

Data-Driven Exploration of Emerging Trends in Sustainable Human Resource Management Using Advanced Analytics

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ABSTRACT

This paper uses advanced analytics to explore emerging trends in sustainable human resource management (HRM). Analyzing publications from 1991 to 2023 via the Scopus database identifies key trends and contributions in sustainable HRM research, including sustainability, green HRM, and corporate social responsibility. The findings highlight an increasing research volume, significant global contributions, and a growing academic interest in integrating sustainability into HR practices. Despite its reliance on the Scopus database, this review provides valuable insights for HR practitioners and organizations aiming to enhance sustainability through HR strategies. It also maps future research directions in sustainable HRM.

KEYWORDS

Sustainable Human Resource Management, Green HRM, Corporate Social Responsibility, Environmental Sustainability, Research Trends in HRM

INTRODUCTION

Sustainable development encompasses the integration of economic, societal, and environmental sustainability, ensuring that the needs of the present are met without compromising the ability of future generations to meet their own needs (Y. Li, 2020). It is a multifaceted concept that requires a holistic approach, considering various dimensions such as education, finance, urban planning, and human development (Dogah & Aluko, 2022; KARPAN et al., 2020; Kovalska & Smilka, 2019; Ristić et al., 2020). The Sustainable Development Goals (SDGs) proposed by the Sustainable Development

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Solution Network play a crucial role in shaping the global management of a sustainable development economy (Ristić et al., 2020). These goals provide a framework for addressing key challenges and guiding efforts towards sustainable development. Education for sustainable development is critical, as it equips learners with the necessary knowledge and skills to promote sustainable development (O’Flaherty & Liddy, 2017). However, research indicates a need to conceptualize sustainable development more comprehensively, as current approaches focus on individual areas rather than the overarching concept (KARPAN et al., 2020). Furthermore, there is a noted lack of awareness about sustainable development in certain regions, such as Nigeria, highlighting the importance of targeted educational interventions to enhance understanding and awareness (Onyilo, 2019).

The role of finance in sustainable development is also significant, with a focus on economic development sustainability (Ristić et al., 2020). Financial strategies and investments are crucial in driving sustainable development initiatives and addressing environmental and societal challenges. Additionally, the contribution of human development towards environmental sustainability is a key factor to consider, emphasizing the interconnectedness of human capital and environmental preservation (Dogah & Aluko, 2022).

Urban planning and construction management are integral components of sustainable development, as they aim to ensure the sustainable development of localities and manage land use in a manner that aligns with sustainability goals (Kovalska & Smilka, 2019). Furthermore, the importance of participatory research in reflecting and supporting the consultation process in developing a vision for education related to Sustainable Development Goals is highlighted, emphasizing the need for inclusive and collaborative approaches to address sustainability challenges (Dlouhá & Pospíšilová, 2018).

Sustainable Human Resource Management (SHRM) is a critical factor in promoting sustainable development within organizations. It involves integrating sustainable strategies and enhancing engagement and relationships with stakeholders to contribute to the adoption of sustainable development goals (Chams & García-Blandón, 2019). SHRM encompasses various dimensions, including social, psychological, environmental, and strategic aspects, highlighting its multifaceted influence on organizational sustainability (B. Mazur & Walczyna, 2020). This concept underscores the pivotal role of human resources and HR management in implementing sustainable development, emphasizing the significance of human capital in driving sustainable organizational practices (Bombiak & Marciniuk-Kluska, 2019; Psannis et al., 2018).

Furthermore, the effective implementation of green human resource management practices, aligned with international standards, is recognized as a 21st-century tool for achieving sustainable development, emphasizing the potential of HRM to contribute to environmental sustainability (Dahiya & Gupta, 2022; A. Gupta & Kumar, 2021). Research also explores the impact of SHRM on employees’ behaviors, indicating that sustainable HRM nurtures change-oriented employees, thereby contributing to organizational sustainability and competitive advantage (Gao et al., 2024; Leghari & Ali, 2023; S. Li et al., 2019). Additionally, the link between sustainability reporting and the core characteristics of SHRM is examined, highlighting the role of human resource tools in establishing and contributing to sustainable business performance (Alauthman et al., 2023; Aslanertik & Çolak, 2021).

