

Greening the Workforce: A Sustainable Human Resources Framework for SMEs through AI and Agile Methodologies

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Abstract: Small and medium-sized enterprises (SMEs) collectively have a significant environmental impact. Green human resource management (GHRM) can help them address this, but implementation challenges hinder sustainable continuity. This research proposes a theoretical business model to help SMEs adapt, meet sustainable goals, and build a resilient ecosystem. The study analyzed 368 Scopus-indexed papers using R-based Bibliometrix, Biblioshiny, VOSviewer, and R Studio. Findings reveal several foundational factors for the new model, including the necessity of green competencies (both natural and acquired) and green motivation. These elements contribute to green organizational citizenship behavior (GOCB), which is crucial for SMEs to adopt GHRM practices. Ultimately, these factors operate under the principles of environmental management, which drive businesses to enhance their environmental performance.

Keywords—Artificial Intelligence, Human Resource Management, SMEs, Agile Methodologies, Green HRM.

1. Introduction

For decades, businesses have prioritized short-term financial gains, a model now recognized as unsustainable given industrialization and population growth. This has highlighted the urgent need for environmentally and socially conscious business practices. Employee buy-in is critical to the success of such initiatives. When employees actively participate in environmental projects, their pro-environmental behavior (PEB) can significantly reduce a company's environmental footprint, contributing to sustainability and long-term success [1, 2]. PEB's direct effects include reduced consumption of energy and raw materials and decreased pollution, while its indirect impacts involve identifying environmental damage and modifying ecological practices within the company [3, 4].

Green Human Resource Management (GHRM) is an innovative management concept designed to guide employees toward green behaviors, fostering corporate sustainability [5, 6]. GHRM integrates environmental principles into human resource practices to achieve corporate environmental management goals [7]. This includes complementary and coordinated practices like green recruitment, training, and performance evaluation, all aimed at cultivating green values, knowledge, and skills. Research confirms that GHRM significantly improves corporate green performance, with many experts deeming it essential for successful environmental initiatives [9, 10]. By highlighting the role of HR in pollution prevention and environmental protection, GHRM has become a key component of corporate environmental strategy.

Despite the global increase in small- and medium-sized enterprises (SMEs), few have adopted GHRM practices [11]. SMEs face unique and common obstacles compared to larger corporations. A major hurdle is a general lack of understanding of green policies and principles, often due to poor corporate communication and limited environmental education [12, 13]. Additionally, financial and human resource constraints can directly impede the implementation of long-term sustainable operations and initiatives [9].

Therefore, this study aims to develop a theoretical business model to help SMEs incorporate GHRM practices. The proposed model is grounded in environmental and agile management principles. Environmental management focuses on ensuring a healthy and safe workplace through clear protocols, expertise, and employee participation. To effectively adopt this new model, employees must also embrace agile management principles, which emphasize adaptability to a constantly changing business environment. The concept of "agile human resource management" involves applying agile principles to the HR department, a growing trend as businesses seek to become more flexible and responsive [11, 14].

To address the research question, a six-step bibliometric analysis methodology was applied. This approach maps the theoretical foundation of the subject, identifies future research areas, and reveals global author collaboration networks. The

analysis also detected and analyzed research clusters within the topic. The study used bibliographic data from 368 articles published between 2011 and 2022, sourced from the Scopus database. The analysis was conducted using R package tools, including Biblioshiny, VOSviewer, and R Studio.

2. Green Human Resource Management and SMEs: A Theoretical Review

Over the last several decades, a significant shift has occurred in the business world, moving away from a singular focus on short-term financial objectives toward a more holistic, ecologically-minded agenda. The industrial revolution and subsequent population crisis underscored the unsustainability of traditional business models, making it clear that activities must respect the environment and society. Human Resource Management (HRM) is now being called upon to adapt and expand its role by adopting environmental management policies. Academics argue that HRM is uniquely positioned to assess and influence employee behavior, attitudes, knowledge, and motivation related to sustainability. By leveraging human resources effectively, companies can successfully execute their eco-friendly strategies.

This evolution has given rise to the concept of **"Green HRM,"** which involves implementing HR policies that promote the efficient use of resources within organizations. More broadly, the term refers to people management policies and practices that are deeply integrated with a company's overall environmental strategy. As Mandip (2012) notes, Green HRM utilizes every employee interaction and touchpoint to foster sustainable behaviors, thereby increasing employee understanding and commitment to environmental concerns [15]. This approach can include a range of initiatives like electronic filing, promoting carpooling, using video conferencing, implementing recycling programs, and encouraging telecommuting. By doing so, organizations can boost efficiency, lower costs, and enhance employee engagement and retention by helping to reduce their carbon footprint.

Academics in the field emphasize that the workforce is crucial to the success or failure of an organization's ecological initiatives. Thus, green HR practices are important not just at the organizational level but also at the personal level. An employee's environmental consciousness in their personal life can be positively reinforced by, and in turn reinforce, their professional environmental behavior. Furthermore, Green HRM can provide a significant competitive advantage by capitalizing on opportunities in changing markets and reducing labor turnover as employees become more satisfied with the company [8, 16]. The adoption of Green HRM practices can also enhance human resources by meeting the workforce development demands of a growing green economy. This new model also aids in rapid HR problem-solving as employees, feeling more involved, provide innovative solutions to challenges stemming from dynamic change. Most importantly, Green HRM strategies help retain staff, as human resources are increasingly drawn to organizations that align with the philosophy of eco-friendly and green enterprises [17, 18].

Ultimately, Green HRM is a win-win strategy for both people and businesses. A company that implements this approach can successfully recruit and retain high-quality employees through rewards and workplace engagement, leading to increased employee happiness and productivity. These positive outcomes can be achieved with strong leadership, emotional support, opportunities for professional growth, and flexible work hours that promote a better work-life balance.

For Green HRM practices to be truly effective, a **"green psychological environment"** is essential. This refers to the social and psychological process through which Green HRM influences green behavior in the workplace [3, 4]. A psychological climate represents an individual's subjective judgment of their work environment. In the literature, a "green climate" is characterized by organizations that achieve long-term goals by engaging in ecologically beneficial activities. Therefore, a "green psychological climate" is an individual's perception of a firm's eco-friendly policies, processes, and practices that embody its green values. Recent studies on this topic show that a positive green psychological climate significantly influences employees' in-role and extra-role green conduct [20-22]. Employees who feel that their company's environmental plan is sound are more likely to engage in autonomous environmental actions, demonstrating the powerful link between organizational communication and individual behavior.

Scholars are particularly interested in the adoption of Green HRM by small- and medium-sized enterprises (SMEs). SMEs constitute over 95% of all businesses and nearly two-thirds of employment in OECD nations. Due to their smaller size, they have the potential to be significant drivers of "green innovation" [23]. While their individual environmental footprints may be smaller than large corporations, their collective impact is substantial. Greening the SME sector is a crucial step towards a greener economy [24], offering immediate internal benefits like improved staff ethical behavior.

However, SMEs face numerous hurdles in implementing green practices, regardless of their size or industrial sector. They are generally willing to participate in voluntary environmental initiatives as long as they are not prohibitively expensive or difficult [25, 26]. Unfortunately, many SMEs are unaware of the financially attractive options available, such as tax rebates and government incentives. Often, they are singularly focused on increasing output and lack the necessary skills and knowledge to capitalize on new opportunities, despite being aware of the potential for increased competitiveness [27].

