

REVIEW

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Knowledge management and sustainable entrepreneurship: a bibliometric overview and research agenda

Nasser Alhamar Alkathiri^{1*} , Foued Ben Said² , Natanya Meyer³  and Mohammad Soliman^{4,5} 

*Correspondence:
nasser.malkatheri@utas.edu.au

¹ College of Economy and Business Administration, University of Technology and Applied Sciences, Salalah, Oman

² University of Manouba, Manouba, Tunisia

³ DHET-NRF SARChI Entrepreneurship Education, University of Johannesburg, Johannesburg, South Africa

⁴ Research and Consultation Department, University of Technology and Applied Sciences, Salalah, Oman

⁵ Faculty of Tourism and Hotels, Fayoum University, Fayoum, Egypt

Abstract

The current work highlights the evolution in knowledge management for sustainable entrepreneurship research by analyzing the key trends and major concepts. Additionally, the knowledge structures of such research themes were analyzed and mapped. Moreover, this paper seeks to present a research agenda concerning the study subject. It employed an integrated bibliometric approach and systematic review of knowledge management and sustainable entrepreneurship research by conducting two main procedures, namely domain analysis (i.e., key trends and evolution) and knowledge structures analysis (i.e., intellectual, social, and conceptual structure). A total of 233 documents were obtained from Scopus and Web of Science datasets and analyzed using both R 4.1.2 and VOSviewer software. The findings demonstrated that the contributors (i.e., the authors, nations, journals, and institutions) produced a discernible evolution in the body of knowledge on the themes of knowledge management and sustainable business within the designated period. Furthermore, science mapping approaches deeply grasp the social, conceptual, and intellectual structures of such research themes. This current work is considered one of the first attempts to systematically review, analyze, and visualize the scientific productions on knowledge management and sustainable entrepreneurship. The findings of the current work also offer a solid understanding and insights into the potential directions for the research agenda in these disciplines.

Keywords: Knowledge management, Sustainable entrepreneurship, Bibliometrics, Domain analysis, Knowledge structures, Research agenda

Introduction

The prevalence of entrepreneurship in the literature is extensively documented due to its significant contributions in a number of areas, including its vital role in technological advancement, competitiveness, employment generation and economic growth (Agu et al., 2021; Meyer, 2022; Neumann, 2021; Singh et al., 2021). Recently, sustainable entrepreneurship has emerged as a progression of traditional entrepreneurship (Fichter & Tiemann, 2020; Urbaniec et al., 2022). Sustainable entrepreneurship emphasizes both social and environmental sustainability in addition to economic objectives, in contrast to traditional entrepreneurship, which concentrates primarily on economic

goals (Romero-Colmenares & Reyes-Rodríguez, 2022). Social sustainability refers to the responsibility of businesses towards stakeholders' well-being, whereas environmental sustainability refers to the role of businesses in protecting the environment, such as lowering environmental destruction (Martins et al., 2019). Economic sustainability focuses on the capacity of the business to generate a sustainable profit.

In order to develop sustainable entrepreneurship, extant literature has suggested a variety of methods. However, knowledge management, which refers to the process of generating, disseminating, and sustaining both internal and external knowledge, has been described as a cornerstone that all of these approaches must include in order to be successful (Pham et al., 2019; Singh et al., 2021). In other words, knowledge management has been recognized as a key enabler in the attempt to accomplish sustainability (Abbas, 2020; Chopra et al., 2021; Martins et al., 2019). Particularly, knowledge management has been regarded as a significant instrument for businesses of all kinds and types that aim to be sustainable through the creation, sharing, and implementation of the accumulated understanding and knowledge that ensure the continued maintenance of current and reliable knowledge (Chang et al., 2018; Chopra et al., 2021; Durst & Zieba, 2020). For example, businesses might be able to determine vital strategies to fulfill the requirements of sustainability if they have greater exposure to the relevant knowledge (Durst & Zieba, 2020; Singh et al., 2021). For that reason, the intersection of these two fields (knowledge management and sustainable entrepreneurship) in the literature has flourished (Abbas, 2020; Durst & Zieba, 2020; Singh et al., 2021). Despite that, our comprehension of the field's advancement is still limited as the existing effort to review the interface between knowledge management and sustainable entrepreneurship remains scarce. Thus, this work substantially contributes to the existing literature on sustainable entrepreneurship and knowledge management. The novelty of this study lies in its comprehensive approach to analyzing the intersection of knowledge management and sustainable entrepreneurship, utilizing a unique keyword mixture that has not been employed before in the field. By conducting a bibliometric analysis based on publications from both Scopus and the Web of Science, the study not only sheds light on the publication evolution in the domain, but also identifies key research trends, influential authors, countries, institutions, and journals. Exploring frequently researched concepts adds depth to our understanding of the subject. Furthermore, the study goes beyond traditional bibliometric analyses by delving into the social, intellectual, and conceptual structures of knowledge management for sustainable entrepreneurship research, offering a holistic view of the field's knowledge structures. This in-depth analysis is crucial in addressing the existing gap in our comprehension of the interface between knowledge management and sustainable entrepreneurship. Moreover, the research provides valuable insights for future investigations, guiding scholars, policymakers, decision-makers, and professionals toward potential directions for advancing the field of knowledge management for sustainable entrepreneurship. In essence, the paper's unique methodology, thorough analysis, and forward-looking suggestions contribute significantly to academic discourse and provide a solid foundation for future research endeavors in this dynamic and evolving field.

This study, therefore, aims to highlight the publication evolution in the area of knowledge management for sustainable entrepreneurship, including (1) the key research

trends (such as the most profile authors, countries, institutions, and journals); (2) and frequently researched concepts in this area. It also seeks to map the knowledge structures of knowledge management for sustainable entrepreneurship research by analyzing and visualizing (a) the social structure; (b) the intellectual structure; and (c) the conceptual structure of this research theme. In addition, the current work aims to provide a clear understanding of the potential directions for future research to boost the extant body of knowledge in such research areas.

Based on this, we conduct this bibliometric study to address the following queries: (1) what progress and directions of academic studies in knowledge management for sustainable entrepreneurship have been prevalent?; (2) what are the most important articles and sources networks?; (3) who are the most referenced authors and prolific scientists?; and (4) what are the main themes of debate in this field?