Moreover, SHRM, with the salience of stakeholders, is examined from a top management perspective, emphasizing the importance of stakeholder engagement in driving sustainable HRM practices within organizations (Järlström et al., 2016). However, there are noted research gaps in understanding how HRM addresses the sustainability of human resources, indicating the need for further exploration in this area (Lu et al., 2019). Additionally, the challenges in implementing sustainable human resources management are acknowledged, emphasizing the presence of objective obstacles that need to be addressed to effectively integrate sustainable HRM practices (N. Mazur et al., 2023).

RELATED WORK

García-Cruz et al. (2024) explore how institutional pressures influence SHRM and the mediating role of organizational engagement in this relationship. Using Partial Least-Squares Structural Equation Modelling on 206 firms in the manufacturing sector, it highlights a circular relationship between institutional pressures, engagement, and SHRM, particularly at the early stages of adoption.

Kailay et al. (2024) examine the influence of SHRM on Employee Well-Being and its subsequent impact on Organizational Commitment and Job Satisfaction among healthcare professionals. Wen et al. (2024) focus on addressing team errors in safety-critical systems like nuclear power plants by constructing a complex network model based on semantic features and the Semantic Web. Quantitative analysis identifies the top five key performance factors and high-risk causative chains and proposes control strategies to improve team performance and mitigate errors in NPPs.

S.-L. Li et al. (2019) investigate how SHRM, through high-commitment work systems, fosters change-oriented behaviors in employees. Using data from 352 employees across 96 organizations highlights that HCWS positively influences employees' taking charge behaviors via work engagement, particularly when employees perceive high levels of impact, offering theoretical insights and practical recommendations. Jun et al. (2024) explore the transformative potential of machine learning in physical education by enabling personalized learning experiences, tracking student progress, and optimizing curricula and assessments.

Yu et al. (2022) explores recruitment discrimination against immigrants as a critical barrier to achieving SHRM. Analyzing survey data from 2504 managers across 39 nations highlights that voluntary association activity reduces RDI by mitigating out-group distrust, with stronger effects in individualist cultures, offering theoretical insights and practical guidance for reducing recruitment bias globally. Moslehpour et al. (2024) investigate factors influencing user intentions to prefer online dating apps in Indonesia by integrating the Technology Acceptance Model and the Theory of Planned Behavior with web semantic techniques. B. B. Gupta & Panigrahi (2022) analyze the role of global information management in enhancing decision support systems for sustainable entrepreneurship development. By leveraging large data and AI for quantitative decisions, it highlights trends and advancements in DSS through a systematic review of Scopus-indexed research, providing insights for researchers and practitioners in this field. Stergiou et al. (2021) present the Integrated Federated Model, a novel architecture combining Cloud Computing and Federated Learning to create an integrated, energy-efficient system for data management. Built using Cloud Service Providers and the PaaS model, InFeMo reduces user waiting time and dynamically selects between local and global training, merging the advantages of FedAvg and CO-OP algorithms to address gaps in federated cloud systems.

Rubio-Leal et al. (2024) conducted a systematic literature review of 1955 articles (1996–2022) focusing on sustainable HRM practices that integrate economic, environmental, and social sustainability, particularly emphasizing Latin America. Using VOSviewer and Web of Science data, it develops an analytical framework to guide future research on the consequences of sustainable HRM in the LATAM context. (Gu & He, 2024) propose the Affective Prompt-Tuning Language Model to enhance emotional text generation with limited computing resources.

Zongyu & Chienwattanasook (2024) investigate the impact of SHRM on the professional identity and job performance of university lecturers in China under an appointment system. Qualitative interviews and content analysis identify three key SHRM dimensions—recruitment and retention, maintenance of motivation and health, and skill development—as critical to enhancing both professional identity and job performance, providing a unique model for academia.

METHODOLOGY

In this systematic literature review, we employed a data-driven methodology to analyze sustainable human resource management (HRM) evolution from 1991 to 2023, utilizing the Scopus database as

our primary source. Our approach involved a systematic search for publications related to sustainable HRM, applying specific inclusion criteria (such as relevance to the field, English language, and peer-reviewed material) and exclusion criteria (like non-peer-reviewed articles and documents outside the specified timeframe). The analysis comprised a quantitative examination of publication trends, citation counts, and geographic distribution, along with a thematic analysis of keywords and key themes. Additionally, we conducted a citation analysis of the most influential documents to gauge their impact in the field. Acknowledging the limitations of our methodology, including potential biases towards English language publications and the scope of the Scopus database, we strived to ensure comprehensive coverage and ethical adherence in our research process. This approach enabled us to provide a detailed and objective overview of sustainable HRM's development over three decades, offering insights into its current state and future trajectories.

