Mapping the decade of green human resource management research: bibliometric analysis

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Abstract: To mitigate the problem of pollution and environmental deterioration, organisations are heading toward the adoption of green practices. Green human resource management (GHRM) is one such practice that attempts to increase human participation in organisational green practices. It reduces the adverse impact of human-related activities on the environment. The emergent area of GHRM has been quickly progressing with a tremendous growth rate in the production of academic publications in this area. This paper performs a bibliometric and thematic analysis of 224 papers collected from the Web of Science (WOS) and Scopus database in GHRM. The analysis is conducted with the help of biblioshiny software. The study aims to identify the most influential and productive paper in GHRM and determine the recent trends in the area. It is found that GHRM is on the development path and getting massive attention mainly from Asian academics.

Keywords: green practices; green human resource management; GHRM; bibliometric analysis; Web of Science; WOS; Scopus; biblioshiny.

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1   Introduction

The countries worldwide, either developed or developing are increasingly concerned about environmental pollution (Sharma and Gupta, 2015). Global warming has become a major area of concern as it is leading to the melting of glaciers and climatic changes (Pandey et al., 2016). The increase in the production level and industrial processes are the major contributors to environmental degradation (Jabbour and Santos, 2008).

As environmental issues have gained significant attention across the globe, organisations are attempting to reduce wastage and pollution caused by their activities (Melnyk et al., 2003). The 'Go green' concept adopted by the organisations leads them to take various green initiatives, such as green management, green accounting, green supply chain management, green marketing, and green human resource management (GHRM) (Yong and Mohd-Yusoff, 2016). As environmentalists are pointing out that human-related activities are the major cause of environmental pollution, so from the above-mentioned green practices, the GHRM practices are gaining momentum in recent times (Mishra et al., 2014).

GHRM is a recent idea that has received lot of attention at the intersection of sustainability and human resource (HR) practises (Daily and Huang, 2001). This developing profession recognises the critical role that human resource management can play in ensuring environmental sustainability within organisations (Renwick et al., 2013). A thorough analysis of the literature identifies numerous important themes and patterns. First of all, GHRM recognises the need to incorporate environment friendly practices into all HR practises, from recruitment and selection to training and development (Gill, 2012). Organisations are increasingly looking for workers that not only have the necessary abilities but also demonstrate a dedication to eco-friendly practises, fostering a 'green' workforce from the very beginning (Opatha and Arulrajah, 2014). Second, GHRM emphasises the need of environmental awareness training and development programs for staff, the employee is given the information and abilities that are necessary to adopt sustainable practices through such programs, which in turn advances the environmental objectives of the organisation (Renwick et al., 2013). Another crucial aspect of GHRM is the incorporation of environmentally conscious performance indicators into the performance evaluation process (Amrutha and Geetha, 2020). Employees' contribution to environmental sustainability are evaluated, and those who actively take part in green activities or accomplish sustainability goals may be recognised or rewarded (Dutta, 2012). Communication and engagement emerge as critical parts of GHRM, in which organisations are required to openly communicate their sustainability objectives, progress, and successes to employees and involve them in eco-friendly practices, establishing a culture of environmental responsibility (Ahmad, 2015). Employees are further motivated to align their behaviour with the organisation's green practices when they are given incentives, awards, and recognition for eco-friendly efforts (Opatha and Arulrajah, 2014). Achieving work-life balance is also considered as an important component of GHRM since stressed and overworked employees are less inclined to participate in green initiatives (Renwick et al., 2008). Flexible work schedules, telecommuting, and regulations that support a good work-life balance are all encouraged (Mampra, 2013). Additionally, GHRM demands efficient change management in order to connect the workforce with an organisation's green aims and culture, acknowledging the crucial role that employees play in achieving sustainable objectives (Chaudhary, 2019). Finally, GHRM represents a paradigm change in HR practices, recognising that

employees are not only crucial to accomplishing sustainability goals but also to promote a culture of environment responsibility inside the organisations (Fahimnia et al., 2015). In a society that is more concerned with sustainability, it helps to provide favourable environmental results, increased satisfaction among employees, and a competitive edge (Ahmad, 2015). As GHRM evolves, more research and practical applications are envisaged, heralding a more sustainable future for organisations and society as a whole (Chaudhary, 2019).