The main challenges SMEs face when implementing green business practices can be categorized as follows: (i) organizational or managerial; (ii) technological; (iii) financial and economic; (iv) external partnership and stakeholder engagement; (v) government support; (vi) market and customer barriers; and (vii) knowledge- and information-related barriers [24, 28]. **Organizational or managerial barriers** often stem from a lack of commitment from management, who prefer traditional business methods and fear the risks associated with innovation. **Financial and economic considerations** present a double-edged sword; while some SMEs may adopt green practices to cut costs, the initial investment often acts as a deterrent [28, 29].

Given these challenges, this study aims to propose a theoretical framework for a business model that can help SMEs overcome these impediments and smoothly transition from traditional human resource management to Green HRM. The model will be based on principles of environmental and agile management, ensuring that SMEs are not only eco-friendly but also flexible and responsive to the evolving business landscape.

3. Materials and Methods

Bibliometric analysis is a popular research method that allows researchers to manage vast amounts of data and produce high-quality findings by categorizing academic articles based on a set of criteria [30, 31]. This study utilized **Bibliometrix**, an R package, to perform a comprehensive bibliometric analysis. We also used **Biblioshiny** and **VOSviewer** for visualization. The process involved collecting data from the Scopus database, which was then imported into **R Studio** for analysis. This method helps categorize and analyze scientific literature, providing valuable insights into the research topic [32, 33].

3.1. Bibliometric Analysis

This study used a six-step bibliometric analysis to address its topic (*Figure 1*). The process began with a literature review (Step 1). Step 2 involved a two-part analysis: 2a was a comprehensive evaluation via bibliometric citation analysis, and 2b was a network analysis identifying influential journals, documents, affiliations, and authors to map global collaboration. Step 3 was content analysis, followed by bibliographic correlation analysis in Step 4. Step 5 combined Multiple Correspondence Analysis (MCA) and factorial analysis for cluster analysis. The final step, Step 6, synthesized the findings to create a new typology in green human resource management.

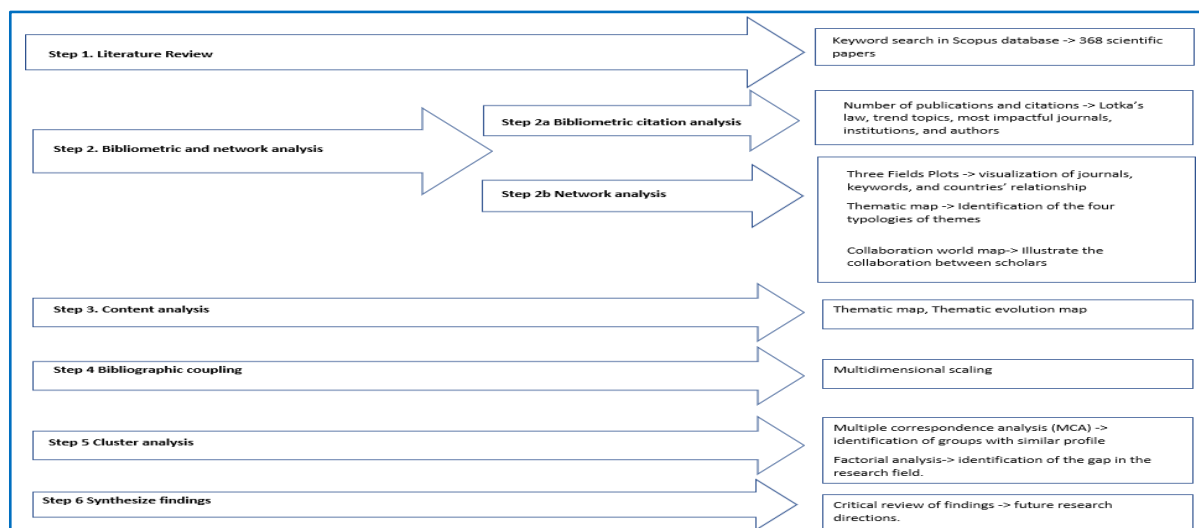


Figure 1. Workflow of methodology. Source: Authors' elaboration.

After retrieving 368 scientific documents from the Scopus database, we used bibliometric citation analysis to achieve several objectives. These included: testing **Lotka's law** to understand author productivity, providing an overview of research trends, identifying the most influential journals, documents, and authors, and developing a thematic map and a global collaboration map. Lotka's law posits that a few authors are highly productive while most publish only one paper. The law's exponent, **b**, indicates author concentration, with a high value showing a small group of prolific writers [34–37]. Lotka's formula is as follows:

$$x^n \times y = c, \quad (1)$$

where

c is a coefficient of determination;

y represents the relative frequency of authors with frequency x number of articles; n represents a constant exponent for a particular set of data;

x is the number of published papers in the subject.

In addition to Lotka's law, a three-field plot, also known as a Sankey diagram, has been created to illustrate the connection between journals, keywords, and nations [34,35,38,39]. Additionally, the underlying research cluster was examined, and bibliographic coupling analysis was used to create a map of current research trends. Ultimately, the primary goal of the multiple correspondence analysis (MCA) technique was accomplished by examining the bibliographic data and combining it into a collection of elements. This approach may be used by authors to highlight the current state of research in a particular field of study and to compile bibliographic information.

3.2. Data

The bibliometric analysis utilized data acquired from **Scopus**, a vast repository of scientific reports launched by Elsevier in 2004. This database, one of the world's largest peer-reviewed collections, contains around 24,000 academic journal titles, over 230,000 book titles, and more than 10 million conference papers, covering a broad spectrum of research areas including the life, social, and health sciences.

Data for the study were collected from Scopus in December 2022 using a detailed keyword search strategy. This search, as outlined in the study's methodology, was built upon a five-part Boolean function. The first part focused on **green and sustainable human resource management**, using keywords like "green human resource management" and "sustainable human resource." The second part, linking this concept to corporate governance, included terms like "corporate governance" and "sustainable governance," acknowledging the shift towards planned and participative management for sustainability. The third part of the search formula, encompassing "sustainable work" and "green job," highlighted the importance of a work environment that encourages long-term employee engagement by mitigating barriers to staying in the workforce. The fourth part addressed employee behavior with the term "employee environmental behavior," reflecting the interaction between the organizational environment and employee actions, a concept known as **psychological distance**. The final component focused on **SMEs**, using keywords like "small enterprises" and "medium enterprises," to pinpoint research on how these businesses can improve their environmental performance through green human resource management.

Following the initial data retrieval, the study's authors purified the dataset, retaining only articles published between 2011 and 2022. All other document types, such as conference papers and book chapters, were excluded. This rigorous selection process resulted in a final dataset of 368 papers for review. The bibliographic data extracted for each paper included the title, publication date, author details, keywords, abstract, and number of citations. For the analysis and visualization of this data, the study employed **R Studio's Biblioshiny packages** and **VOSviewer**. These tools were used to generate various graphs and maps, including topic maps, country cooperation maps, and network visualizations, providing a comprehensive overview of the research landscape and highlighting the dynamics of new management models aimed at enhancing global business performance.

Table 1. Keyword search process in Scopus database.