RESULTS AND DISCUSSION

In conducting our systematic literature review on sustainable human resource management, we utilized the Scopus database, with the findings comprehensively depicted in Figure 1. This figure presents an overview of the dataset spanning from 1991 to 2024, which includes a diverse array of 952 sources such as journals, books, and other relevant publications. The total number of documents in the dataset is 1,979, offering a broad lens through which to view the evolution and current trends in this field.

The temporal distribution of these documents, with an average age of 4.19 years from publication, indicates a balance between historical and contemporary perspectives, as shown in Figure 1. The dataset's academic impact is significant, with an average citation count of 18.26 per document. This trend of ongoing scholarly engagement is further evidenced by the average annual citation rate of 3.621 per document, as highlighted in the figure.

Figure 1. Main information

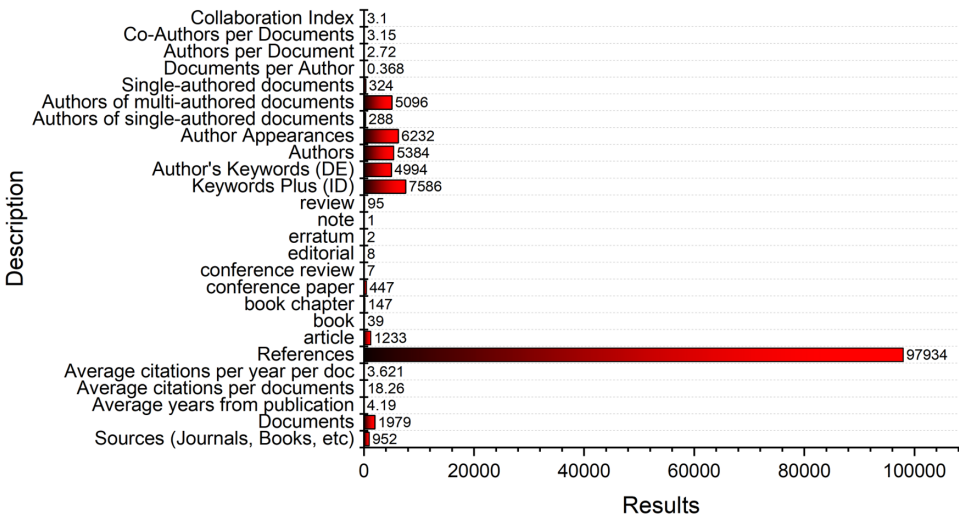


Figure 1 also illustrates the extensive nature of the dataset, with a total of 97,934 references. The breakdown of document types, including 1,233 articles, 447 conference papers, 147 book chapters, and 39 books, is graphically represented, showcasing the multifaceted nature of research

within this field. The thematic richness of the dataset is evident from the 7,586 'Keywords Plus' and 4,994 'Author's Keywords' depicted in the figure, highlighting the wide array of topics and research methodologies. Authorship patterns, as shown in Figure 1, reveal the dataset comprises 5,384 distinct authors with 6,232 author appearances. The distinction between single-authored (288) and multi-authored documents (5,096) suggests a strong inclination towards collaborative research.

