Computational Mapping Analysis of Publications by Bibliometric Approach on Green Human Resource Management

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Abstract

This study aims to investigate the computational mapping analysis to delve into the evolution of green human resource management using VOSviewer and to identify its evolution towards research trend, thrust areas, citations, document type and source, authors and co-authorship, language, countries, keywords and period. Further, the study tried to identify the prolific authors and co-authorship patterns, commonly used keywords, country-wise and organization-wise analysis, research themes, theoretical foundations and simple statistics. This comprehensive exploration has provided valuable insights into the concept of green HRM, its objectives, and its potential benefits for businesses and society as a whole. The study has used the most pertinent recent articles of the last 20 years from the Scopus platform. The study reveals that China, the U.K. and the USA are contributing more research in the area of GHRM. Human resource management has become environmentally friendly in all its functions using green HRM but less thrust has been given up to now in the field of industrial relations.

Keywords: *Bibliometric Analysis, Green Human Resource Management, Computational Mapping Analysis, Scopus.*

INTRODUCTION

In the present business world, green human resource management (GHRM) has become an important factor in protecting the world economy and sustainability. It helps the organization build a strong employee-employer brand and make a preferred choice workplace for top talent in the industry by aligning the organization's values with prospective employees. It ensures the cost-cutting of production and retains environmentally conscious employees. Wehrmeyer (1996) initiated the concept of green human resources and environmental management. He opines that employees are vital for the growth or failure of any organization. Employees' energy, performance and personal commitment can move businesses towards sustainable industrial development. Researchers discovered a good and strong association between GHRM practices and environmental performance (Renwick et al. 2008; Kramar, 2014; Zoogah, et.al. 2011; Jabbour, 2013). However, HRM receives very little scholarship in adding value to achieve environmental sustainability (Jackson, 2010).

Green HRM investigates green initiatives through a process model of HR processes (Gupta, 2015). Zibarras et al (2015) try to promote HRM practices as pro-environmental behaviour in 214 UK organizations. A triple-bottom-line approach was emphasised to focus on organizations' environment, and social and economic performance for the sustainability of business (Jabbour, C. J. C. (2013; CIPD, 2012; Colbert et al. 2007; Elkington, 1998). A similar interpretation of Ghrm is also there with further value addition to the approach, such as innovation, cultural diversity, and the environment (Tiwari, 2015). Urban social-ecological ecosystem and adaptive governance institutions development are the two major strategies that enable practical management. (Borgstrom et.al 2006). Ghrm in the context of the global hydrological cycle and the role of water in global sustainability are important (Rockstrom et.al 2014). Ocean plays a pivotal role in offering potential resources which can affect food security and human well-being (John et.al, 2016).A positive relationship has been shown between GHRM and voluntary behaviour mediated by employee commitment to environmental change (Zibarras and Coan, 2015).

Green supply chain management can be effective if we eliminate unnecessary healthcare waste in hospitals, improving healthcare quality (Chang et. al 2019). Grain-to-Green Program (GTGP) leverages simultaneous

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participation in another payment for Ecosystem Services (PES) in China (Yost et.al. 2020). 'Eco-friendly behaviour' is a mediating factor of green human resource management and organizational identification in tourism organizations

(Ribeiro et. al 2022). Environmental strategies directly impact environmental performance and play a moderating factor in green innovation (GI) and environmental performance (Rehman et.al 2021). Some of the existing challenges to water resources management are: understanding the concept of ecosystem services, communicating with stakeholders, involving stakeholders in research with multiple values, valuation methods of water-related services and applications of decision-support tools (Vollmer et.al 2022). Employees' environmental commitment mediates the association between green HRM practices and green service recovery performance (Iftikhar et al. 2021). Green supply chain management and health and safety practices can help organizations achieve sustainable performance (Maskuroh, et al. 2023).

GHRM methods can be expanded to industrial relations, which are currently limited to a few HR procedures such as hiring, training, and reward in limited organisations, basically in developed countries Bahuguna et al, (2023). Freire et.al (2022) discover the function of job satisfaction as a moderator between green HRM and organizational citizenship behaviour, emphasizing the importance of examining individual effects in a green HRM system. The results of Khaskhely et al.'s study (2022) confirm the positive influence that GHRM and dynamic sustainable capabilities have on sustainable performance when it comes to macro-level components. It contributes to the literature by exploring the interplay between these factors. There is a direct impact of green HRM on consumer behaviour with the moderating role of uncertainty in the relationship between green HRM, employee performance, and eco-friendly behaviour (Renwick et. al 2013). A strong influence of green innovation on sustainable performance emphasizes the importance of green innovation in mediating the relationship between green HR practices and sustainable performance in SMEs (Awwad et al. 2022). GHRM, particularly green rewards, remuneration, and training has a substantial correlation with organizational performance, which is mediated through human capital (Renwick et. al 2016). Green transformational leadership positively promotes employee green creativity (Sidney et al. 2022). GHRM has a strong positive influence on organizational performance and it gives practical guidelines for managers to improve organizational culture and promote employee green behaviour for enhanced sustainability (Burlea et al. 2022).

METHODOLOGY

The term "Bibliometri" was first used by Paul Otlet in 1934 (Sulphey, et al. 2024). Otlet defined bibliometri as "the measurement of all aspects related to the publication and reading of books and documents" (Otlet, 1934). The concept was later added value by mentioning it as a big-data analytics technique which can be used in systematic literature review and foster scholarly works of quantitatively analyzed data, physically published units and bibliographic units (Broadus, 1987; Rosseau, 2014; Syafrudin et al. 2023). Research on the patterns and features of published works is aided by bibliometric study citation and co-citation analysis (Broadus, 1987). It makes it possible to look at scientific endeavours from multiple angles (Dickersin et al., 1994; Gaur and Kumar, 2018). It also aids in gathering and categorizing intricate bibliometric data. The research analysis is based on a process of finding, organizing, and analyzing the major components of a specific field (Cobo, 2011).

The search filter for the current study was used to get only such articles that restricted the words "green human resource management" in either their title keywords or abstract. After limiting to the area of study, year of publication, document type and language (English), out of 1047 papers, finally, 551 research papers were inferred from the Scopus database. Then the data was visualised, mapped and analysed. The analysis was enabled with the software VOSveiwer1.6.19. It is a tool to create, visualise and explore maps, based on network data.

RESULTS

Evolution Of Research Output Based On Scopus

This section presents the scientific output in the area of green human resource management for 20 years. Papers were selected based on the year, subject area, document type and language. The most prolific authors with the number of articles, countries, citations and journals are reflected in Table 1.

