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A Scientometric Analysis of Green HRM Research (2000-2024) Using VOSviewer: Mapping the Intellectual Structure and Emerging Themes from Scopus Data

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ABSTRACT

This study presents a comprehensive scientometric analysis of Green Human Resource Management (Green HRM) research published between 2000 and 2024, utilizing Scopus-indexed data and VOSviewer for bibliometric visualization. Through keyword co-occurrence, co-authorship, and country collaboration analyses, the study maps the intellectual structure, identifies dominant research clusters, and highlights emerging themes in the field. The findings indicate that Green HRM has matured into a multidisciplinary domain anchored by themes such as sustainability, green behavior, human resource practices, and green innovation. Over time, the focus of research has shifted from macro-level issues—like environmental sustainability and policy integration—toward micro-level constructs, including employee engagement, green leadership, and organizational citizenship behavior for the environment. Influential author networks, particularly from China, Malaysia, and Europe, shape the development of the field, while cross-national collaboration continues to grow, especially within Asia and the Middle East. The study reveals knowledge gaps in linking behavioral outcomes to organizational performance and emphasizes the need for future research in digital HR transformation, performance metrics, and underrepresented geographic contexts. These insights provide a roadmap for scholars and practitioners aiming to deepen the strategic and operational integration of sustainability within human resource systems.

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1. INTRODUCTION

In recent decades, the concept of sustainability has significantly influenced organizational strategies across various industries, prompting businesses to incorporate environmental considerations into core human resource management (HRM) practices. This evolution has led to the emergence of Green Human Resource Management (Green HRM), a field that combines environmental management with HRM to promote sustainable organizational behavior and green work culture. Green HRM encompasses a range of practices such as

green recruitment, training, performance management, employee involvement, and reward systems that support the environmental goals of organizations [1]–[3]. The growing environmental concerns and the push for corporate sustainability have made Green HRM a strategic imperative for organizations globally.

The academic discourse on Green HRM has expanded considerably since the early 2000s, fueled by the global shift toward environmental sustainability and the role of organizations in combating climate change. Early studies were primarily conceptual, focusing on defining the principles and identifying practices associated with Green HRM. Over time, empirical investigations began to examine the impact of Green HRM on employee behavior, organizational performance, and environmental outcomes [4]–[6]. The multidisciplinary nature of Green HRM, which intersects with environmental science, management, psychology, and organizational behavior, has contributed to the richness and diversity of the research in this field.

As the field has matured, researchers have sought to explore the mechanisms through which Green HRM influences pro-environmental behavior, employee engagement, and organizational citizenship behavior for the environment (OCBE). Studies have shown that Green HRM practices can foster a sense of environmental responsibility and intrinsic motivation among employees, thereby enhancing sustainability performance [7]. Additionally, organizations have begun to recognize that the integration of green values into HR systems not only supports compliance with environmental regulations but also builds a positive corporate image and long-term competitive advantage [8]. This shift underscores the relevance of Green HRM in aligning human capital strategies with the United Nations Sustainable Development Goals (SDGs), particularly SDG 13 on climate action.

The increasing volume of Green HRM research calls for a systematic evaluation of the intellectual landscape of this domain. Scientometric analysis—a methodological approach that quantitatively analyzes the bibliometric characteristics of publications—offers valuable insights into the development, trends, and thematic evolution of a research field. Unlike traditional reviews, scientometric studies allow researchers to map the intellectual structure, identify influential authors, journals, and institutions, and uncover emerging research clusters using advanced visualization tools such as VOSviewer [9]. These techniques help in capturing not only the productivity and citation patterns but also the co-authorship networks and keyword co-occurrences that reflect the conceptual and social structure of a discipline.