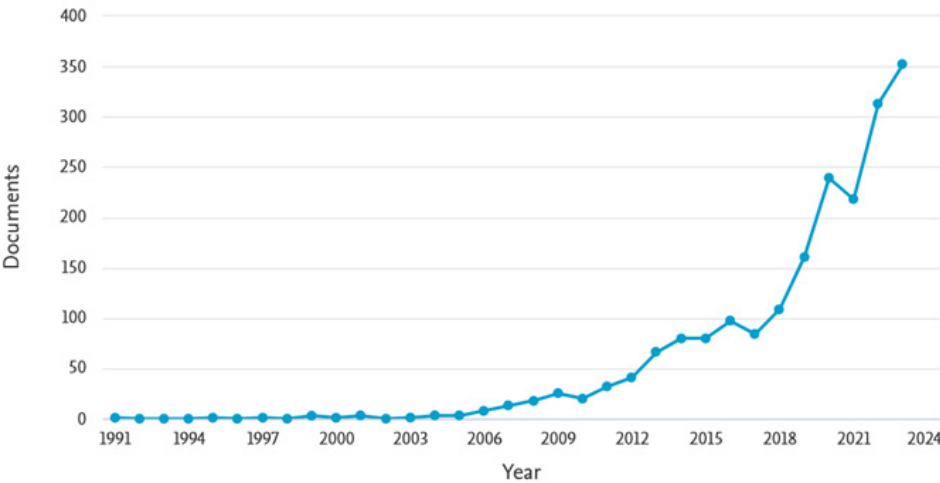
Collaboration dynamics within the field are further elucidated in Figure 1, which displays an average of 2.72 authors per document and 3.15 co-authors per document, with a collaboration index of 3.1. These statistics emphasize the interconnected and cooperative nature of scholarly work in sustainable human resource management. In summary, Figure 1 not only provides a quantitative overview of the field but also underscores the dynamic, impactful, and collaborative aspects of research in sustainable human resource management. This visual representation serves as a critical tool for understanding the scope and nature of the research landscape in this domain.

Annual Scientific Production

In the systematic literature review focusing on sustainable human resource management, a critical aspect of our analysis involved examining the annual scientific production in this field. This trend is comprehensively visualized in Figure 2, which provides a year-by-year breakdown of the number of articles published from 1991 to 2023, based on the Scopus dataset.

The early years of the dataset, as depicted in Figure 2, show a modest beginning in the field, with single articles published in 1991, 1995, and 1997. This trend of minimal publication continued through to the late 1990s, with a slight increase observed in 1999, as shown in the figure.

Figure 2. Annual scientific production



Entering the 21st century, the field began to gain more academic attention, as evidenced by the gradual increase in publications. The years 2001, 2004, and 2006 marked a noticeable uptick in research output, with 3, 3, and 8 articles respectively, as highlighted in Figure 2. This upward trajectory continued steadily, with 2007 witnessing 13 publications and 2008 seeing 18, indicating a growing interest and development in sustainable human resource management research.

The data from 2009 onwards, as shown in Figure 2, reflects a significant surge in research activity. Notably, the years 2009 through 2013 saw consistent annual increases, culminating in 66 articles in

2013. This period marked a pivotal phase in the field’s evolution, as researchers increasingly focused on sustainability issues within human resource management.

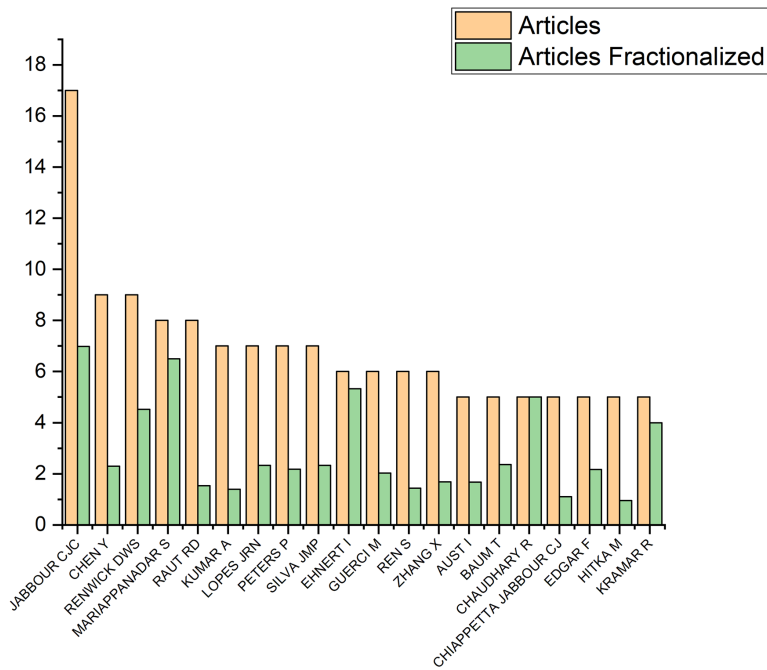
The subsequent years, particularly from 2014 to 2023, illustrate a remarkable growth in scientific output. Each year within this period, as shown in Figure 2, surpassed the last in terms of the number of publications, with 80 articles in both 2014 and 2015, escalating to 352 articles in 2023. This exponential growth underscores the burgeoning interest and critical relevance of sustainable human resource management in contemporary academic discourse and practice.