Several studies have been conducted on GHRM during the last decades. Few of the research are general and extensively cover the whole field of GHRM (Renwick et al., 2013; Shahriari et al., 2019), while others concentrate on a particular aspect, i.e., employee performance and behaviour (Alghamdi, 2021; Arulrajah and Opatha, 2016) or green health, safety, and welfare of employees (Yong et al., 2020) or environmental training (Stefanelli et al., 2019) or green workplace behaviour (Francoeur et al., 2021). All these studies contain different issues of emerging research. The review papers were comparatively straightforward, with an aggregate statistical summary of the papers reviewed and relevant fields (Amrutha and Geetha, 2020).

The present study aims to conduct a bibliometric analysis and give a general overview of research conducted on GHRM in the last decade. The authors have used the Web of Science (WOS) and Scopus database files to select the paper for analysis. The purpose is to identify the most influential and productive paper in GHRM and determine the recent trends in the area. The study also aims to identify the existing research gaps.

The research paper comprises three more sections. The next section of the article elaborates on the research methodology followed by findings, conclusion and implication, and the last limitation and future scope of research is given.

2 Research methodology

The research conducts the bibliometric analysis of the research papers in GHRM and reveals the recent trends in research in this area and identifies areas for future research. Bibliometric analysis is the quantitative analysis of bibliographic materials to know the present trends of research activities (Lu et al., 2021). This methodology has gained attention in the last decades in the research community, and it has been formulated from the library and information science (Merigó and Yang, 2017). Almost in every area, i.e., economics (Bonilla et al., 2015), social science (Ho, 2014), tourism (Ruhanen et al., 2015), library science (Swain et al., 2013), marketing (Kim et al., 2019), finance (Zhang et al., 2019; Nandan and Soni, 2023), management (Gu, 2004), psychology (Vogl et al., 2018), environmental science (Si et al., 2019), medicine (Sweileh et al., 2016), metaverse (Shukla et al., 2023) etc., literature related to bibliometric analysis has been published.

2.1 Source of data

Finding a database and extracting data from that database is the initial stage of bibliometric analysis. The data source for performing the research must be appropriate and reliable (Rueda et al., 2007). Various databases like WOS, Scopus, PubMed, Education Resources Information Center 'ERIC', IEEE Xplore, Directory of open access journal, JSTOR, and Google scholar are available. In this paper, the source of data used for extracting research papers is WOS and the Scopus database. The research papers are

extracted using the search keyword of GHRM. The timeframe for the study is from 2010 to 2021. The process of data mining is shown in Figure 1.

Figure 1   Flowchart showing bibliometric GHRM extraction from Scopus and WOS database
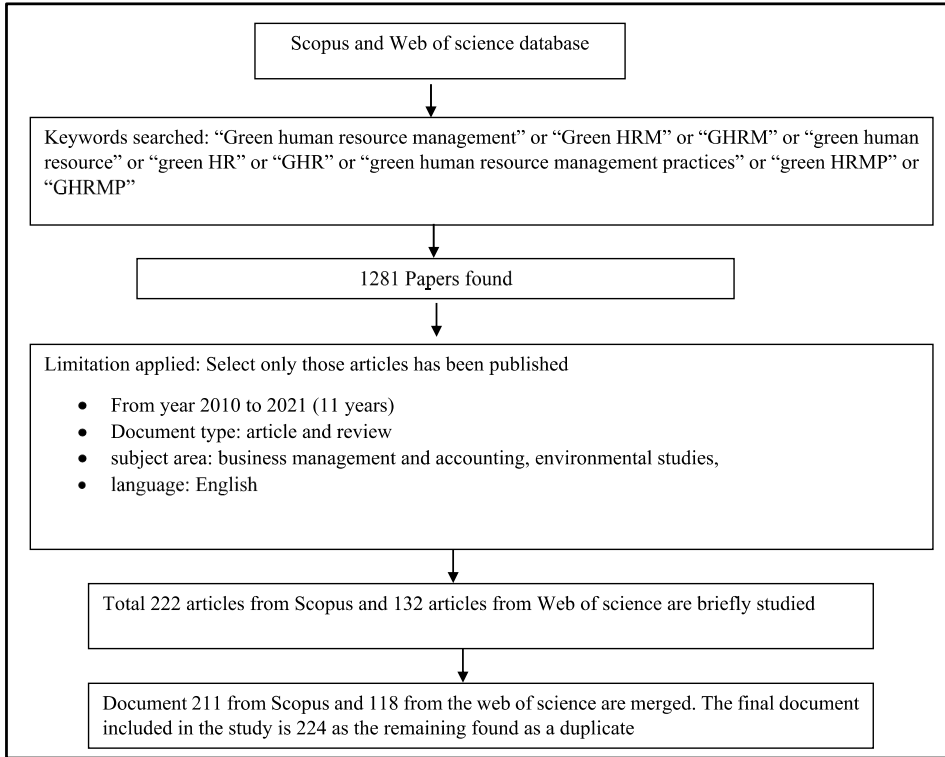
WOS is presently owned by Thomson & Reuters. It has a wide range of coverage of around 182 million journals, books, and proceedings from the year 1900 till date. While the Scopus database has around 82.4 million articles. The research considers both the Scopus and WOS databases because of the vast coverage. Scopus is a systematic, prominent indexing database for scientific production (Kipper et al., 2020). Both WOS and Scopus databases provide research area, authors, publication date, affiliation, countries, keywords, citations, and journal information (Meho and Yang, 2007; Falagas et al., 2008).

