement suggestions, security challenges on smart grid and its application in healthcare for sustainable development. *Sustainable Cities and Society*, 55, 102018.
48. Kharazishvili, Y., Kwilinski, A. (2022). Methodology for Determining the Limit Values of National Security Indicators Using Artificial Intelligence Methods. *Virtual Economics*, *5*(4), 7–26. https://doi.org/10.34021/ve.2022.05.04(1).
49. Kwilinski et al., Kwilinski, A., Slatvitskaya, I., Dugar, T., Khodakivska, L., Derevyanko, B. (2020). Main Effects of Mergers and Acquisitions in International Enterprise Activities. *International Journal of Entrepreneurship*, 24, 1–8.
50. Kwilinski, A. (2019). Implementation of Blockchain Technology in Accounting Sphere. *Academy of Accounting and Financial Studies Journal, 23*(SI2), 1–6.
51. Kwilinski, A. (2023). The Relationship between Sustainable Development and Digital Transformation: Bibliometric Analysis. *Virtual Economics, 6*(3), 56–69. https://doi.org/10.34021/ve.2023.06.03(4)
52. Kwilinski, A., Lyulyov, O., Pimonenko, T. (2023). Environmental Sustainability within Attaining Sustainable Development Goals: The Role of Digitalization and the Transport Sector. *Sustainability*, 15, 11282. https://doi.org/10.3390/su151411282
53. Kwilinski, A., Lyulyov, O., Pimonenko, T., Dzwigol, H., Abazov, R., Pudryk, D. (2022). International Migration Drivers: Economic, Environmental, Social, and Political Effects. *Sustainability, 14*(11), 6413. https://doi.org/10.3390/su14116413
54. Kwilinski, A., Volynets, R., Berdnik, I., Holovko, M., Berzin, P. (2019). E-Commerce: Concept and Legal Regulation in Modern Economic Conditions. *Journal of Legal, Ethical and Regulatory Issues, 22*(Special Issue 2), 1–6.
55. Kwon, I. W. G., Kim, S. H., & Martin, D. G. (2016). Healthcare supply chain management; strategic areas for quality and financial improvement. *Technological forecasting and social change*, 113, 422–428.
56. Lega, F., Prenestini, A., & Spurgeon, P. (2013). Is Management Essential to Improving the Performance and Sustainability of Health Care Systems and Organizations? A Systematic Review and a

Roadmap for Future Studies. *Value in Health, 16*(1), S46–S51. https://doi.org/10.1016/j.jval.2012.10.004

57. Letunovska, N., Abazov, R., Chen, Y. (2022). Framing a Regional Spatial Development Perspective: The Relation between Health and Regional Performance. *Virtual Economics*, *5*(4), 87–99. https://doi.org/10.34021/ve.2022.05.04(5).
58. Letunovska, N., Offei, F. A., Junior, P. A., Lyulyov, O., Pimonenko, T., Kwilinski, A. (2023). Green Supply Chain Management: The Effect of Procurement Sustainability on Reverse Logistics. *Logistics*, 7, 47. https://doi.org/10.3390/logistics7030047
59. Lyulyov, O., Chortok, Y., Pimonenko, T., & Borovik, O. (2015). Ecological and economic evaluation of transport system functioning according to the territory sustainable development. *International Journal of Ecology and Development*, *30*(3), 1–10.
60. Lyulyov, O., Chygryn, O., Pimonenko, T., & Kwilinski, A. (2023). Stakeholders' Engagement in the Company's Management as a Driver of Green Competitiveness within Sustainable Development. *Sustainability, 15*(9), 7249.
61. Maiga, G., & Arinaitwe, I. (2017, May). A model for telemedicine adoption in remote healthcare settings. In 2017 IST-Africa Week Conference (IST-Africa) (pp. 1-8). IEEE.
62. Melnychenko, O. (2019). Application of artificial intelligence in control systems of economic activity. *Virtual Economics, 2*(3), 30–40. https://doi.org/10.34021/ve.2019.02.03(3).
63. Melnychenko, O. (2021). The Prospects of Retail Payment Developments in the Metaverse. *Virtual Economics, 4*(4), 52–60. https://doi.org/10.34021/ve.2021.04.04(4)
64. Mishra, A., Basumallick, S., Lu, A., Chiu, H., Shah, M. A., Shukla, Y., & Tiwari, A. (2021). The healthier healthcare management models for COVID-19. *Journal of Infection and Public Health, 14*(7), 927–937.