In summary, figure 2 not only provides a clear visual representation of the annual scientific production in this field but also highlights the evolving nature and increasing prominence of sustainable human resource management research over the past three decades. The figure serves as an integral component of our systematic review, offering a historical perspective on the field’s development and current trends.

Analysis of Authors

In our systematic literature review on sustainable human resource management, a key analysis element focused on identifying the most prolific authors in the field. This aspect of the study is visually detailed in Figure 3, which presents a comprehensive overview of the top authors based on their contributions to the literature, as per the Scopus dataset.

Figure 3. Analysis of authors



The figure prominently features JABBOUR, CJC, who stands out as the most prolific author with 17 articles. His significant fractionalized article counts of 6.98, as depicted in Figure 3, indicates a substantial impact in the field. This output level not only underscores JABBOUR’s extensive research in sustainable human resource management but also his influential role in shaping the discourse.

Other notable authors, as shown in the figure, include CHEN, Y, RENWICK, and DWS, each contributing 9 articles, with fractionalized counts of 2.30 and 4.52 respectively. These figures reflect their meaningful contributions to the body of research in this domain. MARIAPPANADAR, S, and RAUT, RD are also significant contributors, with 8 articles each, having fractionalized counts of 6.50 and 1.53, highlighting their diverse impact in the field.

Figure 3 further delineates authors such as KUMAR, A; LOPES, JRN; PETERS, P; SILVA, JMP; and EHNERT, I, each making notable contributions with 7 or 6 articles. Their fractionalized article counts, ranging from 1.39 to 5.33, indicate varying degrees of collaboration and influence within the research community.

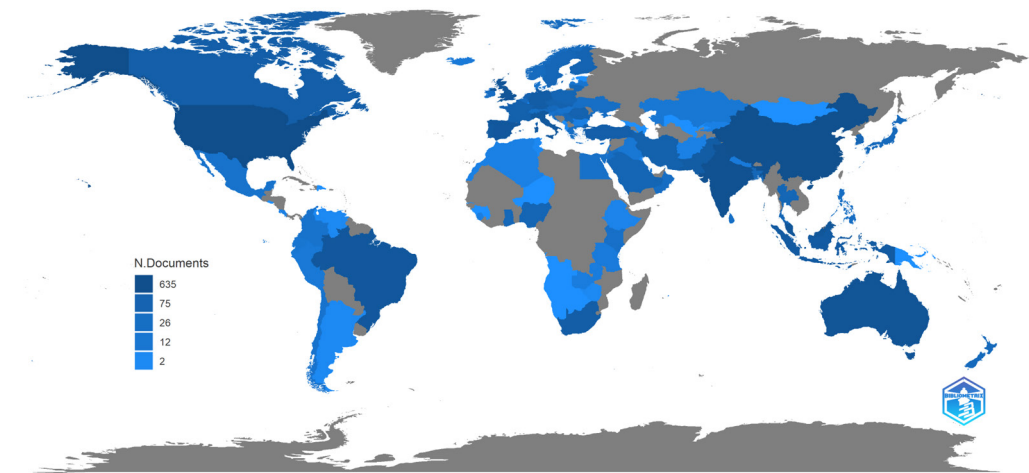
Additionally, the figure includes authors like GUERCI, M; REN, S; ZHANG, X; AUST, I; and BAUM, T, among others, each contributing 5 or 6 articles. Their fractionalized counts, such as CHAUDHARY, R's perfect score of 5.00, demonstrate their focused engagement and influence in sustainable human resource management research. Figure 3 provides a clear and detailed representation of the most influential authors in sustainable human resource management. This visualization highlights the authors' individual contributions and offers insights into the collaborative nature and depth of expertise within this research community. The figure thus serves as a crucial element in our systematic review, mapping out the key contributors who have shaped and advanced the discourse in this vital area of study.

Country Scientific Production

In our systematic literature review on sustainable human resource management, we closely examined the geographical distribution of scientific production in this field. This analysis is encapsulated in Figure 4, which presents a country-wise breakdown of research output based on the Scopus dataset.