The norms and keywords used for searching data are vital as they impact the findings significantly. Previous bibliometric analysis on GHRM paper (Khan and Mukhtar, 2020) was conducted on only Scopus database, and the number of papers used was very limited. So, in this study, the researcher has used both WOS and Scopus databases. The search criteria used is a combination of nine words that are related to GHRM. The search is conducted within title, abstract, keywords, and document, the criteria used are 'GHRM' or 'green HRM' or 'GHRM' or 'green human resource' or 'green HR' or 'GHR' or 'GHRM practices' or 'green HRMP' or 'GHRMP'. The search has been limited to articles and review papers within the subject area of business management and accounting and environmental studies. All the articles considered are written in English.

Total 222 articles of Scopus and 132 articles of WOS were displayed. After this, the researcher briefly studied the abstracts and removed the unrelated articles. At last, 211 Scopus and 118 articles from the WOS database were considered. Finally, both Scopus and WOS files were merged with the help of R programming which resulted in 224 articles as the remaining articles were found duplicates (Collected on July 23, 2021).

For analysing the data, biblioshiny of R program has been used. The tool is used to examine the connection between the author, affiliation, articles, countries, and trending keywords and their relationship (Hoppen and de Souza Vanz, 2016). Further, this tool analyses the co-citation coupling, the geographical location of affiliation, and the co-authors relationship (Khan and Mukhtar, 2020).

3 Findings

As the research published from 2010 to July 2021 was considered for study, therefore, the first article was found to be published in 2010. The overview of data used for bibliometric analysis is presented in Table 1. A total of 224 articles from 87 sources, i.e., journals, books, and conferences were found as indicated in Table 1.

Table 1 Overview of data

Description	Results
Main information about data	
Timespan	2010–2021
Sources (journals, books, etc.)	87
Documents	224
Average years from publication	1.79
Average citations per document	26.04
Average citation per year per document	6.929
References	13,347
Document types	
Articles	204
Articles early access	4
Review	16
Document contents	
Authors keywords	591
Keyword plus	389
Authors	
Authors	541
Authors appearances	727
Authors of single author documents	22
Authors of multi author documents	519

Table 1   Overview of data (continued)

Description	Results
Authors collaboration	
Single authored documents	30
Documents per author	0.414
Authors per document	2.42
Co-authors per document	3.25
Collaboration index	2.68

The average year for publication of documents is found to be 1.79. The overall average citation of the individual document is 26.04 while the citation per year is 6.929. Out of the total 224 documents obtained; 204 are articles, 4 are early access articles, and 16 are review papers. Keywords are also divided as author keywords, which are given by the authors, and keyword plus, which are automatically software-generated. In this study, 591 authors' keywords and 389 keywords plus are obtained as shown in Table 1. It is explored that a total of 727 authors have written articles in the related area, out of which, 22 authors have written a single article and 519 authors are found to have written two or more articles. The average number of co-authors per document is 3.25, document per author is 0.414, and authors per document are 2.42. The collaboration index is 2.68, which is used to measure the level of collaboration between authors.