65. Miśkiewicz, R. (2019). Challenges facing management practice in the light of Industry 4.0: The example of Poland. *Virtual Economics, 2*(2), 37–47. https://doi.org/10.34021/ve.2019.02.02(2).
66. Morell-Santandreu, O., Santandreu-Mascarell, C., & García-Sabater, J. (2020). Sustainability and kaizen: business model trends in healthcare. *Sustainability, 12*(24), 10622.
67. Moro Visconti, R., & Morea, D. (2019). Big data for the sustainability of healthcare project financing. *Sustainability, 11*(13), 3748.
68. Moskalenko, B., Lyulyov, O., Pimonenko, T. (2022a). The investment attractiveness of countries: coupling between core dimensions. *Forum Scientiae Oeconomia*, 10, 153–172. https://doi.org/10.23762/FSO_VOL10_NO2_8
69. Moskalenko, B., Lyulyov, O., Pimonenko, T., Kwilinski, A., Dzwigol, H. (2022b), Investment Attractiveness of the Country: Social, Ecological, Economic Dimension. *International Journal of Environment and Pollution, 69*(1-2), 80–98. https://dx.doi.org/10.1504/IJEP.2021.10050183
70. Mousa, S. K., & Othman, M. (2020). The impact of green human resource management practices on sustainable performance in healthcare organisations: A conceptual framework. *Journal of cleaner production*, 243, 118595.
71. Narang, S., & Vij, D. (2021). The covid-19 pandemic: An analytical study on opportunities for circular economy practices in India's healthcare sector. *Asia Pacific Journal of Health Management, 16*(4), 236-242.

72. NHS Sustainable Development Unit (2010). Saving carbon improving future. NHS Carbon Reduction Strategy Update. Cambridge, UK. https://www.england.nhs.uk/greenernhs/wp-content/uploads/sites/51/2021/02/NHS-Carbon-Reduction-Strategy-2009.pdf
73. Nti, I. K., Adekoya, A. F., Weyori, B. A., & Keyeremeh, F. (2023). A bibliometric analysis of technology in sustainable healthcare: Emerging trends and future directions. *Decision Analytics Journal*, 100292.
74. Palozzi, G., Chirico, A., & Gabbrielli, F. (2020b). Cost analysis of telemedicine implementation in the lens of healthcare sustainability: A review of the literature. *Mobility Internet of Things 2018: Mobility IoT*, 451–469.
75. Palozzi, G., Schettini, I., & Chirico, A. (2020a). Enhancing the sustainable goal of access to healthcare: findings from a literature review on telemedicine employment in rural areas. *Sustainability, 12*(8), 3318.
76. Parasuraman, A., Zeithaml, V. and Berry, L. (1985). A conceptual model of service quality and its implications for future research. *Journal of Marketing*, 49(4), 41–50.
77. Pinzone, M., Guerci, M., Lettieri, E., & Redman, T. (2016). Progressing in the change journey towards sustainability in healthcare: the role of 'Green'HRM. *Journal of Cleaner Production*, 122, 201–211.
78. Polcyn, J., Us, Y., Lyulyov, O., Pimonenko, T., Kwilinski, A. (2022). Factors Influencing the Renewable Energy Consumption in Selected European Countries. *Energies*, 15, 108. https://doi.org/10.3390/en15010108
79. Punnakitikashem, P., & Hallinger, P. (2019). Bibliometric review of the knowledge base on healthcare management for sustainability, 1994–2018. *Sustainability, 12*(1), 205.
80. Puška, A., Stević, Ž., & Pamučar, D. (2022). Evaluation and selection of healthcare waste incinerators using extended sustainability criteria and multi-criteria analysis methods. Environment. *Development and Sustainability*, 1–31.
81. Ramirez, B., J. West, D., & M. Costell, M. (2013). Development of a culture of sustainability in health care organisations. *Journal of Health Organization and Management, 27*(5), 665–672.
82. Rashdan, O., & Csepy, G. (2019). Sustainable Business Models in Healthcare: A Scoping Review of the Quality and Quantity of Literature. In The International Conference Finance and Sustainability (pp. 167-176). Cham: Springer International Publishing.