Table 1. Characteristics of scientific publications on green human resource management

Years	NA	Au	Cou	Cit	TCit/NA	Jou
2004-2008	6	21	5	1083	180.5	6
2009-2013	21	80	13	1903	90.7	19
2014-2018	103	486	32	6140	59.61	17
2019-2023	412	1960	56	5712	13.56	140

Note: TCit/NA* Total Citations/Number of Articles, Au* Authors, Cou* Countries, Cit* Citations, Jou* journals

The above data represent the scientific publications on GHRM which indicate an increasing trend during the study period. In the quarter (2004-2008), only 6(1.08%) articles have been published and then increased to 21(3.81%) in the next five years (2009-2013). Further in 2014-2018 and 2019-2023, it increased dramatically to 103(18.69%) and 412 (74.77%) respectively. There has been a spectacular rise of 51.18% in article publications in the last five years concerning the previous 15 years. As awareness and implementation increase, scientist tries to study its effects more (Kramar, 2014; Zoogah, et.al.2011; Ribeiro et al 2022; Rehman et.al (2021).

Productivity Of Journals

Table 2. Ranking of the top 10 productive journals on GHRM

Journal	Doc	TC	TC/Au	Impact Factor	H Index (Jrnl)	SJR	Con	First Article	Last Article	2004-2008	2009-2013	2014-2018	2019-2023
'International Journal of Environmental Research and Public Health'	94	930	9.89	4.614	167	0.828 (Q2)	Switzerland	2016	2023	0	0	10	84
Sustainability (Switzerland)	79	1340	16.96	3.889	136	0.664 (Q1)	Switzerland	2013	2023	0	1	11	67
'Journal of Cleaner Production'	18	1513	84.05	11.072	268	1.981 (Q1)	UK	2016	2023	0	0	5	13
Journal of Environmental Management	15	472	31.46	8.91	218	1.678 (Q1)	United States	2011	2022	0	1	6	8
Frontiers in Psychology	14	28	2	4.232	157	0.891 (Q2)	Switzerland	2021	2023	0	0	0	14
Frontiers in Environmental Science	13	97	7.46	4.748	61	1.005 (Q1)	Switzerland	2018	2023	0	0	1	12
Science of the Total Environment	13	401	30.84	10.753	317	1.946 (Q1)	Netherland	2014	2022	0	0	4	9
'Journal of Environmental and Public Health	10	3	0.3	2.791	47	0.598 (Q2)	Egypt	2022	2023	0	0	0	10
'International Journal of Sustainable Development and Planning'	9	17	1.88	0.284	20	0.286 (Q2)	UK	2020	2023	0	0	0	9
'Business Strategy and the Environment'	8	384	48	10.801	131	2.870 (Q1)	UK	2019	2023	0	0	0	8

Note: Doc: Total Number of Documents; TC: Number of citations; (TC/Au): Average number of citations per article; H Index (Jrnl): h index of the Journal; SJR: Scimago Journal Rank; Con: Country

Table 2 depicts the classification of the top 10 most productive journals filtered from 140 journals on green human resource management in the period 2004-2023. It is observed that in the initial two quarters, the publications were negligible. Only 0.3% has been published in the first quartile (Q1), 1.52% in Q2, and 16.46% in Q3 & the highest publications in the area of GHRM is 81.7% (Q4). It shows that in the last five years, there has been a phenomenal rise in publications in the area of GHRM. However, the top 10 journals reflect 260 articles which shows massive acceptance across the world. Further, there is a wide circulation of knowledge in the world aiming towards cost-effectiveness in general and to make the environment more sustainable in particular.

It is observed that the journal, "International Journal of Environmental Research and Public Health" has the highest number of publications (94) related to Green HRM followed by "Sustainability' (79) documents. The third-ranking journal, "Journal of Cleaner Production" (18) has the highest citation, 1513 and the highest H-Index, 268, while "Sustainability" has the second highest citation, 1340. The lowest average citations (0.3%) held by "Journal of Environmental and Public Health" with 10 documents, belong to Egypt. In the second quarter, 2009-2013, three different journals [Sustainability (Switzerland), Journal of Environmental Management, Environmental Management] produced a single paper each too.

Productivity of Countries

All the research papers in the current study belong to their respective authors from 93 different countries. Figures 1 highlight the top ten most Prolific countries with the highest number of publications and citations on green human resource management.
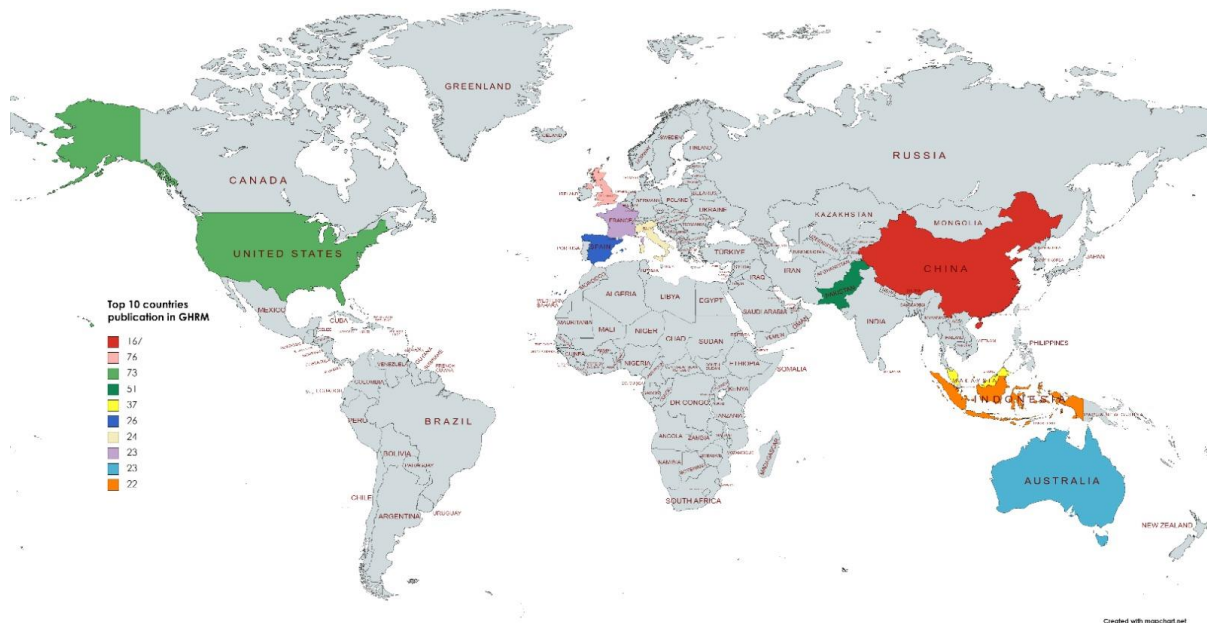

Figure 1. Map showing the top ten most productive countries contributing the highest number of publications

It is observed that China is the most productive country with a total of 167 papers on green human resource management during the period 2004-2023, followed by the United Kingdom (76) and the United States (73). As per the Scopus database, most of the papers by China and the United Kingdom were published during the year 2011 to 2023. However, the United States has started working on papers since 2005 by Pease et al The highest number of citations has been obtained by the United Kingdom with 4372, followed by China (2617) and the United States (2368).