Figure 2   Annual trend in the publication of GHRM articles (see online version for colours)
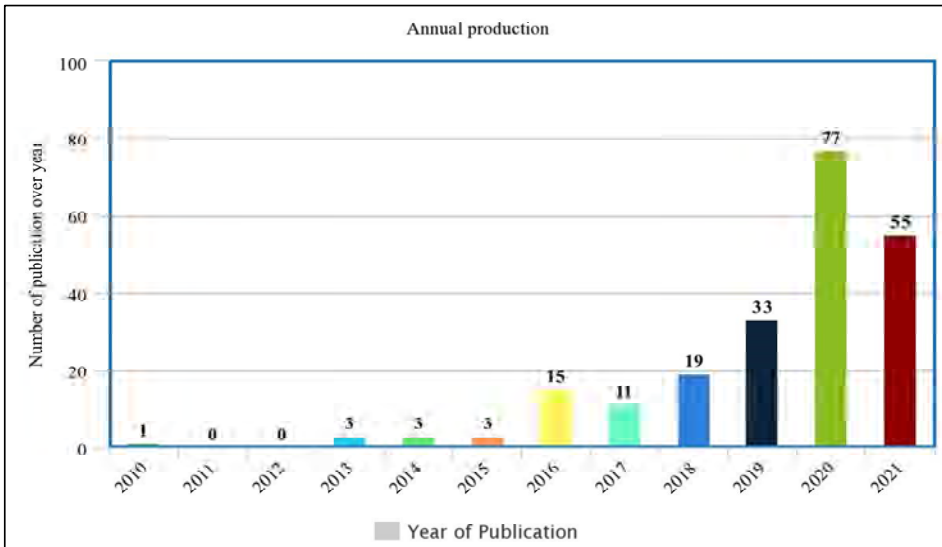
3.1 Annual production

Figure 2 indicates the rising trend of research in the field of GHRM. The figure indicates that GHRM became popular after 2015 because from 2016 to 2021, 95% of the total publications are found. The largest number of articles i.e., around 35% are published in

2020. In 2019, 15% of papers are found and till July 2021, 25% of research articles are published. This increasing trend indicates that the area of GHRM is getting more attention among researchers and academicians.

3.2 Source statistics

Figure 3 illustrates the top 10 journals as per their h-index in which articles related to GHRM are published. The figure indicates that the *Journal of Cleaner Production* is the topmost journal with h index 19.

Figure 3 Top 10 journals with h index (see online version for colours)
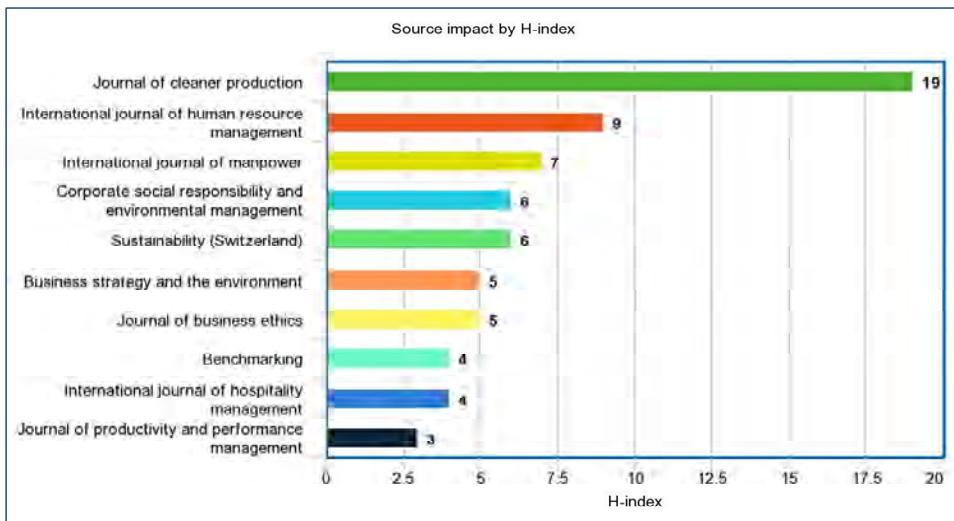