Step	Keyword Search	Articles
1	((“green human resource management” OR “sustainable human resource management” OR “green human resource” OR “sustainable human resource”))	4750
2	((“green human resource management” OR “sustainable human resource management” OR “green human <u>resource</u> ” OR “sustainable human resource”) AND (“corporate governance” OR “governance” OR “sustainable governance”))	746
3	((“green human resource management” OR “sustainable human resource management” OR “green human <u>resource</u> ” OR “sustainable human resource”) AND (“corporate governance” OR “governance” OR “sustainable governance”))	1893
4	((“green human resource management” OR “sustainable human resource management” OR “green human <u>resource</u> ” OR “sustainable human resource”) AND (“corporate governance” OR “governance” OR “sustainable governance”))	1453
5	ALL (“green human resource management” OR “sustainable human resource management” OR “green human resource” OR “sustainable human resource”) AND (“corporate governance” OR “governance” OR “sustainable governance”) AND (“small enterprises” OR “medium enterprises”))	313
6	ALL (“green human resource management” OR “sustainable human resource management” OR “ <u>green</u> human resource” OR “sustainable human resource”) AND (“corporate governance” OR “governance” OR “sustainable governance”) AND (“small enterprises” OR “small businesses” OR “medium enterprises” OR “medium businesses”))	543
7	((“green human resource management” OR “sustainable human resource management” OR “green human resource” OR “sustainable human resource”) AND (“corporate governance” OR “governance” OR “sustainable governance”) AND (“sustainable work”) AND (“small enterprises” OR “medium enterprises”))	432
8	((“green human resource management” OR “sustainable human resource management” OR “green human resource” OR “sustainable human resource”) AND (“corporate governance” OR “governance” OR “sustainable governance”) AND (“sustainable work” OR “green job”) AND (“small enterprises” OR “medium enterprises”))	226
9	((“green human resource management” OR “sustainable human resource management” OR “green human resource” OR “sustainable human resource”) AND (“corporate governance” OR “governance” OR “sustainable governance”) AND (“sustainable work” OR “green job”) AND (“employee environmental behavior”) AND (“small enterprises” OR “medium enterprises”))	390
10	((“green human resource management” OR “sustainable human resource management” OR “green human resource” OR “sustainable human resource”) AND (“corporate governance” OR “governance” OR “sustainable governance”) AND (“sustainable work” OR “green job”) AND (“employee environmental behavior”) AND (“small enterprises” OR “medium enterprises”)) (DOCTYPE, “ <u>ab</u> ”))	368

4. Results

Emphasising the value of green HRM and offering a theoretical foundation for a business model that would help SMEs achieve green performance and create an ecosystem that is resilient, adaptable, and sustainable are the goals of this study. There are 368 pertinent papers in the sample under examination that were published between 2011 and 2022. The average number of citations for these 690-person-produced papers was 6.706. Just 2.9% of the total number of writers are single-authored studies (20 authors), but the majority of authors (97.1% of the total) are part of multi-authored research (670 people).

4.1. Green Human Resource Management in SMEs: A Discrete Research Domain

The scientific output of the writers was evaluated using Lotka's methodology (Table 2). The results show that 589 writers collaborated on a single scientific publication about green HRM methods in SMEs, but just one author contributed to a maximum of eleven published pieces on the topic. Therefore, it is possible to characterise the topic of green HRM and SMEs' adoption of green practices as a separate scientific field with a high level of authorship concentration.

Table 2. Author productivity through Lotka's Law.

Documents Written	N. of Authors	Proportion of Authors
1	589	0.854
2	69	0.1
3	19	0.028
4	9	0.013
5	3	0.004
11	1	0.001

4.2. Annual Scientific Publication and Timespan Trend

Based on Figure 2, research on green human resource management in SMEs saw minimal growth before 2017, with only 23 papers published from 2011-2017. However, publications surged dramatically to 224 from 2018-2022, demonstrating a rising academic interest in SMEs' transition to sustainable HR models. The year 2021 had the highest number of publications. The figure also shows that newer papers have fewer citations, both in total citations per year (TCpY) and total citations per article (TCpA), as it takes time for recent research to gain recognition and influence in the academic community.

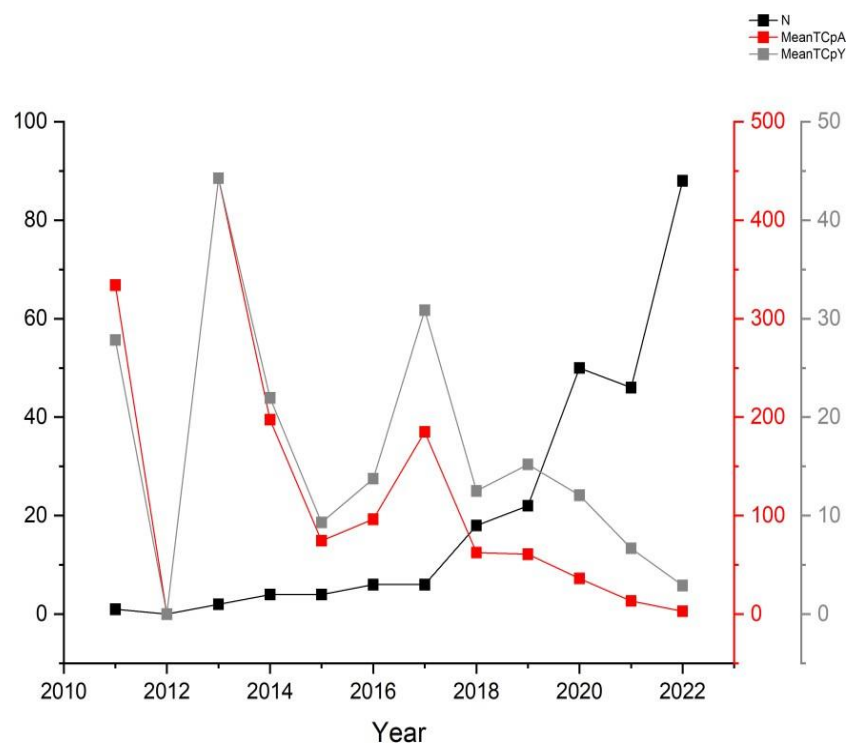


Figure 2. Annual research growth (TCpY: total citation per year, TCpA: total citation per article). Source: Scopus/Biblioshiny.

4.3. Most Influential Journals, Institutions, Authors, and Documents

Between 2011 and 2022, the **Journal of Cleaner Production** and **Sustainability** led the field in publishing research on green human resource management (GHRM) in SMEs, each with 26 articles. The **Business Strategy and the Environment** journal followed with 15 papers, and the **International Journal of Manpower** with 12. Rounding out the top five were **Corporate Social Responsibility and Environmental Management** (8 papers) and the **International Journal of Human Resource Management** (7 papers). These influential journals, all indexed by Scopus, Scimago, and the ABS List, significantly contributed to the body of knowledge on GHRM and its impact on SME success.

Table 3. Most relevant resources in the research field.