Pakistan has fairly contributed papers (51) with 561 citations. Malaysia, Spain and Italy are the next top countries producing 37, 26 and 24 papers respectively with citations of 563, 1004 and 1612. From the bottom three countries in the list, France, and Australia have contributed 23 papers each obtaining 1610 and 943 citations

respectively whereas Indonesia holds the tenth position with 22 papers and 276 citations. It is worth noticing that out of 551 papers in the study, more than half, that is, a total of 404 (73.32%) papers are contributed by the authors of the top five countries.

Productivity of Institutions

The productivity of the top ten most prolific institutions with the number of documents and citations is shown in Figure 2. As green human resource management is comparatively a new concept, the number of articles produced is very low. As observed in Figure 2, Jiangsu University, China, has produced the maximum number of papers on green HRM totalling 5 papers with 95 citations. The second-ranked institution is Shandong University, China, with 4 documents and 137 citations during 2018-2023. Before 2018, they did not have any paper on Ghrm. Further, the Abu Dhabi University (UAE) and School of Economics and Management, Beijing University of Technology (China), hold fourth and fifth ranks accounting for 3 publications each with 715 (238.3% average citations) and 136 (45.3% average citations) citations respectively.
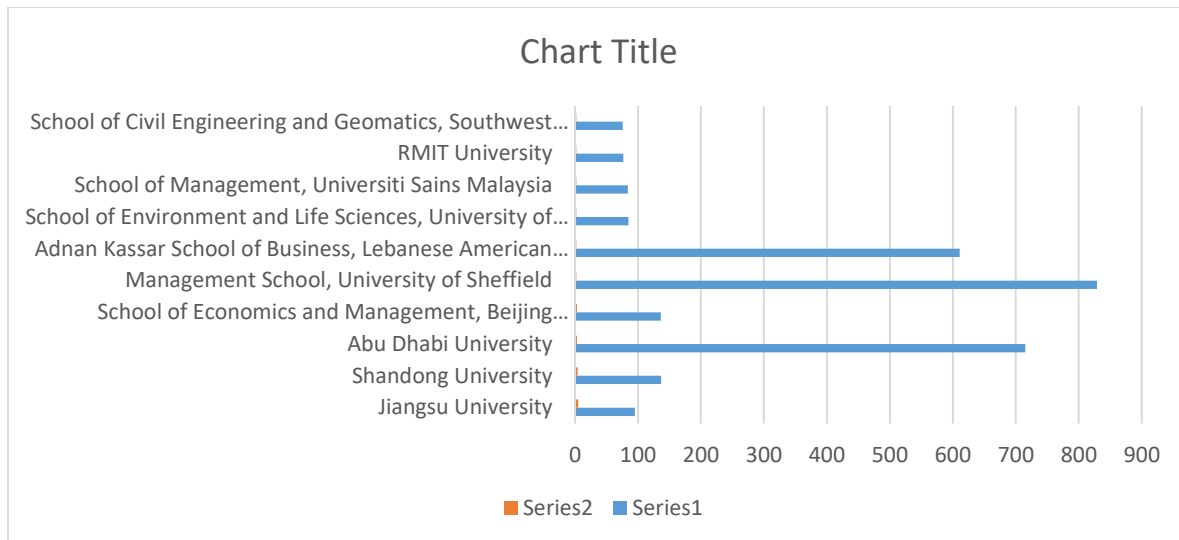

Figure 2. Productivity of the top ten most prolific institutions with the number of documents and citations

The University of Sheffield, UK records the highest citation, that is, 829 (414.5% average citations) on Green HRM followed by Adnan Kassar School of Business, Lebanese American University, (305.5%) with 2 documents each while Jiangsu University is the one with the lowest average number of citations per article (19.0) although it has produced the highest number of papers in GHRM.

Most Prolific Authors

As shown in Table 3, the data inferred from the VOSviewer software shows the most prolific authors contributing the maximum number of documents in the Scopus dataset in the last 20 years, on 'green human resource management'. Out of the 2008 authors, 19 meet the thresholds from which the top 12 authors were considered. Initially, a list of the top authors was prepared with the highest number of publications and citations. Then their affiliation country was found out and observed that more articles are produced in China on 'green human resource management'.

Table 3. Most prolific authors, country, number of documents and highest citations

Ranking	Authors	Country	Number of Documents	Scopus Citations
1	Li x.	China	9	189
2	Zhang y.	China	9	186
3	Liu j.	China	8	124
4	Chen y.	China	7	27
5	Wang j.	China	7	51
6	Jabbour c.j.c	France	6	1095

7	Zhang x.	China	6	196
8	Wang x.	China	6	115
9	Wang h.	China	6	76
10	Zhang w.	China	6	40
11	Liu h.	China	5	253
12	Chiappetta Jabbour c.j.	UK	5	175

It is also witnessed that Li X. and Zhang Y., both have produced nine documents each with 189 and 186 citations respectively. Furthermore, researchers such as Liu J. with eight documents, Chen Y. and Wang J. have contributed seven articles each and both of them belong to China. Our findings emphasize the benefits of integrated green innovation networks and provide theoretical references and advice for businesses considering network membership.

Jabbour c.j.c holds the sixth rank but has collaborated with many co-authors in different papers at different times. They emphasised how the entrenched nature of GHRM in workplaces contributes to national culture and stakeholder theories. They viewed that there is a "soft and human" side of the HR aspect, which is environmentally sustainable for the organizations, but a blossoming management subfield is GHRM which concerns the alliance of people and the environmental objectives of management. Liu H. co-authored with Zhao J. and Sun W. has shown research interest in green creativity; ecosystem services; urban ecological infrastructure. He experimented with discretionary slack and found out that GHRM can promote firms' environmental reputation. Zhang X. co-authored with Shen Y. viewed that the generalised environmental tax has a significant and positive effect on the industrial green transformation.