In line with the guidelines and expectations of Donthu et al. (2021) and Chopra et al. (2021), this bibliometric research provides two significant contributions to knowledge management for sustainable entrepreneurship literature. First, this review offers a one-stop overview of the knowledge management for sustainable entrepreneurship research's performance, including the trends and advancement of publications, leading researchers, countries and journals and the dominant field themes. This suggests that readers such as scholars, policy and decision-makers, and professionals would be able to gain up-to-date insights in a single review without getting involved in duplication of resources to evaluate and understand the field of knowledge management for sustainable entrepreneurship in its entirety. Second, this state-of-the-art overview provides novel ideas on the possible directions for future investigation on knowledge management for sustainability in entrepreneurship. This suggests that academics may rely on this article overview as a starting point for empirical investigations to develop and expand this field in an encouraging and useful trajectory.

The structure of this bibliometric review is as follows. First, the theoretical review of knowledge management and sustainable entrepreneurship is provided. Secondly, a discussion on the adopted methodology is given. Thirdly, the findings of this review are presented. Fourthly, major conclusions and suggestions for further study are outlined.

Conceptualization and theoretical background

This study was developed due to the literature's awareness of the critical role knowledge management plays in the quest for sustainable entrepreneurship. knowledge management's importance in creating, sharing, and maintaining both internal and external knowledge has been highlighted in a number of studies that highlight it as a crucial element for accomplishing sustainability goals (Pham et al., 2019; Singh et al., 2021). It is true that knowledge management has been recognized as a vital tool for companies that aim to sustain sustainable practices by efficiently using their body of information and comprehension (Abbas, 2020; Chopra et al., 2021; Martins et al., 2019). Although there has been much discussion about this intersection, there are not many thorough evaluations of the connection between knowledge management and sustainable entrepreneurship, which represents an exciting opportunity for research. Thus, this work fills a significant vacuum in the literature by utilizing pertinent insights from the interaction

between knowledge management and sustainable entrepreneurship. It does this by building on previous studies.

It is crucial to emphasize the current significance and growing interest in this interdisciplinary junction while analyzing the integration of knowledge management and sustainability in entrepreneurship. Integrating these two concepts allows businesses to improve organizational resilience, creativity, and long-term profitability as they negotiate difficult issues in today's constantly evolving markets. This literature study attempts to clarify the developing discourse around the convergence of knowledge management and entrepreneurship sustainability by utilizing insights from current articles and empirical studies. This study aims to establish the importance of investigating the interactions between these areas through a coherent presentation of pertinent literature, establishing a foundation for a more profound comprehension of their consequences for management theory and practice.

That is, beyond elucidating the importance of investigating the relationship between knowledge management and the sustainability of entrepreneurship, the present study has wider implications for research and practice. Through exploring this new field, the study advances theoretical frameworks that clarify the ways in which knowledge management techniques impact sustainability initiatives and entrepreneurial pursuits. The study's conclusions also apply to stakeholders, legislators, and organizational leaders who must balance social and environmental responsibility and economic success. This study provides practical insights to support strategic decision-making and promote sustainable innovation by illuminating the benefits and possible trade-offs between knowledge management and sustainability in entrepreneurial settings.

Knowledge management

Since the emergence of knowledge management as a concept, academics and policymakers have given it significant attention due to its crucial role in strengthening an organization's ability to succeed and achieve competitive advantage (Martins et al., 2019). Knowledge management refers to the process of turning tacit knowledge into explicit knowledge involving the internal and external transfer of knowledge (Yang, 2008). Specifically, it consists of four interrelated stages: knowledge generation, knowledge storage, knowledge transmission, and knowledge integration of explicit and tacit knowledge (Abbas & Sağsan, 2019). In this regard, (Gaviria-Marin et al. (2019) classified these stages into three cogent and well-organized dimensions: (1) the production of knowledge, which includes knowledge generation and knowledge obtained; (2) the integration of knowledge, which encompasses knowledge dissemination and knowledge retention; and (3) the application of knowledge which comprises knowledge preservation and knowledge implementation. However, there are several possible obstacles to knowledge management. In this regard, Lotti Oliva (2014) classified these barriers into three groups: environmental, institutional, and human impediments. For example, the source of knowledge may lack the ability or motivation to share the knowledge with others or even the organizational culture may not be supportive of knowledge sharing, which may negatively hinder the pursuit of essential knowledge. In contrast, knowledge management practices offer organizations several benefits, such as enhancing a firm's productivity, facilitating the flow of experts, gaining competitive advantage and enabling

a business to be sustainable (Abbas, 2020; Petrov et al., 2020; Martins et al., 2019; Oliva & Kotabe, 2019).

Sustainable entrepreneurship

Sustainable entrepreneurship is a development of entrepreneurship that has gained an increasing popularity. Its philosophy lies in the fact that a company can be successful and profitable while pursuing sustainable objectives such as protecting the ecosystem, deterring global warming, minimizing ecological damage and improving community life (Muñoz et al., 2018). Therefore, it can be said that sustainable entrepreneurship is a distinctive approach that blends the development of economic, social, and environmental benefits with a general consideration of coming generations' needs (Hockerts & Wüstenhagen, 2010). In this context, many related ideas, including social and environmental, eco or green entrepreneurship, have evolved (Le Loarne Lemaire et al., 2022; Strydom et al., 2020, 2021; Sengupta et al., 2018). While the latter refers to factors linked to production or activities performed to reduce environmental harm, such as resource recycling, the former aims to generate public welfare by tackling societal issues like offering affordable healthcare, providing clean water, and reinvigorating poor neighborhoods (Hoogendoorn et al., 2019).

The possibility that sustainable entrepreneurship is an effective strategy for addressing ecological harm, resource shortages, and poverty challenges may have drawn more academics to investigate this topic (Diepolder et al., 2021). For instance, sustainable entrepreneurship was investigated with various topics such as Triple Bottom Line (TBL) (Majid & Koe, 2012), family business (Woodfield & Husted, 2017), education for circular economy (Del Vecchio et al., 2021), knowledge-intensive and entrepreneurial ecosystems (Bertello et al., 2022). These investigations demonstrated the importance of sustainable entrepreneurship in gaining a competitive advantage, improving the economy, and using external knowledge well (Yin et al., 2022).