Sources	Articles	Subject Area	h-Index	Ranking by Scimago List	Ranking by ABS List
<i>Journal of Cleaner Production</i>	26	Strategy and Management	232	Q1	2 **
<i>Sustainability (Switzerland)</i>	26	Environmental Science	109	Q1	
<i>Business Strategy and the Environment</i>	15	Business, Management and Accounting	115	Q1	3 ***
<i>International Journal of Manpower</i>	12	Business, Management and Accounting	61	Q2	2 **
<i>Corporate Social Responsibility and Environmental Management</i>	8	Business, Management and Accounting	82	Q1	1 *
<i>International Journal of Human Resource Management</i>	7	Organizational Behavior and Human Resource Management	123	Q1	3 ***
<i>Benchmarking</i>	6	Business, Management and Accounting	66	Q1	1 **
<i>Organizational Behavior Human Resource Management Review</i>	5	and Human Management	101	Q1	3 ***
<i>Environmental Science and Pollution Research</i>	4	Environmental Science	132	Q1	
<i>International Journal of Contemporary Hospitality Management</i>	4	Business, Management and Accounting	100	Q1	3 ***
<i>Human Resource Management Review</i>	4	Organizational Behavior and Human Management	101	Q1	3 ***
<i>Business Strategy and Development</i>	3	Business, Management and Accounting	11	Q1	
<i>Entrepreneurship and Sustainability Issues</i>	3	Business, Management and Accounting	30		
<i>Frontiers in Psychology</i>	3	Psychology	133	Q1	
<i>International Journal of Hospitality Management</i>	3	Business, Management and Accounting	136	Q1	3 ***
<i>International Journal of Productivity and Performance Management</i>	3	Business, Management and Accounting	67	Q2	1 *
<i>Journal of Business Ethics</i>	3	Business, Management and Accounting	208	Q1	3 ***

According to Table 4, Xi'an Jiaotong University in China is the top institution for research on green human resource management (GHRM) in SMEs, with 16 publications. Following this are Montpellier Business School and Universiti Malaysia Terengganu, each with 12 articles. The University of Otago also ranks third. Notably, a majority of the most relevant affiliations are Malaysian, driven by the country's growing economy and diverse workforce. Researchers there focus on GHRM to help employees in SMEs find career paths and enhance their environmental consciousness.

Table 4. Most relevant institutions.

Affiliations	Country	Articles
Xi'an Jiaotong University	China	16
Montpellier Business School	France	12
Universiti Malaysia Terengganu	Malaysia	12
University Of Otago	New Zealand	10
University Of Alicante	Spain	9
Universiti Sains Malaysia	Malaysia	8
National Institute Of Industrial Engineering (Nitie)	India	7
Rutgers University	USA	7
Sukkur Iba University	Pakistan	7
Universiti Teknologi Malaysia	Malaysia	7

University Of Ghana Business School	Ghana	7
Hungarian University Of Agriculture And Life Sciences	Hungary	6
National Textile University	Pakistan	6
University Of Belgrade	Serbia	6
University Of Southampton	UK	6
Yazd University	Iran	6
Amman Arab University	Jordan	5
Nottingham Trent University	UK	5
University of Lisbon	Portugal	5
Qatar University	Qatar	5
Source: Scopus/Biblioshiny.		

Table 5 lists the writers who have had the most impact on the research community of the studied topic area, based on the findings of the bibliometric analysis of the most important authors in the search field. The measure of articles fractionalised by individual authors, which indicates the proportion of their co-authored publications, is shown in the third column of Table 5. Guerci M. Jabbour Cjc's academic paper, "Green Human Resource Management and Green Supply Chain Management: Linking Two Emerging Agendas," is one of the most important in the field of green HRM. Table 5 shows that Jabbour C.J. is the most influential author in the field.

Table 5. Most impactful authors.

Authors	Articles	Articles Fractionalized
Jabbour Cjc	11	3.07
Guerci M	5	2.00
Piwowar-Sulej K	5	4.50
Renwick Dws	5	2.92
Chiappetta Jabbour Cj	4	1.13
Ho Th	4	0.85
Jackson Se	4	1.42
Julius Mm	4	0.85
Muisyo Pk	4	1.15
Paillé P	4	1.23
Raut Rd	4	0.85
Ren S	4	1.37
Yusliza M-Y	4	0.75
Ahmed U	3	0.70
Bombiak E	3	2.50
De Sousa Jabbour Abl	3	0.62
Edgar F	3	0.92
Garza-Reyes Ja	3	0.53
Gedam Vv	3	0.65
Khan Mh	3	1.50

The most significant research studies on green HRM and its effects on raising environmental awareness among SME workers are finally included in Table 6. Both qualitative and quantitative research-based scientific articles are included in the following table. The sustainability pillar and how it affects human resource management are the subjects of some of the most well-known academic works. Furthermore, some publications examine employee attitudes towards sustainability and their willingness to adopt green practices, while others reinforce the notion that the green HRM model is at the top of

company agendas. Neither research, however, has examined the value of green HRM in SMEs or the creation of a business plan that would help SME workers improve their surroundings..

Table 6. Most impactful scientific articles in the field of green human resource management.

Paper Citations	Total	TC per Year	Normalized TC
Green Human Resource Management: A Review and Research Agenda [40]	744	67.636	1.6814
An Aspirational Framework for Strategic Human Resource Management [41]	519	51.9	2.6278
Effects of Green HRM Practices on Employee Workplace Green Behavior:	390	55.714	2.1062
State-of-the-Art and Future Directions for Green Human Resource	334	25.692	1
Green human resource management practices: scale development and	263	43.833	4.208
Sustainability as a dynamic organizational capability: a systematic review	245	35	1.3231
Green human resource management and the enablers of green organisational culture: Enhancing a firm's environmental performance for sustainable development [44]	234	46.8	3.8475
Green human resource management research in emergence: A review and	214	35.667	3.424
Assessing green human resources management practices in Palestinian	208	29.714	1.1233
Reporting on sustainability and HRM: a comparative study of sustainability	194	24.25	2.0138
What drives employees' intentions to implement green practices in hotels?	188	18.8	0.9519
Green product development and performance of Brazilian firms: measuring	187	20.778	2.5101
Who is in charge? A review and a research agenda on the 'human side' of	173	34.6	2.8445
Progressing in the change journey towards sustainability in healthcare: the	169	21.125	1.7543
Envisioning the invisible: Understanding the synergy between green human resource management and green supply chain management in resistance to change [48]	164	23.429	0.8857
Pathways towards sustainability in manufacturing organizations: Empirical	159	39.75	4.3874
Systematic literature review on sustainable human resource	144	28.8	2.3677
The impact of green human resource management practices on sustainable	142	35.5	3.9183
'Green' Human Resource Benefits: Do they Matter as Determinants of	141	12.818	0.3186
On the importance of sustainable human resource management for the	125	25	2.0553

4.4. Network, Content, and Cluster Analysis

Visualising the connections between authors, nations, and keywords can offer special perspectives on the scientific community. Figure 3 illustrates the relationship between the most pertinent authors (left), countries (middle), and keywords (right) in the subject of green human resource management research using a three-field layout, commonly referred to as a Sankey diagram. The results indicate that the main concerns of Malaysian scholars are sustainability and green human resource management. Furthermore, Chinese academics seem to be authorities on sustainability, corporate social responsibility, and green HRM. The economy of China is expanding quickly, with significant environmental repercussions. Scholarly interest in the topic under investigation has increased as a result.