Given the vast and growing body of literature on Green HRM, there is a pressing need for a comprehensive scientometric review that synthesizes research patterns, identifies knowledge gaps, and reveals future research directions. Previous reviews have largely been narrative or systematic in nature, focusing on specific dimensions such as green training or employee engagement. However, no study to date has conducted a full-scale scientometric mapping of Green HRM using Scopus data over an extended period. By utilizing VOSviewer to analyze keyword co-occurrence, citation networks, and co-authorship patterns, this study seeks to fill this void and offer a data-driven perspective on the intellectual and thematic evolution of Green HRM.

Despite the growing scholarly attention to Green HRM and its increasing strategic importance in contemporary organizations, there remains a lack of comprehensive scientometric analysis that maps the intellectual structure and identifies emerging themes in this field. Existing reviews often provide fragmented perspectives and are limited in scope, offering minimal insights into the evolution of research trends, influential contributors, and thematic clusters within Green HRM literature. Moreover, as the volume of publications continues to expand rapidly, it becomes increasingly difficult for researchers and practitioners to navigate the field without a clear understanding of its knowledge

domains and development trajectories. This study aims to conduct a scientometric analysis of Green HRM research published between 2000 and 2024 using data retrieved from the Scopus database.

2. METHODS

This study employs a quantitative scientometric approach to map and analyze the intellectual structure and thematic evolution of Green Human Resource Management (Green HRM) research from 2000 to 2024. Scientometric analysis, as a branch of bibliometrics, enables the systematic exploration of publication patterns, citation networks, co-authorship structures, and thematic clusters within a specific academic domain. The study relies exclusively on Scopus, a comprehensive and widely recognized scientific database that indexes peer-reviewed literature across diverse disciplines. The decision to use Scopus was based on its extensive coverage of high-impact journals and its compatibility with bibliometric visualization tools such as VOSviewer, which facilitates the mapping of co-occurrence relationships among keywords, authors, institutions, and countries.

The data collection process began by conducting a structured search query in the Scopus database. The search string used was: ("green human resource management" OR "green HRM") AND (LIMIT-TO (DOCTYPE, "ar")) AND (LIMIT-TO (LANGUAGE, "English")) AND (PUBYEAR > 1999 AND PUBYEAR < 2025). This query was designed to retrieve all peer-reviewed journal articles written in English that explicitly focus on Green HRM. The search yielded a total of 980 articles (final number to be determined during execution), including bibliographic information such as author names, publication year, title, abstract, keywords, journal name, citations, and affiliations. After initial screening and cleaning—removing duplicate records and documents lacking sufficient metadata—the final dataset was exported in CSV and RIS formats for further analysis in VOSviewer.

VOSviewer was then utilized to perform the scientometric mapping and network visualization. Three primary types of analysis were conducted: (1) co-authorship analysis to examine collaboration patterns among authors and institutions and (2) keyword co-occurrence analysis to detect thematic clusters and emerging topics in Green HRM research. The software's clustering algorithm and visual layout were used to generate maps that reveal the structure and density of each network. In particular, the keyword co-occurrence map served as the basis for identifying the most salient research themes and their temporal evolution.

3. RESULTS AND DISCUSSION

Keyword Co-Occurrence Network Visualization

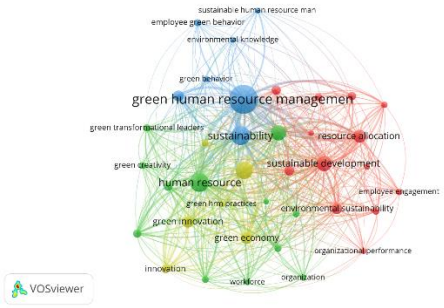

Figure 1. Network Visualization
Source: Data Analysis

Figure 1 displays a keyword co-occurrence network for Green Human Resource Management (Green HRM) research from 2000 to 2024. Each node represents a frequently occurring keyword in the Scopus-indexed literature, and the links (edges) show co-occurrence relationships among keywords. The size of the nodes indicates the frequency of the keywords, while the colors represent clusters of closely related terms. Overall, the network reveals the conceptual structure of the Green HRM field, highlighting dominant themes, interconnected subtopics, and emerging research frontiers.