Knowledge management and sustainable entrepreneurship

The key elements of knowledge management, such as appropriate identification, acquisition, utilization, and distribution of essential data, information and knowledge, have been described as key enablers for business sustainability (Audretsch et al., 2020; Joe et al., 2013). For instance, knowledge management may assist firms in acquiring external knowledge that would enable environmental sustainability (Pham et al., 2019). By exchanging knowledge inside enterprises and with external companies, the possibility of implementing a sustainable plan and innovative activities may arise (Singh et al., 2021). Based on this essential overlap between knowledge management and entrepreneurship sustainability, several empirical studies have investigated their association. For instance, Durst and Zieba (2020) investigated the impact of knowledge risks on an organization's capacity to maintain its economic, social, and environmental sustainability. This study concluded that while knowledge is crucial for corporate sustainability, it may also pose a risk if not well managed. Furthermore, through an empirical study, it has been found that knowledge management positively supports businesses' sustainable development initiatives and green innovation (Abbas & Sağsan, 2019).

Previous bibliometric studies on knowledge management and sustainable entrepreneurship

Even though this topic has been the subject of several studies, as far as our knowledge, none of them specifically analyze knowledge management and sustainable entrepreneurship together. The review of Pham et al. (2019) focused only on the determinants of environmental innovativeness via a knowledge-based resource view. Apart from the low sample size of the reviewed papers (40 articles only), this study ignored other essential elements of sustainability, including economic and social sustainability. Another study by Pellegrini et al. (2020) provided a bibliometric analysis coupled with a systematic literature review over the past 20 years on knowledge management and leadership, which has been described as a key feature of sustainable entrepreneurship (Malik et al., 2020). This study only used Scopus publications and would have been more useful if it had considered other databases, such as the Web of Science.

Additionally, Sanguankaew and Vathanophas Ractham (2019) and Chopra et al. (2021) conducted bibliometric studies focusing on knowledge management and sustainability. However, according to prior work such as Shepherd and Shepherd and Patzelt (2011), these two studies cannot be linked to sustainable entrepreneurship studies. For example, Shepherd and Patzelt (2011) stated that some sustainability studies do not fall within the umbrella of entrepreneurship sustainability if all dimensions of sustainability are not covered. More precisely, Muñoz et al. (2018) reported that without considering potential developments at the economic and social levels, sustainability studies could not be connected to entrepreneurship sustainability studies, such as climate change studies that do not consider economic and social values. In these two studies, climate change was used as a keyword. In addition, non-of these studies included publications from the Scopus database.

Therefore, to the best of our knowledge, none of these studies have reviewed the connection between knowledge management and sustainable entrepreneurship.

Given this background, this bibliometric review will, thus, elucidate the publication trends in the area of knowledge management for sustainable entrepreneurship. In this regard, our bibliometrics is different from prior work in three ways: (1) we reviewed the literature that links knowledge management with sustainable entrepreneurship; (2) we considered publications from both Scopus and the Web of Science using a special keyword combination that has not been employed previously and (3) we provided a thorough research agenda for further investigations in this field.

Methodology

The bibliometric analysis conducted in this study is grouped into two main categories: performance analysis and science mapping. Performance analysis provides insights into the contributions made by different entities within the knowledge management and sustainable entrepreneurship literature. It offers a descriptive account of the role played by authors, institutions, journals, and countries. Examining these literature constituents allows for profiling their activities and impact (Cobo et al., 2011; Donthu et al., 2021). Performance analysis, in particular, serves to benchmark constituent-level productivity and acts as a baseline for profiling participants, similar to how the selected sample

descriptive statistics are presented in quantitative empirical studies (Donthu et al., 2021). The Biblioshiny application within the Bibliometrix package, which is embedded in the R 4.3.1 statistical software, enabled this performance analysis to be conducted. It revealed the most impactful authors in the literature according to various bibliometric indicators.

Additionally, it identified the most impactful journals as well as the most frequently cited references. The Biblioshiny application facilitated an examination of the key contributors and influencers within the research domain based on quantitative metrics and publishing and citation pattern analyses. This provided valuable insights regarding the landscape of scholarship in the knowledge management and sustainable entrepreneurship literature (De Bruyn et al., 2023). On the other hand, science mapping techniques focus on understanding the relationships between various entities. They provide a more holistic perspective by mapping connections and networks within the research domain. The science mapping approach utilized in this study enabled the development of a thematic map that revealed important insights into the topological structure of the research field. Specifically, the thematic map identified the most developed and substantive themes that received the most scholarly attention and contributions. These prominent areas represent the core focus of the field to date. Niche and emerging themes that are less established but show growth potential. Mapping these smaller, developing areas of enquiry can help uncover new directions warranting further exploration (Meyer et al., 2023).

Data collection

The search for documents dealing with the theme of knowledge management and sustainable entrepreneurship was carried out in the two databases of Scopus and the Web of Science (WoS), the two most used databases in academic research (Zhu & Liu, 2020). The document search consisted of selecting documents containing the words knowledge management and sustainable entrepreneurship in the '*Titles, Abstracts, and Keywords*'. The search was limited to papers published in English. The search procedure in both databases is presented in Table 1.

The first search resulted in 185 papers from the Scopus database and 94 from the WoS database by 2 July 2022. Among these 279 downloaded papers, 46 documents were excluded according to the PRISMA protocol (see Fig. 1) from the work of Page et al. (2021).

Bibliometric analysis tools

The 233 chosen documents were analyzed using the Bibliometrix program of the software R 4.1.2 and its Biblioshiny feature. The VOSviewer program was also used to visualize the networks. VOSviewer is a popular software choice in science for visualizing and

Table 1 Search query

Scopus database	TITLE-ABS-KEY (knowledge management) AND TITLE-ABS-KEY (sustainable entrepreneurship) AND (LIMIT-TO (DOCTYPE," ar") OR LIMIT-TO (Doctype")) AND (LIMIT-TO (LANGUAGE, "English"))
Web of Science database	TI = (knowledge management and sustainable entrepreneurship) OR AB = (knowledge management and sustainable entrepreneurship) OR AK = (knowledge management and sustainable entrepreneurship) AND (LA = ("ENGLISH"))