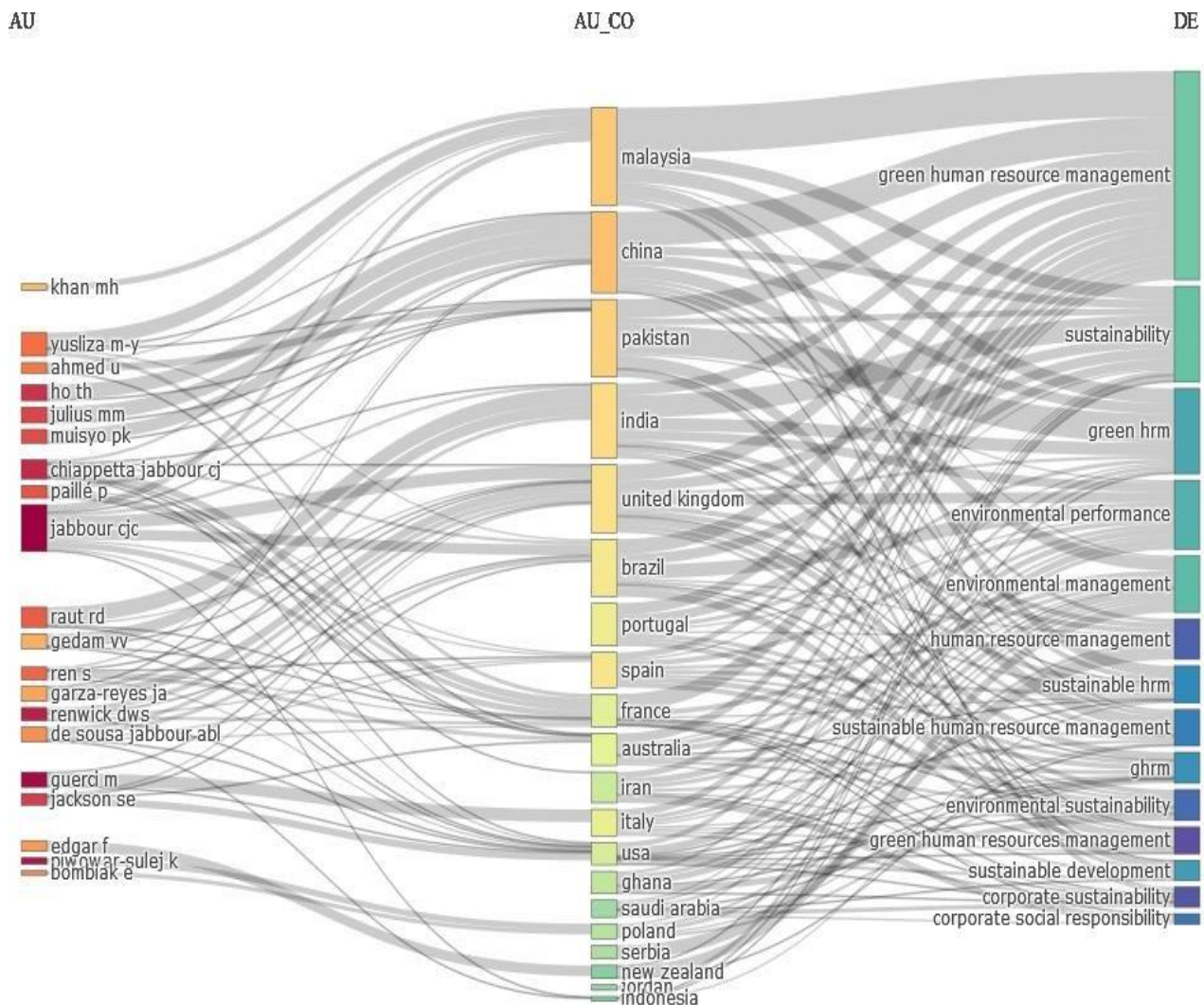


Figure 3. Three field plot or Sankey diagram. Source: Scopus/Biblioshiny.

Figure 4 illustrates the geographical collaboration network of authors in information management and big data analytics, as mapped by Bibliometrix. The map reveals that Europe is the primary hub for scientific collaboration in these fields. The strongest connections link **Europe, India, and Australia**, and significant ties also exist between **Latin America and Europe**. Specifically, British researchers have strong collaborative links with experts in Latin America, India, and China on topics related to green human resource management and employee environmental consciousness in SMEs. The bibliographic coupling map in Figure 5 further validates these collaborations.

Country Collaboration Map

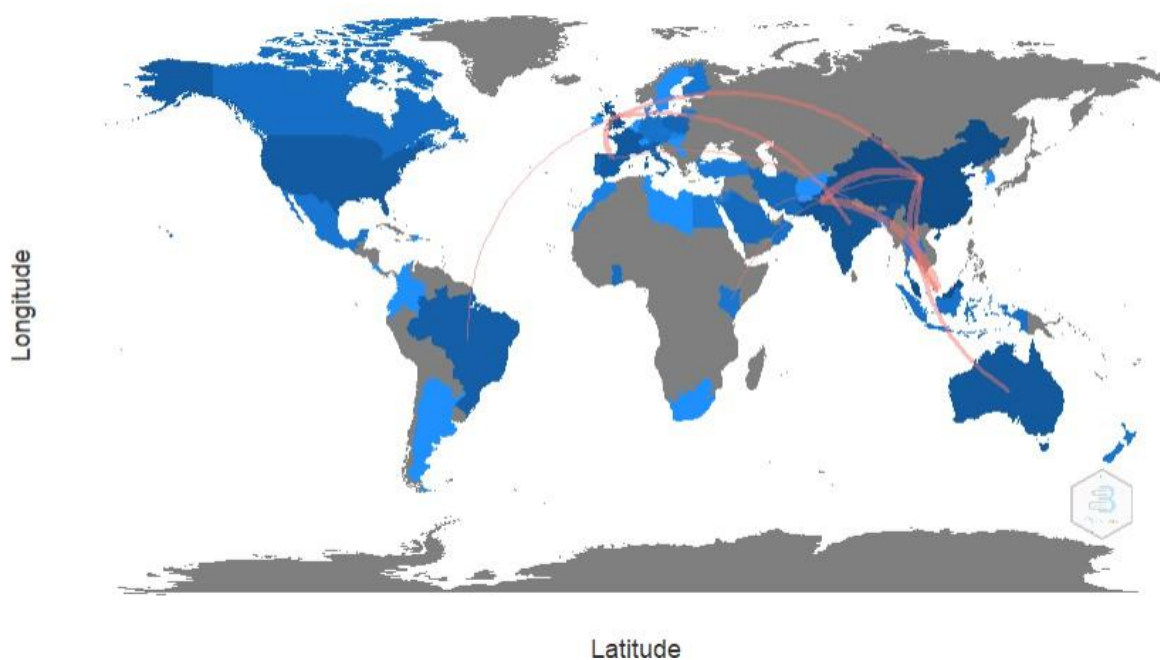


Figure 4. Collaboration map. Source: Scopus/Biblioshiny.