Figure 4 highlights that the United States leads in terms of scientific production with a total of 635 articles. This substantial contribution underscores the country's pivotal role in advancing sustainable human resource management research. China follows closely, with a significant output of 487 articles, indicating its growing influence and active participation in this field.

Figure 4. Country scientific production



As shown in the figure 4, India also plays a major role with 429 articles, reflecting its active research community's interest in sustainability issues within human resource management. Australia and the United Kingdom contributed 314 and 293 articles, respectively, showcasing their robust academic engagement in this domain. Other notable contributions, as depicted in Figure 4, come from Malaysia (257 articles), Brazil (228 articles), Spain (218 articles), and Italy (212 articles). These numbers reflect the global interest and diverse perspectives in sustainable human resource management research.

Portugal, Indonesia, and Pakistan, with 169, 163, and 143 articles, respectively, also mark their presence in the field, as visualized in the figure. These contributions signify the expanding research base and the increasing importance given to sustainable practices in human resources across different regions. Germany, South Africa, Canada, Turkey, and France, as illustrated in 4, further contribute to the field with outputs ranging from 80 to 133 articles. This diversity underscores the global nature of sustainable human resource management research, with significant contributions from various continents.

The bottom of the list in the figure includes Iran, Slovakia, and the Netherlands, each demonstrating a steady engagement in the field with 87, 81, and 80 articles, respectively. Although smaller, these contributions highlight the widespread interest and research efforts in sustainable human resource management across different geographical contexts.

Overall, Figure 4 provides a comprehensive visualization of the country-wise scientific production in sustainable human resource management. This geographical distribution highlights the contributions of various nations and underscores the global relevance and cross-cultural dimensions of research in this field. The figure thus plays a crucial role in our systematic review, offering insights into the geographical spread and diversity of academic contributions in sustainable human resource management.

Analysis of Keywords

In our systematic literature review on sustainable human resource management, we have also analyzed the frequency of occurrence of keywords in the literature, which is a crucial aspect of understanding the thematic focus and trends in the field. This analysis is visually represented in Figure 5, based on the data extracted from the Scopus dataset. As depicted in Figure 5, “sustainability” emerges as the most frequently occurring keyword, mentioned 425 times. This high frequency underscores the central role of sustainability in the discourse on human resource management, reflecting the increasing emphasis on integrating sustainable practices in organizational contexts.

Figure 5. Important keywords



The keyword “human resource management” appears 212 times, as shown in the figure, indicating it is a foundational concept within the research corpus. This is closely followed by “green human resource management,” with 126 mentions, highlighting a specific focus on the environmental aspects of human resource practices.

Figure 5 also reveals that “sustainable development” and “sustainable human resource management” are significant themes, with 77 and 75 occurrences, respectively. These terms reflect the broader objectives of sustainability within human resource management, encompassing both environmental and socio-economic dimensions. The term “corporate social responsibility” appears 72 times, tied with “sustainable hrn,” as illustrated in the figure. This indicates a strong link between corporate ethics, social responsibility, and sustainable practices in human resources. “Environmental sustainability,” “environmental management,” and “environmental performance,” with 53, 51, and 50 mentions, respectively, as shown in Figure 5, point to a clear emphasis on the environmental dimensions of sustainability in human resource practices. These terms highlight the focus on environmental impacts and management strategies within human resources.

Overall, Figure 5 provides a clear and concise visual representation of the key terms and their frequency in the literature on sustainable human resource management. This visualization helps identify the core themes and concepts within the field and indicates the evolving focus areas and trends in the research. The figure thus plays an integral role in our systematic review, offering a detailed perspective on the thematic landscape of sustainable human resource management research.

Most Cited Documents

In our systematic literature review on sustainable human resource management, we have meticulously examined the most cited documents in the field, an analysis that offers valuable insights into the influential works shaping this area of study. This aspect of our review is encapsulated in Table 1, which lists the most cited papers along with their respective DOIs, total citations, citations per year, and normalized total citations, as extracted from the Scopus database.

Table 1 is led by the seminal work of Daily, B.F. (2001), published in the International Journal of Operations & Production Management. This paper, a cornerstone in the field, has garnered 676 citations, averaging 29.3913 citations per year, with a normalized citation count of 2.1103, underscoring its enduring impact and relevance.