The central and most prominent cluster is built around the keyword "green human resource management", which appears as the largest and most interconnected term. It is strongly linked with

keywords such as "sustainability," "human resource," "green behavior," and "green innovation," indicating that Green HRM is situated at the intersection of environmental sustainability and strategic HR practices. The green cluster (bottom-left) comprises terms like "green economy," "green innovation," and "innovation," suggesting a thematic focus on the role of HR in driving eco-innovation and sustainable business models. This cluster reflects studies that examine how Green HRM contributes to organizational innovation through environmentally conscious HR strategies.

The blue cluster (top) contains terms such as "green behavior," "employee green behavior," "environmental knowledge," and "sustainable human resource management." This indicates a growing research stream concerned with psychological and behavioral outcomes of Green HRM practices. These studies explore how training, knowledge sharing, and value alignment influence employees' pro-environmental behaviors at the workplace. The presence of terms like "green transformational leaders" also points to leadership's mediating role in enhancing employee environmental engagement, emphasizing the behavioral and cognitive dimension of Green HRM.

Meanwhile, the red cluster (right side) features keywords such as "resource allocation," "sustainable development," "employee engagement," "environmental sustainability," and "organizational performance." This grouping suggests an emphasis on performance outcomes and policy-level implications of Green HRM. Research in this area often investigates how resource distribution and strategic HR planning align with environmental performance and corporate sustainability goals. The interlinkages between these terms underscore the evolving role of HR in facilitating organizational transitions toward sustainability, particularly in alignment with long-term development frameworks such as the SDGs. The yellow nodes in the center, including "sustainability," "green HRM practices," and "organization," serve as bridging terms across clusters, indicating their conceptual centrality in the field. These keywords connect multiple subfields, suggesting their integrative function in linking innovation, behavioral change, and performance-oriented research. Their central placement signifies the holistic nature of Green HRM, where practices must simultaneously address environmental impact, employee engagement, and organizational outcomes.

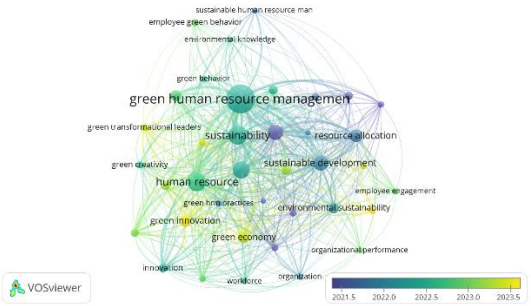

Figure 2. Overlay Visualization
Source: Data Analysis

Figure 2 illustrates the temporal evolution of Green HRM research keywords between 2021 and mid-2023. In this map, colors represent the average publication year of the documents in which the keywords appear, ranging from dark blue (2021.5) to yellow (2023.5). Core terms like "green human resource management," "human resource," "sustainability," and "green innovation" appear in greenish tones, indicating that these keywords were prominent in publications around 2022–2023, suggesting their sustained importance in recent research. Their central placement and connectivity affirm that they are foundational pillars of the field. Notably, newer themes and emerging concepts are represented in bright yellow and are found near terms like "green creativity," "green transformational leaders," and "employee engagement." These keywords reflect evolving interests in understanding the psychological, leadership, and cultural drivers behind Green HRM initiatives. Their recent emergence indicates a shift from policy- or system-level discussions toward more human-centric and behavioral explorations of how sustainability is enacted within organizations. This trend suggests an expansion of the field's scope to include micro-level phenomena such as leadership

influence, intrinsic motivation, and innovative thinking. Conversely, keywords displayed in cooler shades (blue or purple) such as "resource allocation," "sustainable development," and "environmental sustainability" denote concepts that were more prevalent in slightly earlier publications (around 2021–2022). These topics likely reflect the strategic and organizational focus of Green HRM in its earlier development stages, emphasizing structural integration and policy alignment.