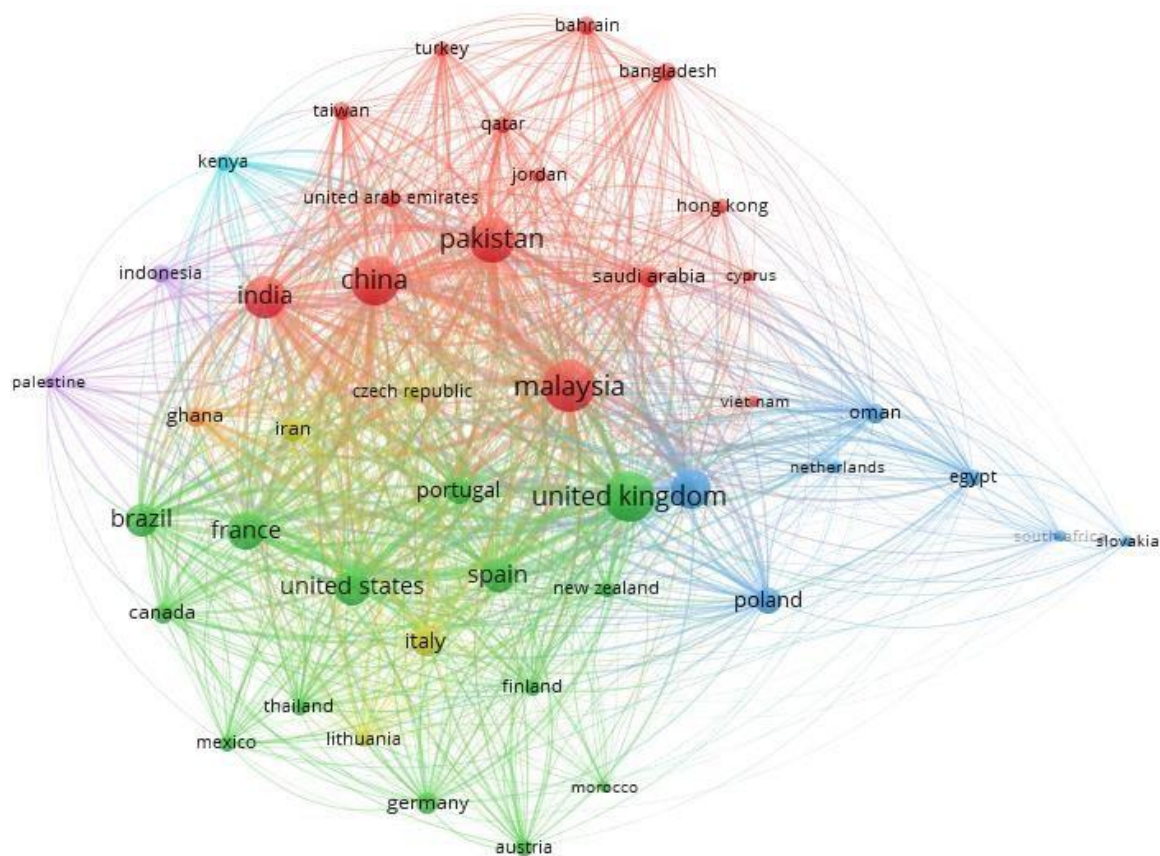
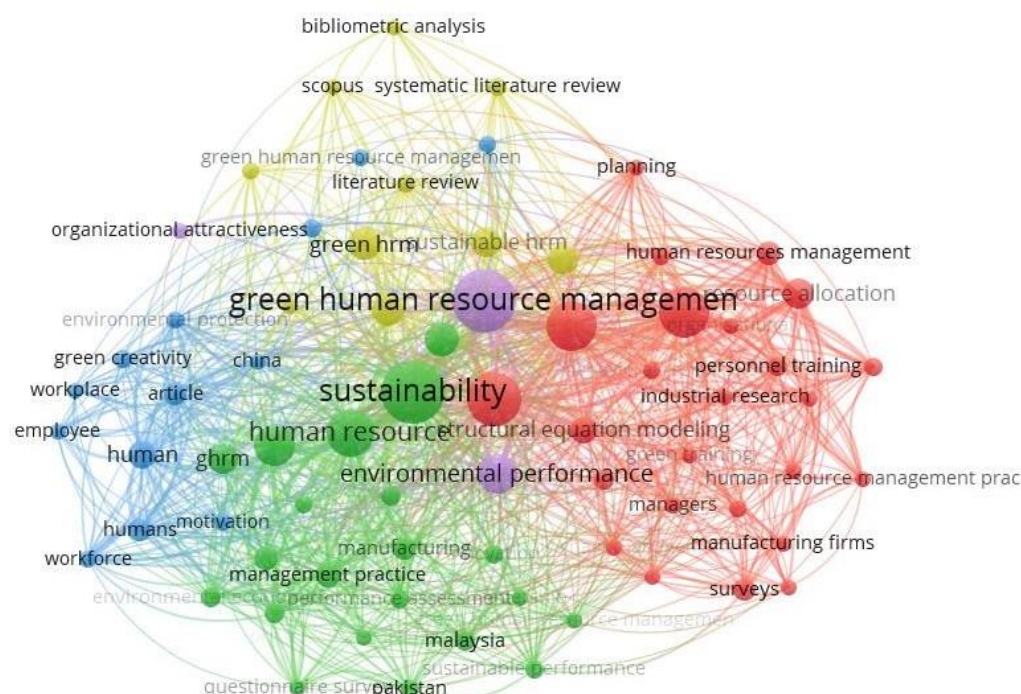


Figure 5. Bibliographic coupling based on documents. Source: Scopus/VOSviewer.

The red cluster, "**Environmental management and green human resource management**," highlights the crucial role of HR in environmental management by combining organizational and HR development. Managers are essential for fostering employee buy-in for sustainability goals through strategies like green mentoring, coaching, and cross-organizational networking, which also helps mitigate bias and encourages knowledge transfer [52, 53].

The purple cluster, "**Green human resource management and environmental performance**," focuses on how GHRM practices, such as green training and development, can enhance environmental performance. Training is critical for equipping employees with the knowledge and skills needed for eco-friendly decision-making and for teaching fundamental competencies like waste information collection to improve a company's environmental standards. This demonstrates a direct link between GHRM and improved environmental performance [54, 55].

Finally, the yellow cluster identifies **bibliometric analysis** as the core methodology used by experts to study green human resources and sustainable management.



Even though green human resource management is linked to pro-environmental behavior, environmental management, and sustainability, the thematic map (Figure 7) reveals new research opportunities. A thematic map illustrates study subjects from a Bibliometrix analysis, using cluster size, density, and centrality to categorize them into four quadrants:

- **Motor Themes (upper-right):** High density and centrality.
- **Basic Themes (lower-right):** High centrality but low density.
- **Niche Themes (upper-left):** High centrality but low density.
- **Emerging Themes (upper-left):** High density and high centrality.

Among these, "green competencies" is identified as a niche theme with significant interest. The term "competencies" refers to the actions and attitudes employees need for effective performance. In this context, green competencies encompass professional qualities and beliefs that drive pro-environmental behavior. SMEs, in particular, must proactively adopt green measures to enhance their employees' green understanding and capabilities [62, 63].

Human attitudes and beliefs are crucial factors influencing green competence. There are four types: natural, learned, adaptive, and performance. Natural competencies are inherent characteristics, while learned competencies are gained through experience [64]. Experts agree that a combination of innate and learned competencies is vital for effective environmental performance. Assessing green behavior through green human resource management can help identify an employee's green performance, which is a blend of their natural, learned, and adaptive competencies [3]. Green competencies and a desire to help the environment are both essential for achieving strong environmental performance.