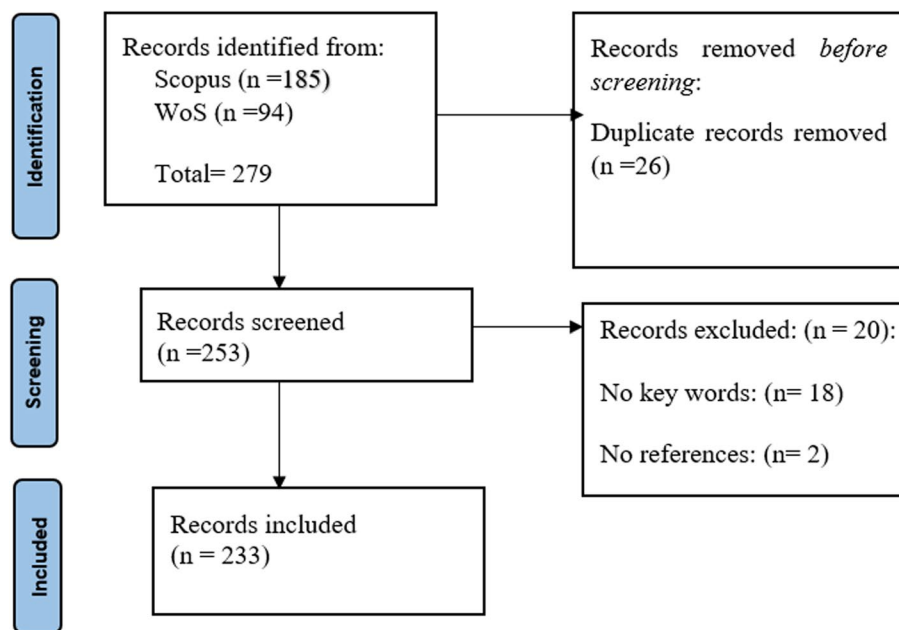


Fig. 1 PRISMA flowchart

mapping huge data sets across various settings and disciplines (2021b; Soliman et al., 2021a). The performance analysis and the science mapping across the networks make up the two sections of the analysis.

Results

Performance analysis

The performance analysis consists of analyzing the evolution of the annual production of papers on the theme of knowledge management and sustainable entrepreneurship. The number of papers published is considered an output indicator, and the number of citations recorded indicates the impact of the output on research in this area (Tiberius & Weyland, 2022). The impact of the authors who publish papers and the authors cited in these papers, as well as the journals that publish and the journals cited, is assessed by the indicators h-index, m-index and g-index. The h-index assesses output and citations combined, indicating that a given author or source has published h articles, each of which has received h or more citations (Choudhri et al., 2015; Hirsch, 2005). The m-index is an index derived from the h-index and is defined as the quotient of the h-index of an author or source divided by the number of years from the first publication (Hirsch, 2005). This index represents an average of the h-index during the entire production period of the author (career) or source. It allows distinguishing between two units with different production durations (Choudhri et al., 2015). A g-index that equals k means that the first k articles published by an author or source are cited on average k times.

Table 2 shows the selected papers on knowledge management and sustainable entrepreneurship published between 1994 and 2022 in 181 academic journals. The average age of a paper is 6 years, with an average citation of 8.558 times per paper. The number of references used is about 9768. The 641 authors of these documents used 919 keywords. The average number of authors per document is 2.75, with 45 documents elaborated by

Table 2 Database description

Description	Results
Timespan	1994:2022
Sources (journals, books, etc.)	181
Documents	233
Average years from publication	6
Average citations per document	8,558
Average citations per year per document	1.11
References	9768
Document types	
Article	122
Article: early access	6
Article; proceedings paper	1
Conference paper	49
Proceedings paper	51
Review	4
Document contents	
Keywords plus (id)	919
Author's keywords (de)	821
Authors	
Authors	641
Author appearances	677
Authors of single-authored documents	45
Authors of multi-authored documents	596
Authors collaboration	
Single-authored documents	48
Documents per author	0.363
Authors per document	2.75
Co-authors per document	2.91
Collaboration index	3.22

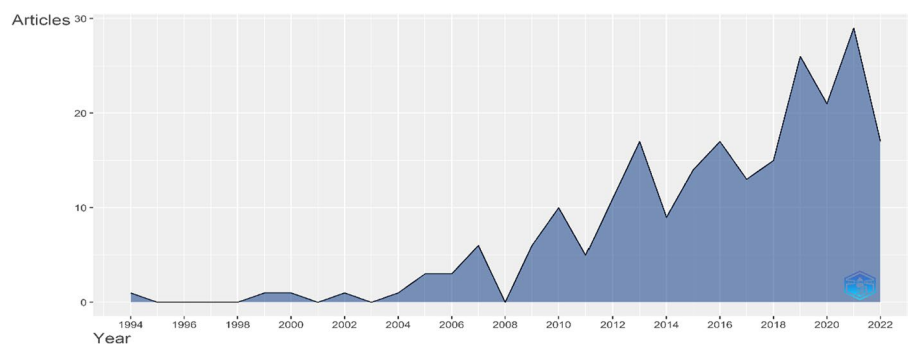


Fig. 2 Annual production

a single author. The level of collaboration between the authors of the theme measured by the collaboration index (Donthu et al., 2021) is equal to 3.22.

The analysis of the temporal evolution of the publication of papers in the knowledge management and sustainable entrepreneurship theme (Fig. 2) has seen a significant increase in 2010 from 5 to 10 papers per year. The year 2013 recorded an escalation from

10 to 15 papers to reach a peak of 30 articles in 2021. This evolution has been achieved according to an annual percentage growth rate of 14.44% papers each year.

The analysis of Fig. 3, which illustrates the evolution of publications on the theme of knowledge management and sustainable entrepreneurship in the 5 most productive sources, shows that conference proceedings monopolize the largest share of publications. The European Conference on Innovation and Entrepreneurship (ECIE) proceedings have published 3 papers in 2015 and 4 between 2016 and 2020. Proceedings of the 30th International Business Information Management Association Conference (IBIMA 2017—VISION 2020): Sustainable Economic Development Innovation Management and Global Growth recorded the publication of 5 papers. The journal *Sustainability* (Switzerland) is in the first place, with 7 articles published between 2019 and 2022.

Table 3 shows that this journal has the highest h_index (3), g_index (6), and m_index (0.75) scores. Table 4 shows that this journal is the most cited in the theme. *The Journal of Sustainable Tourism* ranks second in terms of m-index.

Table 5 presents the impact of the 10 most productive authors. These 10 authors have published 2 papers each. Regarding citations, Valter Cantino and Damiano Cortese from the Università Degli Studi di Torino, Italy, are the two authors who occupy the top position. These two authors have published two papers (Cantino et al., 2017), which aim to “explains the learning processes involving place-based enterprises” and (Cortese et al., 2019), which aims to “examine systemization of a control panel for local decision-makers that encourages knowledge management and sharing for learning and sustainable entrepreneurship”. The third author prominent in terms of citations is Philip Hallinger, Professor of Management at the College of Management, Mahidol University, Thailand and a visiting professor at the University of Johannesburg, South Africa. His most cited paper is ‘Analyzing the intellectual structure of the knowledge base on managing for sustainability, 1982–2019: A meta-analysis’ which was published in 2020. These three papers are cited only once by the authors of the 233 papers analyzed for this theme.