83. Schwartzman, J. A., & Zucchi, P. (2021). Healthcare Managers' Perception about the Sustainable Development Goals (SDGs). *Journal of Management and Sustainability*, 11, 141.
84. Senna, P., Reis, A., Santos, I. L., Dias, A. C., & Coelho, O. (2020). A systematic literature review on supply chain risk management: is healthcare management a forsaken research field?. *Benchmarking: an international journal, 28*(3), 926–956.
85. Shaw, E., Walpole, S., McLean, M., Alvarez-Nieto, C., Barna, S., Bazin, K., ... & Woollard, R. (2021). AMEE Consensus Statement: Planetary health and education for sustainable healthcare. *Medical teacher, 43*(3), 272–286.
86. Shi, G., Liu, N., Yu, X., Zhang, H., Li, S., Wu, S., . . . Li, C. (2019). Bibliometric analysis of medical malpractice literature in legal medicine from 1975 to 2018: Web of science review. *Journal of Forensic and Legal Medicine*, 66, 167–183. https://doi.org/10.1016/j.jflm.2019.07.002

87. Singh, S., Madaan, G., Kaur, J., Swapna, H. R., Pandey, D., Singh, A., & Pandey, B. K. (2023). Bibliometric Review on Healthcare Sustainability. Handbook of Research on Safe Disposal Methods of Municipal Solid Wastes for a Sustainable Environment, 142–161.
88. Smiianov, V., Lyulyov, O., Pimonenko, T., Andrushchenko, T., Sova, S., Grechkovskaya, N. (2020). The impact of the pandemic lockdown on air pollution, health and economic growth: system dynamics analysis. *Wiadomości Lekarskie, LXXIII*(11), 2332–2338.
89. Soliman, M., Lyulyov, O., Shvindina, H., Figueiredo, R., & Pimonenko, T. (2021). Scientific output of the european journal of tourism research: A bibliometric overview and visualisation. *European Journal of Tourism Research*, 28
90. Spicka, J. (2018), How Do Agricultural Biogas Investments Affect Czech Farms?. *Central European Business Review, 7*(4), 34-60. https://doi.org/10.18267/j.cebr.205.
91. Spicka, J., Hlavsa, T., Soukupova, K., Stolbova, M. (2019). Approaches to estimation the farm-level economic viability and sustainability in agriculture: A literature review. *Agricultural Economics, 65*(6), 289-297. https://doi.org/10.17221/269/2018-AGRICECON.
92. Suha, S. A., & Sanam, T. F. (2023). Exploring dominant factors for ensuring the sustainability of utilising artificial intelligence in healthcare decision making: An emerging country context. *International Journal of Information Management Data Insights, 3*(1), 100170.
93. Sun, P., Wang, M., Song, T., Wu, Y., Luo, J., Chen, L., & Yan, L. (2021). The psychological impact of COVID-19 pandemic on health care workers: a systematic review and meta-analysis. *Frontiers in psychology,* 12, 626547.
94. Szczepańska-Woszczyna, K. (2018). Strategy, Corporate Culture, Structure and Operational Processes as the Context for the Innovativeness of an Organization. *Foundations of Management, 10*(1), 33–44.
95. Szczepanska-Woszczyna, K., & Bogaczyk, R. (2023). Organisational Climate and Employee Engagement – a Case Study of International Corporations. *Forum Scientiae Oeconomia, 11*(3), 9–29.
96. Szczepańska-Woszczyna, K., & Gajdzik, B. (2016). Competencies of engineering staff in steelworks after their restructuring. *Metalurgija, 55*(2), 271–274.
97. Szczepańska-Woszczyna, K., & Kurowska-Pysz, J. (2016). Sustainable business development through leadership in SMEs. *Engineering Management in Production and Services, 8*(3), 57–69.
98. Szczepańska-Woszczyna, K., Gatnar, S. (2022). Key Competences of Research and Development Project Managers in High Technology Sector. *Forum Scientiae Oeconomia, 10*(3), 107–130. https://doi.org/10.23762/FSO_VOL10_NO3_6.