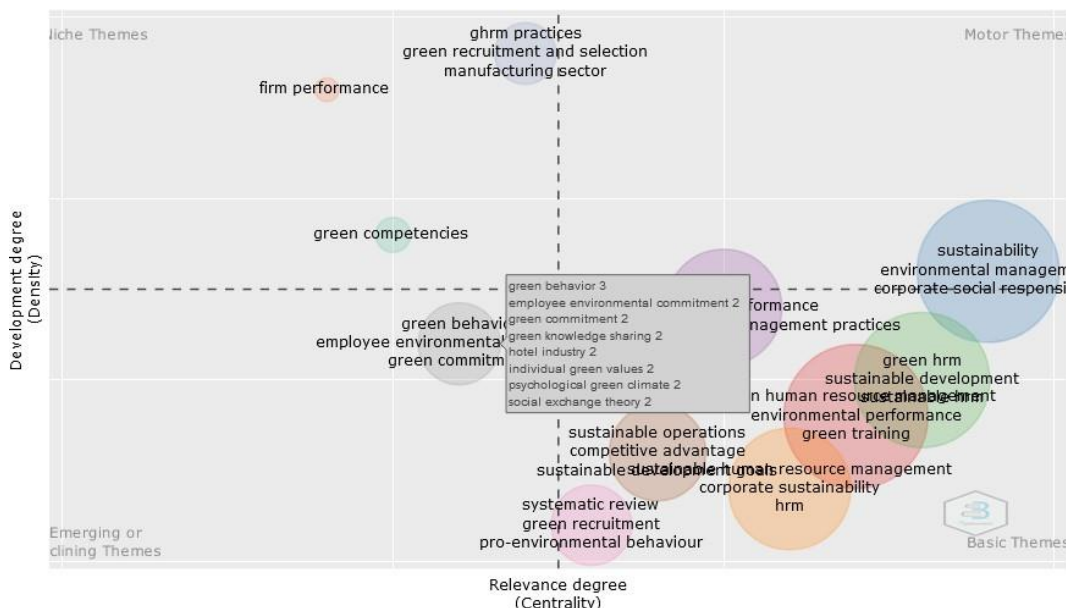


Figure 7. Thematic map based on authors' keywords. Source: Scopus/Biblioshiny.

Emerging themes in research highlight the necessity for SMEs to enhance employee green behavior. A key method for this is **green knowledge sharing**, which is the process of transferring and sharing eco-friendly knowledge among various stakeholders, including colleagues and competitors, to develop new, environmentally-conscious strategies and technologies [65, 66]. By integrating this green knowledge into their decision-making and operations, SMEs can strive for minimal environmental impact and gain a competitive advantage [66, 67].

Furthermore, a **multiple correspondence analysis (MCA)**, as shown in Figure 8, reveals a new and important connection for implementing green human resource management (GHRM) in SMEs. The MCA map, which visualizes keyword co-occurrence, shows two clusters. The red cluster contains topics already well-documented in the literature, while the blue cluster indicates a research gap, highlighting a link between organizational citizenship and environmental behavior. This connection introduces the new concept of **green organizational citizenship behavior (GOCB)**.

GOCB encompasses voluntary, discretionary employee actions that benefit green management but are not explicitly rewarded. This behavior goes beyond standard job expectations and is self-motivated, demonstrating that GHRM practices can significantly influence employee conduct [5, 47, 69]. Prior research shows that employee behaviors and competencies

boost company effectiveness [13]. GOCB, in particular, relies on an individualized approach to encourage green habits and a culture of corporate environmental citizenship, ultimately contributing to a more sustainable workplace [69].

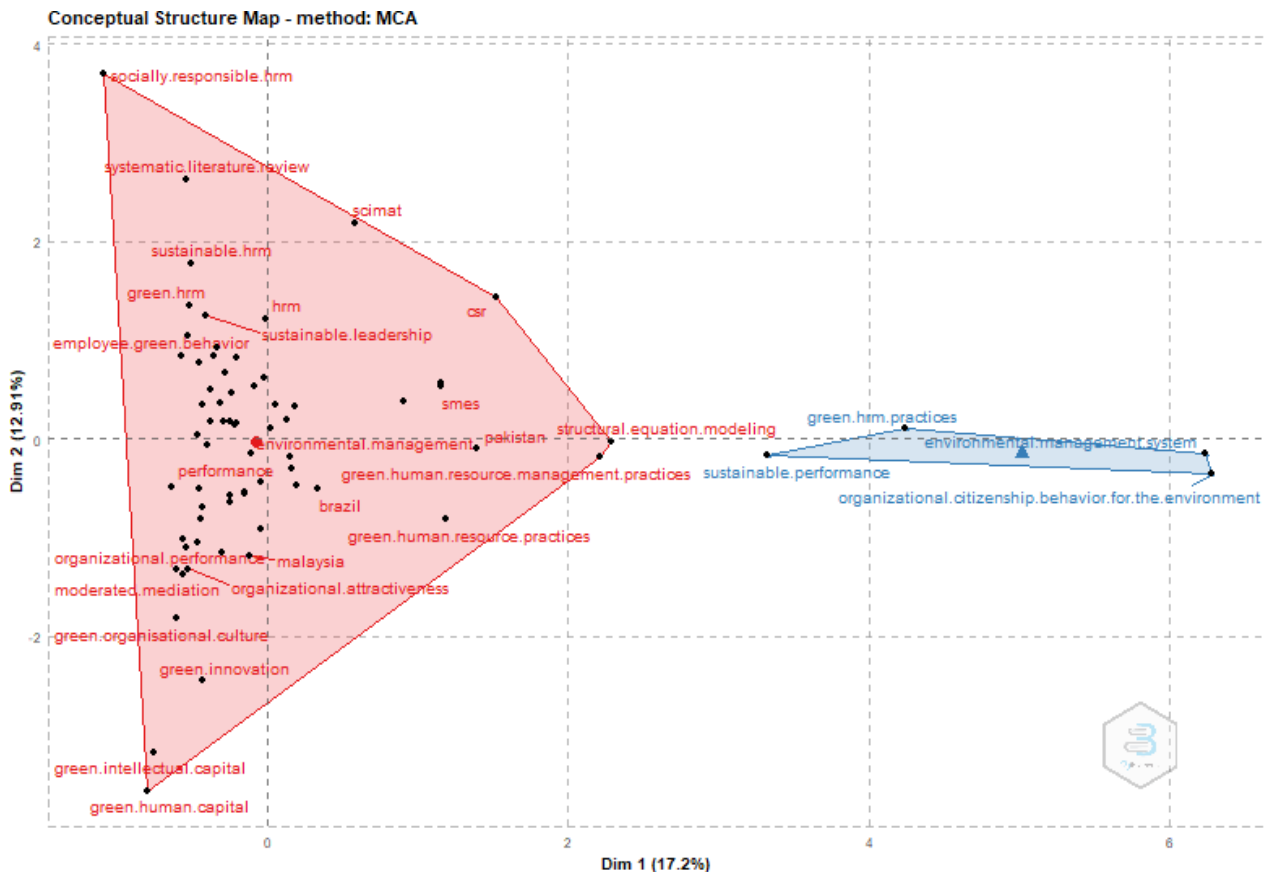


Figure 8. Thematic map based on the keywords of authors. Source: Scopus/Biblioshiny.

5. Discussion

For decades, human resource management (HRM) focused on economic goals like legal compliance and cost reduction. However, with the growing importance of sustainability, HRM's role has expanded to promote a sustainable society. This shift can be viewed from a macro perspective—HRM's role in organizational contributions to society and the environment—or a micro perspective—focusing on sustainability within the HRM system itself [56, 70]. This new relationship between sustainability and HRM has led to the concept of “**green human resources management**” (GHRM), which balances economic, social, and environmental goals [8]. GHRM aims to enhance professional well-being, loyalty, and satisfaction while also working to improve quality of life and reduce social injustice [8, 19, 72].

Despite its benefits, SMEs face challenges in adopting GHRM, primarily due to employees' lack of awareness of its advantages. This is often caused by a lack of green training, incentives, and rewards. This study aimed to develop a theoretical business model to guide SMEs in implementing GHRM practices. A bibliometric analysis of 368 documents from the Scopus database was conducted to explore this issue.