All Keywords Network Analysis and Co-occurrences

The keywords co-occurrences network analysis is conducted to observe all the keywords used in various research papers. This analysis helps to get an idea about which kind of topics, themes, related variables and intentions have been mostly emphasized by the researchers. Keywords co-occurrences network map of 'all keywords' which occurred in the different research papers on 'green human resource management' is shown in Figure 3.
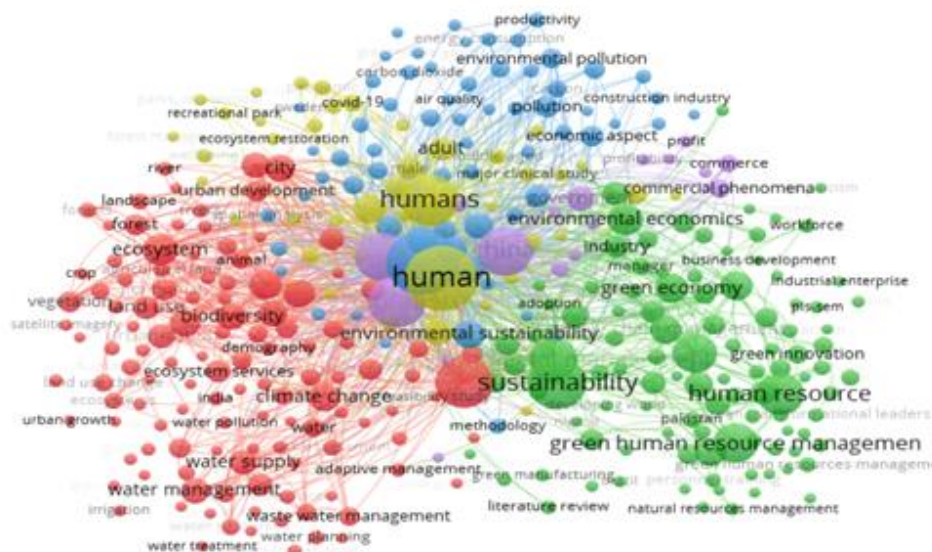

Figure-3. Keywords co-occurrences network map of 'all keywords'

In figure-3, out of 551 articles on 'Ghrm', published during 2004-2023, of the 4444 'all keywords', 350 meet the threshold keeping 5 as the minimum number of occurrences. The text-mining routine creates a map using VOSviewer, where the distance between different terms is construed as an indication of the connection among the various keywords (Laudano et al., 2018).

Author Keywords Co-Occurrences

The major author keywords are presented in Table 4.

Table 4. Top 50 author keywords co-occurrences network analysis

#	Author Keywords	OC*	#	Author Keywords	OC*
1	Green Human resource management	66	26	China	8
2	Sustainability	50	27	Green Human resource management (ghrm)	8
3	Green HRM	23	28	Management	7
4	Sustainable development	23	29	Pls-sem	7
5	Environmental performance	22	30	Green management	7
6	Ecosystem services	18	31	SMES	6
7	Environmental management	16	32	Green recruitment and selection	6
8	Green innovation	15	33	Life cycle assessment	6
9	Green supply chain management	14	34	Structural equation modeling	6
10	Environmental sustainability	13	35	Green Human resource management practices	6
11	Green infrastructure	13	36	Human resources	5
12	Environment	12	37	Triple bottom line	5
13	Ghrm	12	38	Corporate sustainability	5
14	Green Human resource management	10	39	Green performance	5
15	Urbanization	10	40	Green intellectual capital	5
16	Green transformational leadership	9	41	Job satisfaction	5
17	Human resource management	9	42	Pakistan	5
18	Biodiversity	9	43	Social exchange theory	5
19	Employee green behavior	9	44	Agriculture	5
20	Circular economy	9	45	Corporate social responsibility	5
21	Green creativity	9	46	Green hrm practices	5
22	Conservations	9	47	Green supply chain	5
23	Sustainable human resource management	8	48	Land use	5
24	Sustainable performance	8	49	Energy efficiency	5
25	Green training	8	50	Measure based solutions	5

Note: OC*: Co occurrences

Table-4 depicts the top fifty 'author keywords' which appeared the maximum number of times in the Scopus dataset having the greatest significance by the authors. The most frequent keyword is 'green human resource management', showing 66 times of occurrences, followed by 'sustainability', 50 times. Many other similar keywords also occurred in the dataset which was similar to 'green human resource management', such as 'Green HRM', 'Ghrm', 'Green Human resource management (ghrm)' and 'Green Human resource practices'. Other important keywords are 'Sustainable development', 'Environmental management', 'Green supply chain management', 'Green infrastructure', 'Green training' etc.

The 'author keywords' co-occurrences network map is shown in Figure 8 highlighting the keywords related to 'green human resource management'.

Index Keywords Co-Occurrences

The most occurred index keyword network map is presented in Figure 4. As per VOSviewer dataset, from 2965 index keywords 297 meet the threshold where the minimum number of occurrences is five. It also projects that keyword linkage is done through different lines.
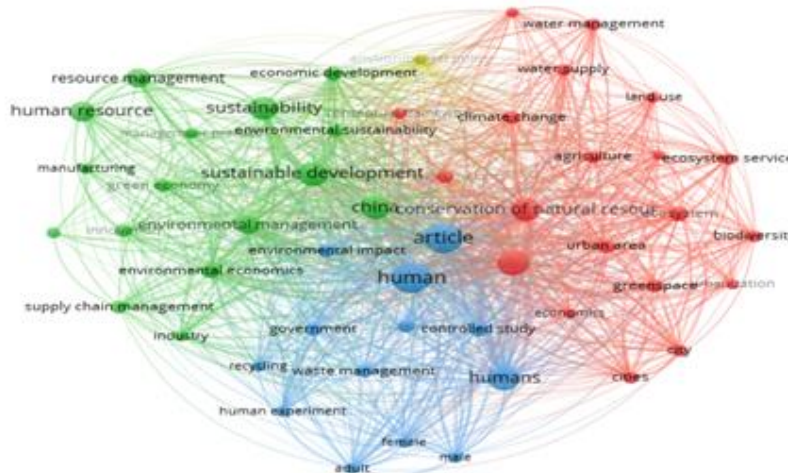
Figure 4. 'Index keywords' co-occurrences network map of different keywords, which occurred in the different research papers related to green human resource management.

According to Figure 5, few keywords have co-occurred predominantly as 'human' has co-occurred 174 times, 'humans' 108 times, 'article' 168 times, 'environmental protection' 110 times, 'sustainable development 99 times, 'conservation of natural resources 96 times etc. The greater number of occurrences represents more possibility of research in the area.