Figure 4 Publication of articles in top 10 journals (see online version for colours)
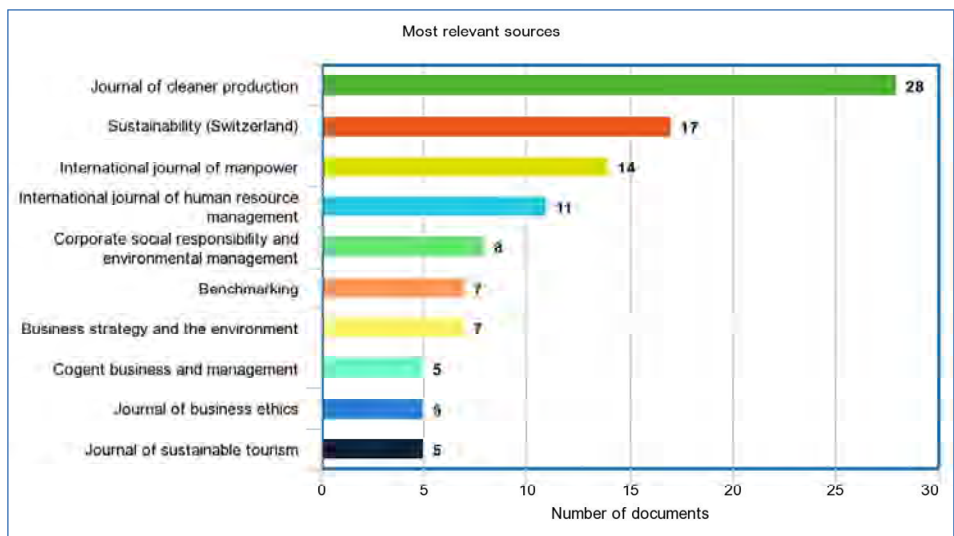
Figure 4 indicates the number of articles published by top 10 journals in the field of GHRM. It is shown that *Journal of Cleaner Production* is the topmost journal which published 28 articles. Also, around 47% articles are found to be published in top 10 journals.

Table 2 provides the details of the publication year wise in the top 10 journals. It indicates that in the topmost journal, the maximum publication of articles related to GHRM is in 2018, 2019 and 2021. Further journals at the second rank published studies from 2018 reaching a maximum in 2021. It can also be seen that the publication of GHRM related articles gained pace in 2015.

Table 2   Year-wise detail of articles published in top 10 journals

Journals	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Journal of Cleaner Production	0	0	0	0	0	1	4	2	2	7	7	5
Sustainability (Switzerland)	0	0	0	0	0	0	0	0	2	2	6	7
International Journal of Manpower	0	0	0	0	0	0	0	0	0	0	12	2
International Journal of Human Resource Management	0	0	0	1	0	1	7	0	0	0	0	1
Corporate Social Responsibility and Environmental Management	0	0	0	0	0	0	0	0	1	3	2	2
Benchmarking	0	0	0	0	0	0	0	0	0	1	3	3
Business Strategy and the Environment	0	0	0	0	0	0	0	0	0	2	3	2
Cogent Business and Management	0	0	0	0	0	1	0	1	0	0	2	1
Journal of Business Ethics	0	0	0	1	1	0	0	0	2	0	1	0
Journal of Sustainable Tourism	0	0	0	0	0	0	0	0	1	1	2	1

3.3   *Authors statistics*

3.3.1   *Authors influences*

Bibliometric analysis of data explored the prominent authors in terms of the articles and number of citations. Table 3 provides the list of leading authors in Green HRM from the WOS and Scopus indexed journals during the period 2010 to 2021. The table shows that Jabbour and Yusliza has published 10 articles, Chiappetta has published nine articles,

Guerci and Renwick wrote 6 articles. It can also be seen from the table along with the good number of articles written by these authors, the quality of the research is maintained which is indicated by the corresponding h index.