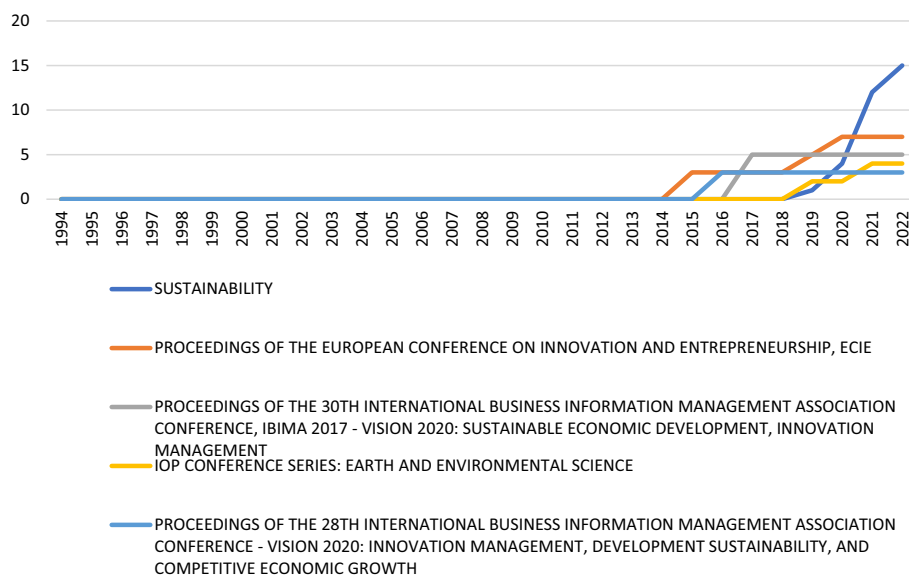


Fig. 3 Sources production dynamics

Table 3 The 10 most productive sources of impact

Sources	h_index	g_index	m_index	TC	NP	PY_start
Sustainability (Switzerland)	3	6	0.75	285	7	2019
International Journal of Entrepreneurial Behavior and Research	2	2	0.33	36	2	2017
International Journal of Entrepreneurship	2	2	0.50	5	2	2019
Journal of Cleaner Production	2	2	0.15	57	2	2010
Journal of Small Business and Entrepreneurship	2	2	0.17	13	2	2011
Journal of Sustainable Tourism	2	2	0.67	52	2	2020
Technovation	2	2	0.11	248	2	2004
World Review of Entrepreneurship, Management and Sustainable Development	2	2	0.40	5	2	2018
2010 IEEE Transforming Engineering Education: Creating Interdisciplinary Skills for Complex Global Environments	1	1	0.08	4	1	2010
2013 International Conference on Virtual and Augmented Reality in Education	1	1	0.10	4	1	2013

TC: total citations; NP: number of publications; PY_start: starting publication year

Table 4 The 10 most cited sources

Sources	Articles
Sustainability (Switzerland)	127
Journal of Cleaner Production	99
Strategic Management Journal	79
Journal of Business Venturing	68
Academy of Management Review	58
Strategic Entrepreneurship Journal	55
Entrepreneurship Theory and Practice	54
Business Strategy and the Environment	53
Organisation Science	52
Journal of Business Ethics	49

Table 5 The most productive author's impact

Authors	h_index	g_index	m_index	TC	NP	PY_start
Cantino Valter	2	2	0,333	36	2	2017
Cortese Damiano	2	2	0,333	36	2	2017
Hallinger Philip	2	2	0,667	14	2	2020
Minghat Asnul Dahar	2	2	0,154	10	2	2010
Rahman Shah-Nour	2	2	0,2	4	2	2013
Yasin Ruhizan M	2	2	0,154	10	2	2010
Ashraf Sheikh Farhan	1	2	0,5	4	2	2021
Bhardwaj Broto Rauth	1	2	0,25	5	2	2019
Lee Young Lyoul	1	2	0,091	19	2	2012
Nazir Mehrab	1	2	0,5	4	2	2021

TC: total citations; NP: number of publications; PY_start: starting publication year

The most cited reference in this database of documents dealing with knowledge management and sustainable entrepreneurship (Table 6) is the paper by Cohen and Winn

Table 6 The most cited references

Cited references	Citations
Cohen & Winn, 2007) "Market imperfections, opportunity and sustainable entrepreneurship <i>Journal of Business Venturing</i> "	8
(Schaltegger & Wagner, 2011) "Sustainable entrepreneurship and sustainability innovation: categories and interactions <i>Business Strategy and the Environment</i> "	8
(Teece et al., 1997) "Dynamic capabilities and strategic management", <i>Strategic Management</i>	7
(Fornell & Larcker, 1981) "Evaluating Structural Equation Models with Unobservable Variables and Measurement Error". <i>Journal of Marketing Research</i>	6
(Barney, 1991) "Firm Resources and Sustained Competitive Advantage". <i>Journal of Management</i>	5
(W. M. Cohen & Levinthal, 1990) "Absorptive Capacity: A New Perspective on Learning and Innovation". <i>Administrative Science Quarterly</i>	5
(Lumpkin & Dess, 1996) "Clarifying the Entrepreneurial Orientation Construct and Linking It to Performance". <i>The Academy of Management Review</i>	5
(Nonaka et al., 1995) <i>The Knowledge-creating Company: How Japanese Companies Create the Dynamics of Innovation</i>	5
(Alvarez & Busenitz, 2001) "The entrepreneurship of resource-based theory". <i>Journal of Management</i>	4
(Spender & Grant, 1996) "Knowledge and the firm: Overview". <i>Strategic Management Journal</i>	4

(2007), published in the *Journal of Business Venturing* in 2007. In this paper, the authors develop a new sustainable entrepreneurship model based on four market imperfection types. This model allows obtaining entrepreneurial rents favoring improving social and environmental conditions at local and global levels. With 8 citations, Schaltegger and Wagner's (2011) paper was published in the journal *Business Strategy and the Environment* and dealt with the link between sustainable entrepreneurship and sustainable innovation.