Most Cited Papers with Title, Authors and Year of Publication

Table 5.   Most cited papers with title, authors and year of publication

Ranking	Authors	Paper title	Year	TC
1	Renwick D.W., Redman T. and Maguire S.	Green Human Resource Management: A Review and Research Agenda	2013	795
2	Kalmykova Y., Sadagopan M., Rosado L.	Circular economy - From review of theories and practices to development of implementation tools	2018	625
3	Rost S., Gerten D., Bondeau A., Lucht W., Rohwer J., Schaphoff S.	Agricultural green and blue water consumption and its influence on the global water system	2008	589
4	Singh S.K., Giudice M.D., Chierici R., Graziano D.	Green innovation and environmental performance: The role of green transformational leadership and green human resource management	2020	514
5	El-Kassar A.-N., Singh S.K.	Green innovation and organizational performance: The influence of big data and the moderating role of management commitment and HR practices	2019	413
6	Jabbour C.J.C., De Sousa Jabbour A.B.L.	Green Human Resource Management and Green Supply Chain Management: Linking two emerging agendas	2016	373
7	Roscoe S., Subramanian N., Jabbour C.J.C., Chong T.	Green human resource management and the enablers of green organisational culture: Enhancing a firm's environmental performance for sustainable development	2019	255
8	Andersson E., Barthel S., Ahrné K.	Measuring social-ecological dynamics behind the generation of ecosystem services	2007	239
9	Jackson S.E., Seo J.	The greening of strategic HRM scholarship	2010	221
10	Guerci M., Longoni A., Luzzini D.	Translating stakeholder pressures into environmental performance – the mediating role of green HRM practices	2016	204
11	Teixeira A.A., Jabbour C.J.C., De Sousa Jabbour A.B.L., Latan H., De Oliveira J.H.C.	Green training and green supply chain management: Evidence from Brazilian firms	2016	199
12	Singh S.K., El-Kassar A.-N.	Role of big data analytics in developing sustainable capabilities	2019	198
13	Renwick D.W.S., Jabbour C.J.C., Muller-Camen M., Redman T., Wilkinson A.	Contemporary developments in Green (environmental) HRM scholarship	2016	185
14	Pinzone M., Guerci M., Lettieri E., Redman T.	Progressing in the change journey towards sustainability in healthcare: The role of 'Green' HRM	2016	183
15	Zibarras L.D., Coan P.	HRM practices used to promote pro-environmental behavior: a UK survey	2015	167

16	Borgström S.T., Elmqvist T., Angelstam P., Alfsen-Norodom C.	Scale mismatches in management of urban landscapes	2006	160
17	Rockström J., Falkenmark M., Allan T., Folke C., Gordon L., Jägerskog A., Kummu M., Lannerstad M., Meybeck M., Molden D., Postel S., Savenije H.H.G., Svedin U., Turton A., Varis O.	The unfolding water drama in the Anthropocene: Towards a resilience-based perspective on water for global sustainability	2014	160
18	Rehman S.U., Kraus S., Shah S.A., Khanin D., Mahto R.V.	Analyzing the relationship between green innovation and environmental performance in large manufacturing firms	2021	154
19	John M.A.S., Borja A., Chust G., Heath M., Grigorov I., Mariani P., Martin A.P., Santos R.S.	A dark hole in our understanding of marine ecosystems and their services: Perspectives from the mesopelagic community	2016	148
20	O'Donohue W., Torugsa N.A.	The moderating effect of 'Green' HRM on the association between proactive environmental management and financial performance in small firms	2016	142

Note: TC: Total Citations

Focusing on the Scopus database, the top twenty most cited papers are presented in Table 5. The rank one paper accumulating 795 citations is 'Green Human Resource Management: A Review and Research Agenda' (Renwick et al., 2013). This research focuses on the integration of environmental management and human resource management. The second most cited article contributed by Kalmykova et.al (2018) having 625 citations, projects the theories and tools of circular economy (CE). They have developed two strategies: 'CE Strategies Database' and 'CE Implementation Database'. The former adds value for the recovery and use of the products but the latter points towards solutions which are readily available in the market.

The third highly cited article contributed by Rost et.al, (2008) has 589 citations and reflects the global assumption of "blue" and "green" water by agriculture and terrestrial ecosystems. They view that almost half of the irrigation water stemmed from nonrenewable and nonlocal sources and presently land cover conversion reduces global evapotranspiration. Further, the fourth-ranked paper with 514 citations examines the mediating role of green HRM practices between green transformational leadership and green innovation, which in turn impacts environmental performance (Singh. et al, 2020).

Then, the next paper contributed by El-Kassar, et.al (2019) with 413 citations tried to find the effect of big data and the moderating role of management commitment and HR practices among green innovation and organizational performance. Jabbour et al (2016) with 373 citations tried to link green human resource management and green supply chain management, Roscoe. et al (2019) earning 255citations, explore the relationship between GHRM practices which enables green organizational culture and the firm's environmental performance.

The eighth article examines the relationship between management practices, ecological consequences and certain social drivers in generating ecosystem services (Anderson et.al, 2007). Further, The next five papers in the list, have more than 180 citations each, emphasizing the role of HRM systems, stakeholder pressures, green training, and green supply chain practices in achieving environmental sustainability (Jackson et. al, 2010; Teixeira et.al, 2016). Guerci et.al, (2016) found the mediating role of green HRM practices on translating stakeholder pressures and environmental performance. The integration of big data technologies, green supply chain management, and green HR practices enhances sustainable capabilities and firm performance. (Singh et.al, 2019). Renwick et al (2016) focus on green recruitment competencies, employee participation, and financial performance to promote workplace environmental sustainability.

The fourteenth paper by Pinzone et al (2016) with 183 citations examines the role of "Green" HRM practices in promoting collective engagement and voluntary actions for environmental protection. Further, the fifteenth paper by Zibarra L.D. et al (2015) with 167 citations, found that HRM practices are not used to a great extent to encourage environmental behaviour. The next paper, by Borgström et.al (2006) with 160 citations, depicts the importance of managing urban green spaces to ensure ecosystem services. Rockström J. et.al, (2014) view that too much use of water resources and the mindset towards land integration and water stewardship are the resilience-based perspectives towards global sustainability.