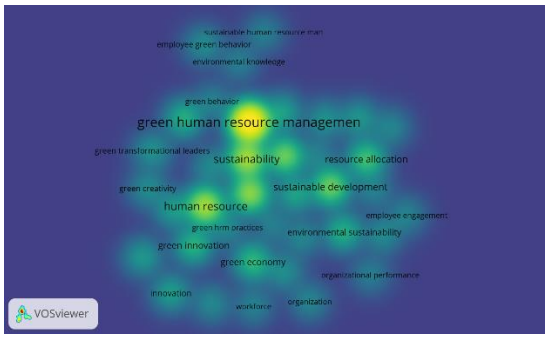

Figure 3. Density Visualization
Source: Data Analysis

Figure 3 provides a density-based representation of keyword occurrences within Green HRM literature from 2000 to 2024. In this map, areas with brighter yellow tones indicate regions with high concentrations of frequently co-occurring keywords, while darker blue and purple areas denote lower keyword densities. The brightest focal point centers around the term "green human resource management," which signifies its dominance and central role in the academic discourse. Closely associated terms such as "sustainability," "human resource," "green behavior," and "sustainable development" also appear in denser zones, indicating their recurrent appearance across many articles and their strong conceptual linkage within the field. Conversely, keywords like "green transformational leaders," "green creativity," "organization," and "employee engagement" are positioned in zones with moderate to lower density, suggesting that these are emerging or specialized subthemes that have not yet achieved the same level of widespread coverage. The overall pattern of the heatmap illustrates that Green HRM research is heavily clustered around themes of environmental behavior, sustainability integration, and strategic human resource management.

Co-Authorship Network Visualization

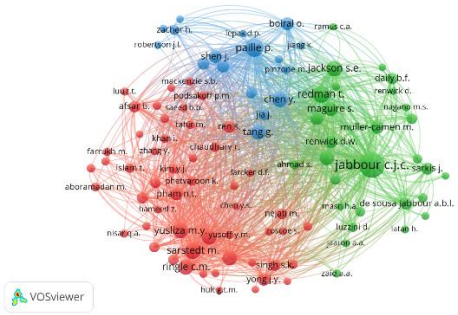

Figure 4. Author Visualization
Source: Data Analysis

The co-authorship network visualization highlights the collaborative structure among leading scholars in the field of Green Human Resource Management. Each node represents an author, and the size of the node reflects their productivity or citation impact. The color-coded clusters—green, red, and blue—indicate distinct author groups or collaborative communities. Notably, Jabbour C.J.C. emerges as the most central and influential figure in the green cluster, which also includes key contributors like Sarkis J., Jackson S.E., and Renwick D.W., indicating a strong European research network. The red cluster, featuring authors such as Sarstedt M., Ringle C.M., and Yusliza M.Y., appears to be associated with studies employing advanced statistical methods like SEM and PLS-Path Modeling, often linked with Asian and Middle Eastern institutions. Meanwhile, the blue cluster, led by Paillé P., Shen J., and Boiral O., suggests a North American or behavioral research orientation focused on green behavior and psychological outcomes.