The most quoted document, which belongs to the 233 document base, is by Tshiaba et al. (2021), entitled *Measuring the Sustainable Entrepreneurial Performance of Textile-Based Small–Medium Enterprises: A Mediation–Moderation Model*. This paper examines the role of knowledge management practices in sustainable entrepreneurship performance. This study also investigated the relationships between six concepts: knowledge-sharing behavior, innovative capacity, absorptive capacity, dynamic capability, opportunity recognition, and sustainable entrepreneurship.

This intellectual structure analysis focused on identifying key research topics and their interconnections. This analysis helped us identify main research clusters, emerging trends, and the evolution of scientific knowledge over time. It provided valuable insights into the intellectual landscape and the trajectory of the field.

Conceptual structure analysis

Figures 4 and 5 show that the most used theme is entrepreneurship, which appeared in 2013 and was heavily used in 2017. The innovation theme appeared in 2013 and was used extensively in 2017 before disappearing in 2019. The knowledge management theme is a theme that has persisted since its appearance in 2012. It has seen a high frequency of use in 2016. Social entrepreneurship, sustainable development and dynamic capability are the themes that dominate the current research. The year 2021 saw the appearance of the theme of leadership.

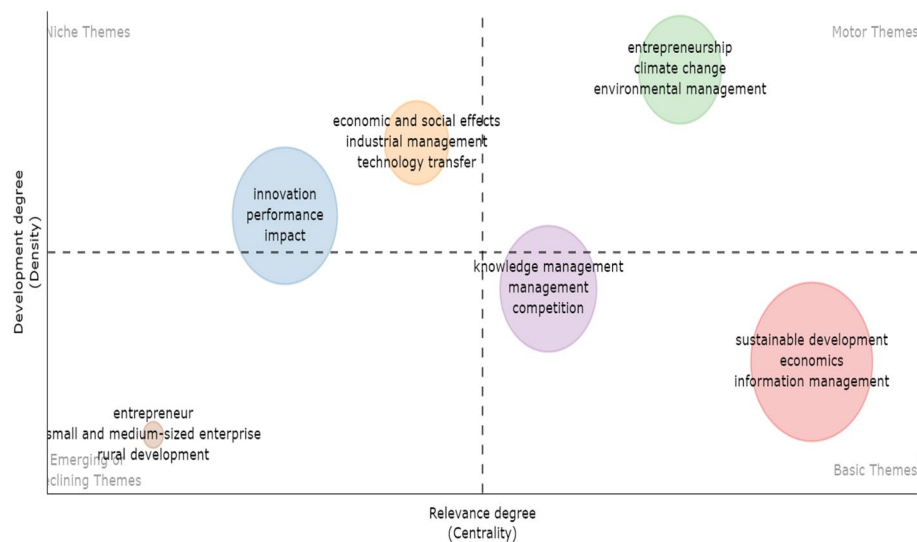


Fig. 6 Authors' keyword thematic map

The motor themes are in the right-hand frame at the top, characterized by high density and centrality. These motor themes are grouped into 3 clusters. Table 7 presents their characteristics.

This conceptual structure analysis aimed to uncover semantic relationships between terms and concepts used in the literature. This analysis helped identify basic concepts, core concepts, marginal concepts and emerging concepts, their associations, and the development of research themes. It provided a deeper understanding of the underlying ideas and conceptual frameworks driving the research (see Tables 8, 9, 10).

Conclusions

The current analysis has concentrated on providing significant insights on (1) performance analysis, including annual scientific production, sources production dynamics, most productive sources impact, most cited sources, most productive authors, and most cited references; and (2) conceptual structure analysis such as keywords cloud, authors keywords dynamic, motor's themes characteristics, basic thematic clusters, emergent themes characteristics and authors keyword thematic map. By using various quantitative techniques and measurements, the bibliometric approach employed in this research has shown and confirmed the potential of bibliometrics to manage a huge corpus of publications and give comprehensive reflections on the subject at hand. Notably, the results of the current analysis yield several significant implications and future avenues.

The performance analysis discusses the performance of research that concentrates on knowledge management and entrepreneurship sustainability. Addressing the effectiveness of research constituents, although the field's early publication growth has been slightly slow, this analysis shows that knowledge management and entrepreneurial sustainability research have rapidly grown in recent years. As an illustration, in 2010, there were just 5 publications in this field on average each year. However, by 2021, that number had climbed to 30. Notably, this growth is continuously rising,

Table 7 Basic theme clusters

Sustainable development	Major topics	Related second-order topics	Studies
	Economics	Agriculture, Commerce, Regional Planning	Ferreira et al. (2020) investigate the role of technology transfer in the European continent, especially in relation to environment-related patents, and how they affect economic growth, entrepreneurship, and innovation across different geographical contexts
	Agriculture	Bio-energy, Forestry	Voytenko and Peck (2011) argued that Ukraine faces broad needs for energy security enhancement, energy diversification, revitalization of agriculture, and improvements in the state of the environment
	Commerce	Sales, International Trade	Shahid and Reynaud (2022) examine how the green market perception mediates the effect of sustainability orientation on entrepreneurial intentions and how this effect varies by field of study
	Higher Education	Curricula, Engineering Education	Frolova et al. (2021) compare the curricula of business and entrepreneurship programs in three different countries and provide recommendations for making business and entrepreneurship education more sustainable
	Entrepreneurial Activity	Entrepreneurial Skills	Lehoux et al. (2021) examine how different types of organizations can create responsible value by adopting the RRI approach and the business model challenges they face
	Engineering	Design, Engineering Research	Hawkins et al. (2014) argued that Major environmental, economic, and social trends are transforming the application of sustainability thinking within the engineering profession and within organizations that hire engineers
	Information Management Human Resource Management	Personnel Training, Professional Aspects, Learning Systems	Al-Maati and Damaj (2010) examine how AUK provides sustainable engineering education with entrepreneurship

Table 7 (continued)

Knowledge Management	Knowledge-based systems Knowledge transfer Knowledge-sharing Intellectual capital	Cantino et al. (2017) identified 6 phases of entrepreneurial learning involving place-based enterprises through theories of adaptive co-management and Lachmann's evolutionary theory of entrepreneurship Xiuping Chen and Jia-qiong Wang (2011) Analyze knowledge transfer peculiarities and the role of entrepreneurial aspects, explaining entrepreneurial input and forms for sustainable transfer Romanelli and Zbucea (2020) analyze knowledge exchange connected to social innovation and urban regeneration through situations in Romania considering various dimensions
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Table 8 Motor themes cluster