The eighteenth most cited article contributed by Rehman et al. (2021) having 154 citations focuses on understanding the relationship between Green Intellectual capital(GCI), GHRM, Green Innovation(GI) and

environmental performance in firms. John et al (2016) with 148 citations, study the role of greenhouse gases, holistic assessment of the community and biodiversity preservation for managing human resources efficiently. The twentieth-ranked paper contributed by O'Donohue et al (2016) having 142 citations, highlights the value of GHRM as a supportive tool for small firms in meeting environmental sustainability demands with cost-effectiveness.

Countries With Collaborations

Table 6. Ranking of the top ten countries and their levels of international collaborations.

Country	NC	% of NC	Main Collaborations	Int. C	Citation
China	23	12.29	UK, US, Pakistan, Malaysia, Saudi Arabia	167	2617
United Kingdom	26	13.9	China, US, Malaysia, France, Spain	76	4372
United States	26	13.9	China, UK, Pakistan, Malaysia, Australia	73	2368
Pakistan	16	8.55	China, Malaysia, US, Italy, Netherlands	51	561
Malaysia	16	8.55	China, UK, US, Pakistan, Indonesia	37	563
Spain	11	5.88	UK, US, Australia, Indonesia, Italy	26	1004
Italy	14	7.48	China, UK, US, Pakistan, France	24	1612
France	21	11.22	China, US, UK, Spain, Italy	23	1610
Australia	20	10.69	China, UK, US, Pakistan, Malaysia	23	943
Indonesia	14	7.48	UK, US, Malaysia, Spain, France	22	276

Note: NC* Number of collaborating countries; Int. C* Articles produced with international collaboration.

Table 6 presents a scenario where UK has the highest collaboration (26 countries) and 4372 (27.45%) citations. The collaboration mainly focuses on five countries (China, US, Malaysia, France, Spain) with 76 documents. Looking from the other aspect the data also depicts the lowest number of collaborations (11 countries) which is in the name of Spain mainly focusing on five (UK, US, Indonesia, Australia, Italy) countries as well with 1004 (6.30%) citations and 26 documents. China holds the next rank in international cooperation, with 23 countries. Finally, France has the highest average number of citations per article with international collaboration (70.0), followed by Italy (67.16), the UK (57.52) and Australia (41.0). The US, Spain and China present a higher average number of citations in domestic publications than international cooperation.

Figure 12 represents the international collaboration map between the leading countries and the collaborated countries that jointly produced a minimum of five papers, on green human resource management. Out of 39 collaborated countries found in VOSviewer, major countries

DISCUSSION AND CONCLUSION

Green Human Resources Management fosters organizations to minimise costs and maintain an environmentally friendly workplace. This study has probed the recent advances in the field of Green HRM using VOS viewer software and investigated the global trends and patterns through a bibliometric study using 551 research papers in the Scopus platform.

The study has highlighted the most prolific author and co-authorship of highly cited research articles, mostly used keywords, country-wise review, organization-wise analysis, research themes, theoretical foundation, publication trend and simple statistics. This article has explored the concept and research advances in green HRM, its objectives and benefits to the business world and society.

As per the Scopus dataset, the first article related to Green HRM was published in 2004 by Ali and Benjaminsen, in *Mountain Research and Development*. In the first quarter, only 6 articles (1.08%) are published whereas in the last quarter (2019-2023), 51.18% of articles are published, which shows a phenomenal rise. However, the

"International Journal of Environmental Research and Public Health" has the highest number of publications (94) and *"Journal of Cleaner Production"* (18) has the highest number of citations (1513).

Concentrating on the maximum number of articles published, China has topped in producing papers, 167 among 93 total countries. The next prolific countries are the UK (76) and the USA (73) articles respectively. The maximum number of citations has been obtained by the United Kingdom (4372). Considering the institutions, *"Jiangsu University"*, China, has the maximum number of articles on Green HRM, whereas the *"University of Sheffield"*, UK records the utmost average citations.

In the current study, it is found that the authors, Li X and Zhang Y have more articles published on GHRM (9 each), Jabbour C.J.C. (France) has more citations (1095) from 6 documents.

The major keywords other than "green human resource management" are "sustainability", "environmental performance", "green supply management", "green infrastructure", "conservation of natural resources", "ecosystem services" etc.

The most cited paper is "Green Human Resource Management: A Review and Research Agenda", contributed by Renwick et. al(2013). In fact, the most collaborated countries are the UK, the USA, China, France and Australia.

This paper contributes to the field of Global Human Resource Management (GHRM) by offering a comprehensive analysis of the existing knowledge. By examining the above key elements, the review enriches the GHRM literature and offers insights into the core areas of research. These inputs allow for a deeper understanding of these core areas and present new directions for future research in GHRM.

The comprehensive information presented in the paper serves as a valuable resource for future research. It offers an overview of influential authors, important papers, significant journals, and potential research questions in the field of GHRM. This information can guide researchers in exploring new avenues and advancing the knowledge base of GHRM.

The study is limited to the Scopus database only and of 20 years. Again, the problem was of various researchers with the same name. Third, there is a lack of studies focusing on the theoretical frameworks underlying GHRM. Fourth, the role of line managers in GHRM has not been extensively explained. Finally, more qualitative studies and more techniques for the implementation of GHRM should have been explored.

However, there is potential to extend the concept of GHRM to include other HR practices, such as employee relations and some soft aspects like employee protean career, employee wellness, employee engagement etc.

It is important to note that GHRM is still in its infancy, and making generalizations without sufficient evidence would not be appropriate. Based on the review and subsequent analysis, a few research areas are proposed: more theoretical frameworks such as stakeholder theory or the resource-based view are to be developed. Secondly, may identify the skills and competencies required by HR professionals and other functional areas managers, specifically line managers. Further, more dependent, independent, moderating variables, related to the current business world, organizations' work culture, strategy, policies, and practices may be considered, and finally, emphasised to be given in more qualitative research.

Additionally, GHRM plays a crucial role in attracting and retaining environmentally conscious employees. By aligning the organization's values with those of potential employees, GHRM helps establish a strong employee-employer brand, making the organization a preferred choice for top talent. This alignment can lead to reduced recruitment costs and increased operational efficiency.

REFERENCES

Ali, J., & Benjaminsen, T.A. (2004). Fuelwood, timber and deforestation in the Himalayas: The case of Basho Valley, Baltistan Region, Pakistan. Mountain Research and Development, 24(4), 312-318.

Andersson, E., Barthel S., Ahrné K. (2007). Measuring social-ecological dynamics behind the generation of ecosystem services. Ecological Applications, 17(5), 1267-1278.

Awwad, Al-Shammari A.S., Alshammrei S., Nawaz N. & Tayyab M., (2022). Green Human Resource Management and Sustainable Performance with the Mediating Role of Green Innovation: A Perspective of New Technological Era. Frontiers in Environmental Science, 10.