99. Szczepańska-Woszczyna, K., Gedvilaitė, D., Nazarko, J., Stasiukynas, A., Rubina, A. (2022). Assessment of Economic Convergence among Countries in the European Union, Technological and Economic Development of Economy, 28, 1572–1588. https://doi.org/10.3846/tede.2022.17518
100. Szczepańska-Woszczyna, K., Muras, W., & Pikiewicz, M. (2021). Shareholders in creating the value of IT sector companies by shaping organisational culture in the context of the digital economy. In I. Stańczyk, & M. M. Stuss (Eds.), Sustainability, Technology and Innovation 4.0 (pp. 304–316). Routledge.
101. Tonjang, S., & Thawesaengskulthai, N. (2022). Total Quality and Innovation Management in Healthcare (TQIM-H) for an Effective Innovation Development: A Conceptual Framework and Exploratory Study. *Applied System Innovation, 5*(4), 70.

102. Trushkina, N., Abazov, R., Rynkevych, N., Bakhautdinova, G. (2020). Digital Transformation of Organizational Culture under Conditions of the Information Economy. *Virtual Economics, 3*(1), 7-38. https://doi.org/10.34021/ve.2020.03.01(1).
103. Trzeciak, M., Kopec, T.P., Kwilinski, A. (2022). Constructs of Project Programme Management Supporting Open Innovation at the Strategic Level of the Organization. *Journal of Open Innovation: Technology, Market, and Complexity*, 8, 58. https://doi.org/10.3390/joitmc8010058.
104. Tummers, L., Kruyen, P. M., Vijverberg, D. M., & Voesenek, T. J. (2015). Connecting HRM and change management: The importance of proactivity and vitality. *Journal of Organizational Change Management, 28*(4), 627–640. https://doi.org/10.1108/JOCM-11-2013-0220
105. United Nations (2015a). Department of Economic and Social Affairs Sustainable Development. The 17 Goals. https://sdgs.un.org/goals
106. United Nations (2023). United Nations Conference on Environment and Development, Rio de Janeiro, Brazil, 3-14 June 1992. https://www.un.org/en/conferences/environment/rio1992
107. United Nations. Department of Economic and Social Affairs Sustainable Development (2015b). Transforming our world: the 2030 Agenda for Sustainable Development, 1–35. https://documents-dds-ny.un.org/doc/UNDOC/GEN/N15/291/89/PDF/N1529189.pdf?OpenElement
108. Usharani, S., Manju Bala, P., Rajmohan, R., Kumar, T. A., & Pavithra, M. (2022). Blockchain Technology Use Cases in Healthcare Management: State-of-the-Art Framework and Performance Evaluation. *Blockchain, Artificial Intelligence, and the Internet of Things: Possibilities and Opportunities*, 117–140.
109. Villa, S. (2021). Operations Management for Healthcare Organizations: Theory, Models and Tools. Routledge Taylor & Francis Group.
110. Villarreal, E. R. D., García-Alonso, J., Moguel, E., & Alegría, J. A. H. (2023). Blockchain for healthcare management systems: A survey on interoperability and security. *IEEE Access*, 11, 5629–5652.
111. WHO Regional Office for Europe (2017). Roadmap to implement the 2030 Agenda for Sustainable Development, building on Health 2020, the European policy for health and well-being. Copenhagen. http://www.euro.who.int/__data/assets/pdf_file/0008/345599/67wd09e_SDGroadmap_170638.pdf?ua=1
112. World Health Organization (2023). Strengthening climate-resilient and environmentally friendly health systems and services. https://www.who.int/europe/activities/strengthening-climate-resilient-and-environmentally-friendly-health-systems-and-services
113. World Health Organization. Regional Office for Europe. (2013). Health 2020: a European policy framework and strategy for the 21st century. World Health Organization. Regional Office for Europe. https://apps.who.int/iris/handle/10665/326386
114. Wyatt J. (2015). Healthcare management and leadership. *Perspectives in Public Health*, *135*(5), 222. https://doi.org/10.1177/1757913915599697
115. Zhanibek, A., Abazov, R., Khazbulatov, A. (2022). Digital Transformation of a Country's Image: The Case of the Astana International Finance Centre in Kazakhstan. *Virtual Economics*, 5, 71–94. https://doi.org/10.34021/ve.2022.05.02(4).
116. Ziabina, Y., Kwilinski, A., Lyulyov, O., Pimonenko, T., & Us, Y. (2023). Convergence of energy policies between the EU and Ukraine under the green deal policy. *Energies*, *16*(2), 998.