Entrepreneurship	Entrepreneurship education Entrepreneurial education Small and medium enterprise Sustainable entrepreneurship	Through the perspective of tacit knowledge sharing, Jiang et al. (2019) identified factors hindering knowledge spread in an entrepreneurship class's social network Motloch and Truex (2015) address complex adaptive systems and strategies like appreciative inquiry to help communities interconnect sustainability and thrive sustainably
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demonstrating the researchers' ongoing interest in this field. In addition, the performance analysis of the most productive sources, most cited sources, most productive authors and most cited references clearly shows that the domain of knowledge management and entrepreneurship sustainability research has obtained valuable contributions from a diverse group of scholars from various nations and organizations worldwide. The publications included in this review were published in 181 journals by more than 600 authors worldwide. The top five cited journals were *Sustainability* (Switzerland), *Journal of Cleaner Production*, *Strategic Management Journal*, *Journal of Business Venturing*, and the *Academy of Management Review*.

Regarding the most productive journal, *Sustainability* (Switzerland) is the most prolific journal with the highest number of publications in knowledge management and entrepreneurship sustainability. Noteworthy, the top authors are from developed nations. However, the data used in these studies were not necessarily gathered only from developed countries.

Analyzing the knowledge structure of knowledge management and sustainable entrepreneurship studies is another important conclusion of this analysis. Particularly, the conceptual structure analysis investigates the library database, allowing this bibliometric study to disclose the cluster of pertinent topics found both within and beyond

Table 9 Niche/marginal theme clusters

Major theme	Related themes	Studies
Economic and social effects	Industrial Management, Technology Transfer, Social Entrepreneurship Development, Economic Growth Risk Management, Strategic Planning, Discovery, Entrepreneurial Orientation Environmental Impact, Environmental Technology, Industrial Economics, Patents and Inventions, Research Research and Development, Management, Tacit Knowledge	According to the paper, Hansson et al. (2005) explore how second-generation science parks can transition from focusing on structural holes between organizations to building social capital that facilitates entrepreneurship and knowledge-sharing networks. Ferreira et al. (2020) examine how environmental patents related to water adaptation technology and climate change mitigation influence economic growth rates across European countries, finding that their geographical contexts and levels of entrepreneurship and innovation affect technology transfer
Innovation	Innovation, performance, impact, science, absorptive capacity, business, model, opportunity, orientation, capabilities, firm, performance, tourism, corporate entrepreneurship, dynamic capabilities, volution, framework, human resource management, pls-sem, self-efficacy, value creation, supply chain management	Priem et al. (2012) review the progress of demand-side research perspectives in technology innovation, entrepreneurship, and strategic management literature, finding this approach emphasizes product markets and consumer preferences to explain value creation strategies, considering how managers respond to consumer heterogeneity impacts firm heterogeneity and ultimately value creation, suggesting future demand-side work holds promise for generating new useful knowledge. (Hallinger, 2020) analyzes research on managing sustainability from 1982 to 2019 across seven management disciplines, finding supply chain management had the strongest engagement and influential authors/concepts/schools of thought in sustainable supply chain management

Table 10 Emerging theme cluster

Major theme	Related themes	Studies
Entrepreneur	Small and medium-sized enterprise Rural development stakeholder adaptive management	Stawicka (2021) examines how aspects of corporate social responsibility, like communication with stakeholders, knowledge management, and strategy, influence building sustainable development models in enterprises. Andersson, (2021) explores how Sweden's inshore fisheries industry has navigated changes as tourism rose in the service economy through ethnographic research finding fishermen balance resistance to political demands with conformity to economic pressures while dependent on authorities and engaging harbor visitors

knowledge management and entrepreneurship sustainability. The analysis of conceptual structure identified several consistent and interconnected themes that make up knowledge management and the sustainable entrepreneurship body of knowledge. These

include social entrepreneurship, sustainable development, sustainable entrepreneurship, dynamic capability and innovation. This demonstrates that various disciplines have influenced the topic of knowledge management and sustainable entrepreneurship study.

The basic themes are expected to stay constant over time due to their fundamental function as the cornerstone of knowledge necessary to develop new insights in this field. However, technological and management systems advancements will likely emerge new knowledge management and entrepreneurship sustainability research themes. The results of this review revealed several emerging themes, such as ecological incubation, economic ecology, entrepreneurial economy, entrepreneurial network, and organizational learning. The emergence of such new themes in this field due to technological advancement would hopefully facilitate enterprises' ability to achieve a better competitive edge and sustainable business through the advancement in knowledge management. For instance, the internet of things, nanotechnology, blockchain, 5G and artificial intelligence are expected to enhance knowledge acquisition, retention, and dissemination, perhaps leading to more sustainable entrepreneurship. Following these indications, firms should likely be able to advance their entrepreneurship sustainability. The following sections will provide the relevant implications and suggested paths for future study to advance the subject of knowledge management for sustainable entrepreneurship based on the discussion and results above.

Implications and future research agenda

The implications of this study are twofold. Firstly, the theoretical implications revealed the progress and directions of academic studies in knowledge management for sustainable entrepreneurship. The theme development is most interesting, specifically around the driving themes, which are centered around sustainability. The most prevalent themes are sustainability management, sustainable growth and sustainable entrepreneurship. Only one niche theme related to sustainable innovation was identified.

Further theoretical implications revealed the most important articles and sources. Having this at hand can assist in identifying the mainstream research and authors easily. This review, therefore, offers a one-stop overview of the combined topics of knowledge management and sustainable entrepreneurship. This implies that scholars, policy and other decision-makers will be able to derive timeous insights from a single review without wasting time and resources evaluating and understanding the entire field of knowledge management for sustainable entrepreneurship. Secondly, the study brings forth some practical implications, specifically in future research streams. This cutting-edge summary offers unique perspectives on future research directions in knowledge management for entrepreneurship sustainability. This implies that academics may rely on this study's overview as a reference point for further empirical studies to expand and develop this field in a positive and useful direction. We identified the following key future research streams. Each theme was chosen for its potential to fill specific research gaps and contribute to a better understanding of sustainability in entrepreneurial operations. Themes such as Sustainable Innovation and Knowledge Management, Leadership, Knowledge Management, and Sustainable Entrepreneurship, Knowledge Management

and Sustainable Entrepreneurship in Technology-Based Businesses, and Knowledge Management and Sustainable Entrepreneurship were identified to investigate the critical intersections between knowledge management practices and sustainable business operations. By diving into these topics, the study hopes to give insights that will help to influence future research efforts and promote the incorporation of sustainable practices into entrepreneurial ventures.