Bahuguna, P.C., Srivastava, R. & Tiwari, S., (2023). Two-decade journey of green human resource management research: a bibliometric analysis. Benchmarking: An International Journal. 30 (2), 585-602.

Borgström, S.T., Elmqvist, T., Angelstam, P., & Alfsen-Norodom, C., (2006). Scale mismatches in management of urban landscapes. Ecology and Society, 11 (2).

Broadus, R.N., (1987). Toward a definition of "bibliometrics". Scientometrics. 12: 373–379.

Burlea-Schiopoiu, A., Shoukat, M.H., Shah, S.A., Ahmad, M.S., & Mazilu, M., (2022). The Sustainability of the Tobacco Industry in the Framework of Green Human Resources Management. Sustainability (Switzerland), , 14(9).

Chang, H.-C., Wang, M.-C., Liao, H.-C., & Wang, Y.-H., (2019).The application of GSCM in eliminating healthcare waste: Hospital EDC as an example. International Journal of Environmental Research and Public Health. 16(21).

CIPD, Responsible and Sustainable Business: HR Leading the Way Collection of Thought Pieces, (2012). CIPD, London.

Cobo, M.J., López-Herrera, A.G., Herrera-Viedma, E., & Herrera, F. (2011). An approach for detecting, quantifying, and visualizing the evolution of a research field: A practical application to the fuzzy sets theory field. Journal of Informetrics, 5(1), 146– 166.

Colbert, B. and Kurucz, E., Three Conceptions of triple-bottom-line business sustainability and the Role for HRM, Human Resource Planning, 2007, 30(1), 21-29.

Dickersin, K., Scherer, R., & Lefebvre, C. (1994). Systematic reviews: Identifying relevant studies for systematic reviews. Braz. Med. J., 309(6964): 1286-1291 (6 pages).

El-Kassar, A.-N., & Singh, S.K., (2019). Green innovation and organizational performance: The influence of big data and the moderating role of management commitment and HR practices. Technological Forecasting and Social Change.144, 483-498.

Elkington, J., (1998). Partnerships from cannibals with forks: The triple bottom line of 21st-century business. Environmental Quality Management. 8(1), 37–51.

Freire, C., & Pieta, P., (2022) The Impact of Green Human Resource Management on Organizational Citizenship Behaviors: The Mediating Role of Organizational Identification and Job Satisfaction, Sustainability (Switzerland). 14(13).

Gaur, A., & Kumar, M., (2018). A systematic approach to conducting review studies: An assessment of content analysis in 25 years of IB research. J. World Bus., 53(2), 280– 289 (10 pages).

Guerci, M., Longoni, A., & Luzzini, D., (2016). Translating stakeholder pressures into environmental performance – the mediating role of green HRM practices. International Journal of Human Resource Management, 27(2), 262-289.

Gupta, R. S. N. (2015). Green HRM: An innovative approach to environmental sustainability [Paper Presented]. Twelfth AIMS International Conference on Management, INDIA. https://doi.org/10.1108/BIJ-10-2021-0619

Gordillo-Rodriguez, M. T., Pineda, A., & Gómez, J. D. F. (2023). Brand Community and Symbolic Interactionism: A Literature Review. Review of Communication Research, Vol.11, pp.1-32.

Iftikhar, U., Zaman, K., Rehmani, M., Ghias, W., & Islam T., (2021). Impact of Green Human Resource Management on Service Recovery: Mediating Role of Environmental Commitment and Moderation of Transformational Leadership. Frontiers in Psychology. 12.

Jabbour, C. J. C. (2013). Environmental training in organisations: From a literature review to a framework for future research. Resources, Conservation and Recycling, 74, 144–155. https://doi.org/10.1016/j.resconrec.2012.12.017

Jabbour, C.J.C. and Jabbour, A.B.L.S. (2016). Green human resource management and green supply chain management: linking two emerging agendas. Journal of Cleaner Production. 112, 1824-1833.

Jackson, S.E., & Seo, J. (2010). The greening of strategic HRM scholarship, Organisation Management Journal. 7(4), 278-290.

John, M.A.S., Borja, A., Chust, G., Heath, M., Grigorov, I., Mariani, P., Martin, A.P., & Santos, R.S., (2016) A dark hole in our understanding of marine ecosystems and their services: Perspectives from the mesopelagic community. Frontiers in Marine Science. Mar, 3.

Kalmykova, Y., Sadagopan, M., & Rosado, L., (2018). Circular economy - From review of theories and practices to development of implementation tools. 135, 190-201.

Khan, K., Shams, M.S., Khan, Q., Akbar, S., & Niazi, M.M., (2022) Relationship Among Green Human Resource Management, Green Knowledge Sharing, Green Commitment, and Green Behavior: A Moderated Mediation Model. Frontiers in Psychology. 13.

Khaskhely, M.K., Qazi, S.W., Khan, N.R., Hashmi, T., & Chang, A.A.R., (2022). Understanding the Impact of Green Human Resource Management Practices and Dynamic Sustainable Capabilities on Corporate Sustainable Performance: Evidence From the Manufacturing Sector. Frontiers in Psychology. 13.

Kramar, R. (2014). Beyond strategic human resource management: Is sustainable human resource management the next approach? The International Journal of Human Resource Management, 25(8), 1069–1089.

Li, X., Du, J., & Long, H., (2020). Mechanism for green development behavior and performance of industrial enterprises (Gdbp-ie) using partial least squares structural equation modelling (pls-sem), International Journal of Environmental Research and Public Health, 17(22), 1-19.

Liu, J., & Wu, Y., (2022). Green Human Resource Management, Employee Work Values, and Enterprise Environmental Performance. Journal of Environmental and Public Health. DOI: 10.1155/2022/8129359

Maskuroh, N.; Widyanty, W.; Nurhidajat, R.; Wardhana, I.W. and Fahlevi, M., Green human resource management and green supply Chain Management on Sustainable performance of nickel mining companies in Indonesia, Uncertain Supply Chain Management, 11(1), Mar 2023, Pp.203-212, 2291-6822.

Masri, H. A., & Jaaron, A. A. M. (2017). Assessing green human resources management practices in palestinian manufacturing context: An empirical study. Journal of Cleaner Production, 143, 474–489.

O'Donohue, W., & Torugsa. N.A., (2016). The moderating effect of 'Green' HRM on the association between proactive environmental management and financial performance in small firms. International Journal of Human Resource Management, 27(2), 239-261.

Otlet, Paul (1934). Traité de Documentation: Le Livre sur le Livre. Théorie et Pratique. Bruxelles: Editiones Mundaneum.