The findings from the analysis highlight several crucial factors for the proposed model. The co-occurrence map shows a strong link between GHRM and environmental management, emphasizing the critical role of human capital in achieving environmental goals. For SMEs to achieve green performance, employees must possess both innate and acquired green competencies. A key new component identified in the research is the “**willingness moment**,” which is essential for translating competencies into effective green performance. Even with high green competencies, a lack of willingness will hinder success, making this a critical predictive factor for an employee's environmental attitude [8, 72].

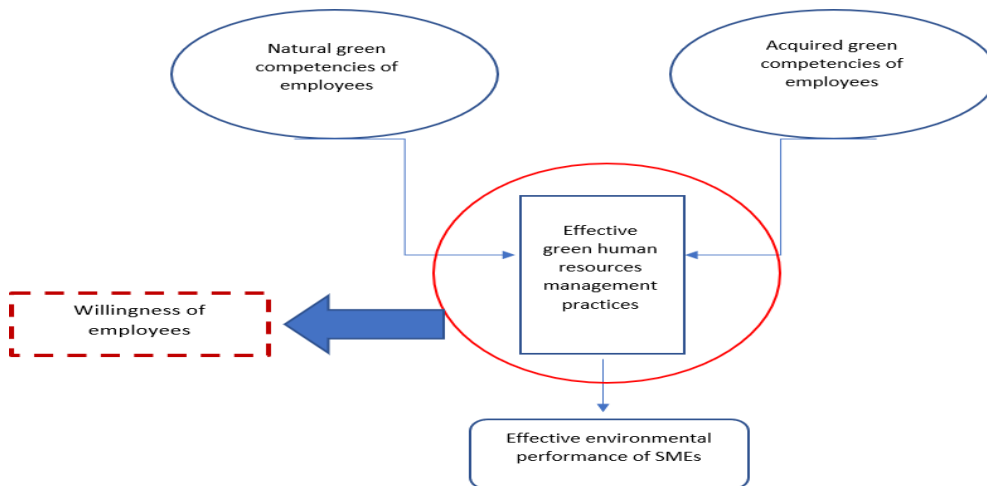


Figure 9. Contribution of green competencies in the model of green human resource management. Source: Own elaboration.

Green knowledge sharing is a crucial factor for a successful green business model in SMEs. It involves employees exchanging green information to boost the organization's environmental performance. This collaborative knowledge sharing leads to a competitive advantage and a deeper organizational understanding of environmental management [68, 72]. Another vital element is green organizational citizenship behavior (GOCB). This refers to the voluntary, pro-environmental actions employees take that benefit the company's environmental image and reduce costs without direct reward [69].

These factors form the foundation of a proposed business model for SMEs, illustrated in Figure 10. The model is based on combining **green organizational citizenship behavior, green competencies, and environmental management** [47, 77]. It suggests that by integrating green motivations and competencies, SMEs can foster GOCB among their employees. This process, governed by environmental management principles, will help SMEs achieve their environmental performance goals and ensure sustainable business continuity. For future research, the text proposes integrating environmental, social, and corporate governance factors into the model to further enhance green awareness and provide targeted training and motivation [78, 79].

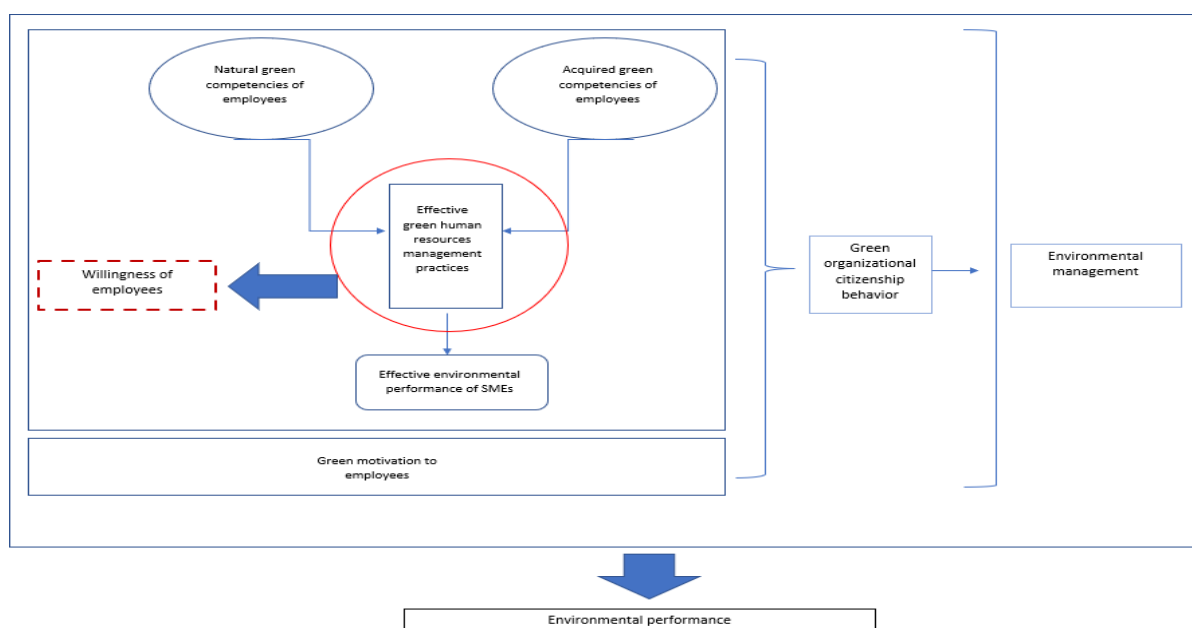


Figure 10. Proposed business model for the adoption of green human resource management strategies by SMEs. Source: Own elaboration.

The text you provided outlines several limitations of agile methodologies. A key challenge is that agile isn't a simple, standardized method but rather a set of concepts requiring a significant cultural change and commitment from all stakeholders, not just project managers and developers. It necessitates continuous feedback from users and collaboration across internal departments. This high level of required engagement means more people must invest time and effort into a project's success. Consequently, future research will explore integrating factors of different business cultures and the process of cultural change into the proposed business model.

6. Conclusions

Firms are the primary source of environmental problems and must therefore play a leading role in addressing them. To this end, many businesses are adopting eco-initiatives, with **Green Human Resource Management (GHRM)** emerging as a key solution. GHRM focuses on using human resource operations to promote long-term development, encouraging sustainable practices, and instilling a sense of environmental accountability in employees [17, 71, 80]. By placing sustainability at the core of people management, GHRM helps foster social and economic well-being alongside environmental consciousness. Research shows that GHRM improves corporate reputation and performance, effectively assisting personnel and motivating them toward a greener environment [81].

Small and medium-sized enterprises (SMEs) face increasing pressure to adopt these strategies due to their collective environmental impact. While SMEs account for a significant portion of the European workforce and economy, they face substantial challenges in implementing GHRM, including a lack of executive involvement and a general knowledge gap [82]. A major barrier is the absence of a clear business model to guide their transition.

This study proposes a three-layered business model grounded in environmental management and GHRM principles. The first layer involves fostering both inherent and learned **green competencies** and providing **green incentives** to employees. This combination leads to improved **green organizational citizenship behavior**, which, in turn, facilitates effective **environmental management**. The final layer shows how this strategic collaboration of factors helps SMEs achieve their goals of sustainability and green continuity.

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