Sustainable innovation and knowledge management

Although this theme was highlighted as one of the niche themes with a high density and low centrality, its relevance is still noticeable. While some studies have been done that focus on the relationship between knowledge management and sustainable organizational innovation, which also aligns with sustainable entrepreneurship, there is still room for research growth. For example, a study by Abbas (2020) focused on the mediating effect of organizational learning between knowledge management and sustainable organizational innovation. These findings revealed that knowledge management and organizational innovation procedures are essential in the progress and survival of organizations. Further studies on the mediating factors that may link sustainable innovation, knowledge management and sustainable entrepreneurship can be valuable in the progression of business performance. Businesses are increasingly expected to create innovations that resolve economic, ecologic, and social objectives to adhere to sustainable development (i.e., sustainable innovations). Obtaining this goal, however, is not easy, and while several studies have attempted to improve our understanding of sustainable innovation, few address the issues of knowledge management as a significant factor. A systematic review by Cillo et al. (2019) mentioned that future research might contribute to the discussion of how academics evaluate the effects of companies engaging in sustainable innovation processes. When assessing the impacts of sustainable innovations, it may also be beneficial to consider the benefits of knowledge management. Finally, because the path to sustainable innovation is longer than the path to conventional innovation (i.e., sustainable innovations necessitate niche transitions), a critical issue is how short and long-term yields shape choices about sustainable innovation projects. Again, this is where knowledge management can play a crucial role.

Leadership, knowledge management and sustainable entrepreneurship

The role of leadership in utilizing knowledge effectively is not a new research topic. Many studies have been conducted on, for example, the different leadership styles (Singh, 2008), organizational leadership (Donate & de Pablo, 2015), competitive advantage through strategic leadership (Mahdi & Nassar, 2021) and its impact on knowledge management practices. These studies all found that leadership is crucial in knowledge management practices. Leadership is essential in processing and using knowledge, and according to Boal and Schultz (2007), strategic leaders are critical components of a complex adaptive system's adjustment process. Further research can include topics linked to leadership and sustainable entrepreneurship as these were not necessarily related topics within the exciting studies.

Knowledge management and sustainable entrepreneurship in technology-based businesses

Technology usage and related topics are key research areas that have recently attracted much attention. The benefits of technology usage within businesses have been highlighted several times. Technology usage assists in higher production, leading to improved competitive advantage and potential increased market share (Liu et al., 2020). Because the essence of technology-based businesses is premised on innovation and knowledge management, knowledge management has recently made significant advances. Knowledge management can be a valuable tool for technology-based businesses in this field. As the issue of sustainability has also gained much attention in recent years, this concept deserves further attention. The concept of sustainable entrepreneurship specifically focuses on developing more sustainable ways of doing things. This sometimes conflicts with technology-driven business models focusing on maximizing profits (Davies & Chambers, 2018). Therefore, research focusing specifically on the synergy between technology-driven business models and sustainable entrepreneurship could prove valuable in future. The emergence of such new themes in this field due to technological advancement will potentially facilitate businesses to achieve a better competitive edge and long-term business success through advancements in knowledge management while practicing more sustainable entrepreneurship.

Knowledge management and sustainable entrepreneurship

Although this study focused on the issues of knowledge management and sustainable entrepreneurship, the essence of these combined aspects is still lacking. Thus, future studies can specifically focus on the four interrelated stages of knowledge management (knowledge generation, knowledge storage, knowledge transmission, and knowledge integration) and its benefits and implications within sustainable entrepreneurship practices.

Triple helix, quadruple helix, quintuple helix

Ferreira and Steenkamp (2015) argue that the triple helix concept of university–industry–government collaboration is important for digital economies and knowledge management as it aims to build an "enterprising state" through co-innovation between these stakeholders to address challenges presented by issues like healthcare needs, unemployment, and emerging business models, facilitated by knowledge-sharing mechanisms at entrepreneurial universities and analysis of initiatives in areas like national innovation strategies and new technologies. Sedlak et al. (2016) examine the differences in orientation and values between universities and industry for evaluating innovation, proposing that the quadruple helix model encourages collaborative knowledge production and innovation among diverse stakeholders, with the study aiming to demonstrate how universities can support such actors and assess factors influencing entrepreneurial culture development considering strategic awareness and management responses.

Limitations and future research

The current review study is no different from other research studies in that it has some limitations. Nonetheless, these limitations also offer vital chances, suggestions, and directions for further studies. First, the present paper used a thorough bibliometric approach, which included an analysis of the performance (key trends) and the knowledge structures (i.e., the conceptual, intellectual, and social structures) of knowledge management and sustainable entrepreneurship research over the specified time period. Therefore, it is advised that future studies systematically review, analyze, and map the research methods-related issues and contributions of the publications in the field of knowledge management and sustainable entrepreneurship. Second, this study conducted a bibliometric analysis of knowledge management and sustainable entrepreneurship using the R software package Bibliometrix R3.1 and VOSviewer.

Further research is recommended to make use of other programs. Third, the current study focused on English-language papers published in WoS and Scopus journals. Future research is suggested to gather and review data from other databases (e.g., Google Scholar and others). Collecting a wealth of data on the subject will be made simpler as a result. Future research can also include a bibliometric analysis of editorials, research notes, and other non-reviewed papers. According to Au-Yong-Oliveira et al. (2021), these unreviewed articles may contain worthwhile and promising early-stage concepts and themes that have not yet been published in peer-reviewed articles and journals. In addition, this could help expand one's understanding and point of view of the key trends, evolution, and knowledge bases pertaining to sustainable entrepreneurship and knowledge management.

Abbreviation

WoS Web of Science

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Author contributions

Conceptualization, NAA and MS; methodology, FBS and NM; software, FBS; validation, FBS and NM; formal analysis, FBS; investigation, FBS; resources, FBS and NAA; data curation, FBS; writing—original draft preparation, NAA; NM; MS and FBS; writing—review and editing, NM; NAA and MS; visualization, MS.

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Availability of data and materials

The data sets generated for the analysis of this study are available in the Web of Science (WoS) and Scopus repositories.

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Competing interests

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