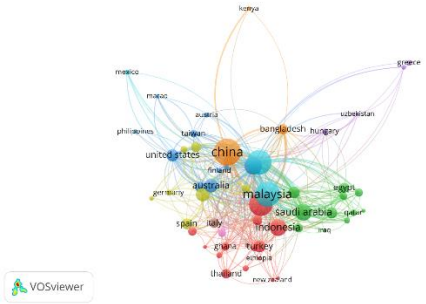

Figure 5. Country Visualization

Source: Data Analysis

The country collaboration map visualizes the geographic distribution and international partnerships in Green HRM research from 2000 to 2024. Larger nodes, such as China, Malaysia, and Indonesia, represent countries with the highest publication output, indicating their central role in driving research in this domain. China emerges as the most dominant contributor, heavily connected to countries like Bangladesh, Malaysia, and the United States, highlighting strong transnational academic ties. Malaysia and Saudi Arabia also show extensive interlinkages, particularly with Indonesia, Egypt, and Turkey, reflecting active regional collaboration within Asia and the Middle East. Western nations such as the United States, Australia, and Germany appear in separate clusters, maintaining moderate but important connections, especially with Asia-Pacific counterparts. Peripheral countries like Kenya, Greece, and Uzbekistan have fewer links, indicating more isolated or emerging contributions.

DISCUSSION

Central Themes and Conceptual Core of Green HRM

The keyword co-occurrence network identifies "green human resource management" as the central and most frequently appearing term, underscoring its role as the thematic anchor of the field. Closely linked terms such as "sustainability," "human resource," "green behavior," and "green innovation" reinforce the multidisciplinary nature of Green HRM, which intersects organizational behavior, environmental management, strategic HRM, and innovation studies. This is consistent with previous literature emphasizing the strategic integration of sustainability into HR practices to promote pro-environmental behavior and long-term ecological goals [10], [11]. The prominence of terms like "green innovation" and "green economy" indicates a conceptual alignment between HRM strategies and broader environmental and economic objectives. These findings suggest that the field is increasingly addressing how HRM can support organizational adaptation to environmental pressures and technological change. The integration of green practices into recruitment, training, and performance appraisal systems is no longer viewed as optional but rather essential for achieving sustainable competitiveness.

Emerging Topics and Thematic Shifts

The overlay visualization reveals temporal patterns in keyword usage, providing insights into thematic evolution. Earlier publications (darker hues) emphasize foundational issues such as "environmental sustainability," "resource allocation," and "sustainable development." These topics reflect a macro-level orientation, focusing on policy, strategy, and institutional transformation. In contrast, more recent research (2022–2024) is represented in brighter yellow and focuses on micro-level psychological and behavioral dimensions. Emerging terms such as "green transformational leaders," "green creativity," and "employee engagement" suggest a shift toward understanding the cognitive and emotional factors that drive sustainable behaviors at the individual and team levels. This aligns with the growing interest in green leadership styles and their influence on shaping environmentally responsible cultures within organizations [8]. This shift also reflects a paradigmatic broadening of the field—from system-level implementation of green practices to exploring the mechanisms and mediators that explain how and why Green HRM practices influence individual behavior. For example, the rising interest in green organizational citizenship behavior (OCB) indicates a movement toward unpacking the discretionary efforts employees make beyond formal requirements to support environmental goals.

Density and Hotspots of Research

The density visualization reinforces the concentration of research around a small set of core concepts—notably "green HRM", "sustainability", and "green behavior." These hotspots reflect areas of intellectual maturity, where concepts have been extensively theorized and empirically tested. In contrast, the relative sparseness of terms like "organizational performance," "workforce,"

and "organization" points to potential research gaps, particularly in linking Green HRM to tangible performance outcomes or human capital development at scale. Interestingly, "green creativity" and "green transformational leadership" are located in lower-density regions despite their relevance, suggesting they are still emerging in the literature. Their relatively low saturation presents opportunities for future studies to explore how creative capacities and leadership influence green behavior and sustainable innovation—areas crucial for the advancement of ecological responsiveness in organizations.