Pinzone, M., Guerci, M., Lettieri, E., & Redman T., (2016). Progressing in the change journey towards sustainability in healthcare: The role of 'Green' HRM. Journal of Cleaner Production. 122, 201-211.

Rehman, S.U., Kraus, S., Shah, S.A., Khanin, D., & Mahto R.V., (2021). Analyzing the relationship between green innovation and environmental performance in large manufacturing firms. Technological Forecasting and Social Change. 163, ISSN: 401625.

Renwick, D.W., Redman, T., & Maguire, S., (2013). Green Human Resource Management: A Review and Research Agenda. International Journal of Management Reviews. 15 (1), 1-14, ISSN: 14608545.

Renwick, D.W.S., Jabbour, C.J.C., Muller-Camen, M., Redman, T., & Wilkinson, A. (2016). Contemporary developments in Green (environmental) HRM scholarship. International Journal of Human Resource Management. 27(2), 114-128.

Renwick, D., Redman, T., & Maguire, S. (2008). Green HRM: A review, process model, and research agenda. University of Sheffield Management School Discussion Paper, 1, 1–46. http://dx.doi.org/10.13140/RG.2.2.30801.07520

Ribeiro, N., Gomes, D.R., Ortega. E., Gomes, G.P., & Semedo A.S., (2022). The Impact of Green HRM on Employees' Eco-Friendly Behavior: The Mediator Role of Organizational Identification. Sustainability (Switzerland). 14 (5), ISSN: 20711050

Rockström, J., Falkenmark, M., Allan, T., Folke, C., Gordon, L., Jägerskog, A., Kummu, M., Lannerstad, M., Meybeck, M., Molden, D., Postel, S., Savenije, H.H.G., Svedin, U., Turton, A., & Varis, O., (2014). The unfolding water drama in the Anthropocene: Towards a resilience-based perspective on water for global sustainability. Ecohydrology. 7 (5), 1249-1261, ISSN: 19360584

Roscoe, S, Subramanian, N, Jabbour, CJC, & Chong, T., (2019). Green human resource management and the enablers of green organisational culture: Enhancing a firm's environmental performance for sustainable development. Business Strategy and the Environment, 28(5), 737-747.

Rost, S., Gerten, D., Bondeau, A., Lucht, W., Rohwer, J., & Schaphoff, S., (2008). Agricultural green and blue water consumption and its influence on the global water system, Water Resources Research, 44-9.

Rousseau, R., (2014). Forgotten founder of bibliometrics. Nature. 510, 218 (1 page).

Shen, Y., Zhang, X., (2022). Study on the Impact of Environmental Tax on Industrial Green Transformation. 19(24).

Sidney, M.T., Wang, N., Nazir, M., Ferasso, M., & Saeed, A., (2022). Continuous Effects of Green Transformational Leadership and Green Employee Creativity: A Moderating and Mediating Prospective. Frontiers in Psychology. 13, ISSN: 16641078.

Singh, S.K., El-Kassar, A.-N., (2019). Role of big data analytics in developing sustainable capabilities. Journal of Cleaner Production. 213, 1264- 1274.

Singh,S.K.,Giudice,M.D.,Chierici,R.andGraziano,D.(2020), Green innovation and environmental performance: the role of green transformational leadership and green human resource management. Technological Forecasting and Social Change. Vol.150, 119-762.

Sulphey, M.M. , AlKahtani, N.S., Senan, N.A.M and Adow, A.H.E. (2024). A bibliometric study on organization citizenship behavior for the environment. Global Journal of environmental Science and Management. 10(2), 891-906. DOI: 10.22034/gjesm.2024.02.29

Syafrudin, Budihardjo, M.A., Priyambada, I.B., Haumahu, S.A.Q., & Puspita, A.S., (2023). Bibliometric analysis for sustainable food waste using multicriteria decision. Global J. Environ. Sci. Management. 9(SI): 271-300 (30 pages).

Teixeira, A.A., Jabbour, C.J.C., De Sousa Jabbour, A.B.L., Latan, H., & De Oliveira J.H.C., (2016). Green training and green supply chain management: Evidence from Brazilian firms, Journal of Cleaner Production, 116, 170-176.

Tiwari, S., (2015). Framework for adopting sustainability in the supply chain. International Journal of Automation and Logistics, 1(3), 256-272.

Vollmer, D., Burkhard, K., Adem Esmail, B., Guerrero, P., & Nagabhatla, N., (2022). Incorporating Ecosystem Services into Water Resources Management—Tools, Policies, Promising Pathways. Environmental Management. 69(4), 627-635.

Wang, J., & Lv, W., (2023). Research on the Impact of Green Innovation Network Embeddedness on Corporate Environmental Responsibility. International Journal of Environmental Research and Public Health. 20(4).

Wang, X., Sun, C., Wang, S., Zhang, Z., & Zou, W., (2018). Going Green or going away? A spatial empirical examination of the relationship between environmental regulations, biased technological progress, and green total factor productivity. International Journal of Environmental Research and Public Health. 15, 9, ISSN: 1661-7827.

Wehrmeyer, Walter (1996). Wehrmeyer, Walter (Ed.). Introduction. Greening People: Human Resources and Environmental Management. Sheffield: Greenleaf Publishing. 11–32. ISBN 9781874719151.

Xiao, Y., Younus, R., Saeed, W., Ul Haq, J., & Li, X., (2022). Is There a Link Between Green Human Resource Management and Consumer Buying Behavior? The Moderating Role of Employee Diffidence. Frontiers in Psychology. 13, ISSN: 16641078.

Yong, J.Y.,Yusliza, M.-Y.& Fawehinmi, O.O., (2019). Green human resource management: a systematic literature review from 2007 to 2019. 27(7), 2005-2027.

Yost, A., An, L., Bilsborrow, R., Shi, L., Chen, X., Yang, S., & Zhang, W., (2020). Mechanisms behind concurrent payments for ecosystem services in a Chinese nature reserve. Ecological Economics. Vol.169, ISSN: 9218009.

Zhao, J., Liu, H., & Sun,W., (2020). How proactive environmental strategy facilitates environmental reputation: Roles of green human resource management and discretionary slack. Sustainability (Switzerland). 12(3).

Zibarras, L.D., Coan, P., (2015). HRM practices used to promote pro-environmental behavior: a UK survey. International Journal of Human Resource Management. 26, (16), 2121-2142.

Zoogah, D. B. (2011). The dynamics of green HRM behaviors: A cognitive social information processing approach. German Journal of Human Resource Management. 25(2), 117–139.