Table 1. Most cited documents

Paper	Total Citations	TC per Year	Normalized TC
Daily & Huang, 2001	676	29.3913	2.1103
Jackson et al., 2014	592	59.2000	17.2406
Dao et al., 2011	503	38.6923	9.9481
Jabbour & De Sousa Jabbour, 2016	436	54.5000	11.8965
Kramar, 2014	433	43.3000	12.6101
Jackson et al., 2011	406	31.2308	8.0297
Gago et al., 2015	389	43.2222	14.0560
Zaid et al., 2018	376	62.6667	11.2904
Saeed et al., 2019	366	73.2000	14.7795
Das et al., 2019	320	64.0000	12.9220
Jabbour & Santos, 2008	307	19.1875	6.9685

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Table 1. Continued

Paper	Total Citations	TC per Year	Normalized TC
Ren et al., 2018	307	51.1667	9.2185
Bag et al., 2020	300	75.0000	13.7172
Masri & Jaaron, 2017	294	42.0000	12.4539
Zhang et al., 2011	289	22.2308	5.7157
Jabbour, 2013	265	24.0909	12.8226
Wilkinson et al., 2001	263	11.4348	0.8210
Jackson & Seo, 2010	257	18.3571	11.0538
Mousa & Othman, 2020	255	63.7500	11.6597
Yong et al., 2020	253	63.2500	11.5682

The 2014 paper by Jackson, S.E., featured in the *Academy of Management Annals*, also commands significant attention, as depicted in Table 1. It has accumulated 592 citations, with an impressive yearly citation rate of 59.2 and a high normalized citation count of 17.2406, reflecting its critical role in advancing the discourse in sustainable human resource management.

Dao, V. et al.'s 2011 publication in the *Journal of Strategic Information Systems*, highlighted in Table 1, has also been influential, with 503 total citations and a yearly average of 38.6923. This work's normalized citation count of 9.9481 indicates its substantial contribution to the field. Jabbour, C.J.C.'s 2016 article in the *Journal of Cleaner Production* and Kramar, R.'s 2014 paper in the *International Journal of Human Resource Management* are other notable entries in Table 1. These documents have recorded 436 and 433 total citations, respectively, with high yearly citation rates, reflecting their significant influence on sustainable human resource management research. Table 1 also includes other pivotal works, such as Gago, J.'s 2015 article in *Agricultural Water Management* and Zaid, A.A.'s 2018 publication in the *Journal of Cleaner Production*. These papers, with 389 and 376 total citations, respectively, have been instrumental in shaping contemporary understanding and practices in the field.

The table further lists other influential documents, including those by Saeed, B.B. (2019) in *Corporate Social Responsibility and Environmental Management*, and Das, S. (2019) in the *Journal of Cleaner Production*. These works, along with others mentioned in 1, demonstrate a wide-ranging impact, both in total citations and citations per year, highlighting their pivotal role in the evolution of sustainable human resource management.

CONCLUSION

Drawing upon the Scopus database, our systematic literature review on sustainable human resource management reveals significant insights into the field's evolution and current trends. The extensive dataset from 1991 to 2023 highlights the growing academic interest and research output, as evidenced by the increasing number of publications and citations over time. The diverse geographical distribution of research underscores the global relevance of sustainable HRM practices. Prominent themes identified through keyword analysis include sustainability, green HRM, and corporate social responsibility, reflecting the field's focus on integrating environmental and ethical considerations into HR practices. As indicated in our analysis, key authors and influential papers have significantly shaped this field's discourse and direction. Therefore, this review maps the historical development and underscores the dynamic, impactful, and collaborative nature of research in sustainable human resource

management. However, this work depends on information from the Scopus database, which has some restrictions. The focus of the database on English-language articles could overlook important studies from areas without English-speaking people. Its coverage is skewed toward some disciplines and major publications, excluding specialist studies pertinent to sustainable HRM. Scopus's chronological range, therefore, restricts the inclusion of earlier works with perhaps basic insights. Finally, depending too much on Scopus's citation statistics should be seen carefully since these numbers might be affected by elements outside the inherent research caliber.

CONFLICTS OF INTEREST

We wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome.

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