Intellectual Structure and Author Influence

The co-authorship analysis identifies three major clusters of scholars contributing to the Green HRM discourse. The green cluster, led by Jabbour C.J.C., Sarkis J., and Renwick D.W.S., represents the most influential group, with research focusing on the strategic and operational integration of environmental sustainability into HRM. This group has significantly shaped the macro-level discourse around institutional and policy implications of Green HRM. The red cluster, centered around authors such as Sarstedt M., Ringle C.M., and Yusliza M.Y., appears to focus on methodological advancement, especially the use of structural equation modeling (SEM) and partial least squares (PLS) in exploring the mediating mechanisms of Green HRM. Their methodological contributions have improved the precision and rigor of Green HRM research, making them particularly relevant for future empirical studies. The blue cluster, led by Paillé P., Shen J., and Boiral O., represents a psychological-behavioral orientation, contributing significantly to the understanding of employee green behavior, green values, and psychological climate. This cluster has provided deep insights into how Green HRM practices impact individual attitudes and environmental actions, especially through motivational and affective pathways.

International Collaboration and Global Distribution

The country collaboration network reveals that China, Malaysia, and Indonesia are the most prolific and central contributors to the Green HRM literature. China's prominence reflects its strategic policy focus on sustainable development and green growth, as mirrored in its national development plans. Malaysia and Indonesia, as rapidly industrializing economies with growing environmental concerns, also show strong research output and international linkages—particularly with Saudi Arabia, Turkey, and Bangladesh. Western countries such as the United States, Australia, and Germany remain active, but their connections tend to form separate clusters, suggesting regional concentration of collaboration. Interestingly, countries like Kenya, Greece, and Uzbekistan appear as peripheral contributors, possibly reflecting emerging interest but limited integration into mainstream Green HRM scholarship. This map also highlights the South-South collaboration trend, where research partnerships are increasingly formed between developing nations—particularly in Asia and the Middle East—potentially driven by shared challenges in labor, environment, and industrial policy. However, the relatively low representation of African and Latin American countries points to an underexplored geographic gap that future research could address.

Strategic Implications and Future Research Directions

Based on the findings, several implications for future research emerge. First, there is a need to bridge the micro–macro divide in Green HRM research by linking individual-level behaviors and values to organizational-level outcomes such as innovation, productivity, and sustainability performance. Multilevel models and longitudinal studies could offer deeper insights into how Green HRM evolves over time and scales across organizational levels. Second, researchers should consider contextualizing Green HRM in emerging economies, where institutional voids,

regulatory variation, and cultural dimensions shape the adoption and effectiveness of green practices. Comparative studies across regions can uncover the boundary conditions under which Green HRM practices yield optimal results. Third, despite the growing focus on psychological mechanisms, digital transformation and green technology adoption remain underrepresented themes. The integration of Green HRM with Industry 4.0, digital platforms, and remote work cultures offers promising directions for future exploration. Moreover, environmental crises such as climate change, pandemics, and supply chain disruptions offer real-world laboratories to test the resilience and adaptability of Green HRM systems. Lastly, academic collaboration and journal specialization must be further encouraged. Special issues in leading HRM and sustainability journals could accelerate theoretical refinement and empirical validation. Research networks and international funding initiatives may also enhance the global inclusivity of the field, integrating underrepresented voices and contexts into the Green HRM narrative.

4. CONCLUSION

This scientometric analysis of Green Human Resource Management (Green HRM) research from 2000 to 2024 offers a comprehensive mapping of its intellectual structure, thematic evolution, and collaborative dynamics. The findings reveal that Green HRM has evolved from a strategic, policy-driven orientation toward a more nuanced exploration of behavioral, psychological, and leadership dimensions, with core themes centering around sustainability, green behavior, and innovation. The emergence of recent topics such as green creativity and transformational leadership indicates a shift toward micro-level drivers of environmental performance. Prominent authors and institutions—particularly from China, Malaysia, and Europe—form influential collaborative networks, while international partnerships are increasingly concentrated in Asia and the Middle East. Despite its growing maturity, Green HRM research still presents gaps in linking individual behavior to organizational outcomes, integrating digital transformation, and expanding geographic representation. As environmental challenges intensify globally, the role of HRM in enabling sustainable organizational change becomes increasingly vital, positioning Green HRM as a critical field for future interdisciplinary inquiry.

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