Jabbour attempts to create a bridge between GHRM and green supply chain management (Jabbour et al., 2016). Anwar et al. (2020) have explained how environmental citizenship behaviour and employee green behaviour can be achieved in an organisation. Jackson et al. (2011) show the future direction path of GHRM.

Table 3 Leading authors in Green HRM

S. no.	Authors	Articles	H-index
1	Jabbour, C.J.C.	10	9
2	Yusliza, M.Y.	10	7
3	Chiappetta, J.C.	9	6
4	Guerci, M.	6	6
5	Renwick, D.W.S.	6	5
6	Fawehinmi, O.	5	4
7	Khan, M.	5	3
8	Pham, N.T.	5	4
9	Ramayah, T.	5	5
10	Yong, J.Y.	5	5

Figure 5 Authors co-citation analysis (see online version for colours)
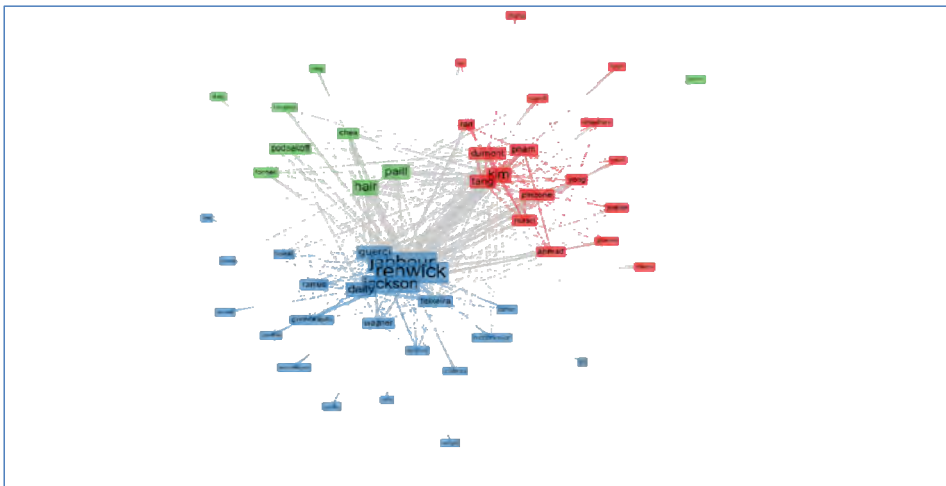
3.3.2 Author co-citation analysis

The citation of authors and papers can be used to evaluate the prominence of the study in the literature i.e., the popularity of the paper (Ye et al., 2020). When two authors, P and Q are cited in article R, then studies, P and Q are known as co-citation (Fahimnia et al., 2015). Figure 5 indicates the analysis of the top 50 authors, who are cited by other authors at least 20 times. The figure segregates the authors into three clusters shown

using three colours, blue, green, and red. The blue cluster is the biggest cluster, followed by red and green. The size of the box, determines the density of co-citations, the large box indicates a highly co-cited author. Jabbour from the blue cluster is the most co-cited author followed by Renwick and Jackson; in the red cluster, the most co-cited author is Kim and in the green cluster, the most co-cited author is Hair. Hence, the most prominent authors are Jabbour, Renwick, and Jackson. Since, these authors have the highest PageRank, which are 0.0213132762737008, 0.021312532372084, and 0.0213104419847717 so, they are the most popular and prestigious authors in GHRM. PageRank defines the relationship within webpage which can be lengthened to explore the relationships between citation network and papers (Fahimnia et al., 2015).

3.3.3 Authors collaboration analysis

To display the collaboration structure of authors, biblioshiny software is used to conduct the analysis with the collected dataset of 224 articles from 2010 to 2021. Out of the total of 541 authors, the top 50 most cited authors are displayed in the figure obtained. In Figure 5, the selected authors are represented as the nodes in the filters bar and the number of edges represents a minimum number of collaboration of authors, in this case the number of edges is 2. As shown in figure, 10 clusters are formed. The thickness of a line within the cluster represents the degree of collaboration. The top 3 collaboration clusters are turquoise followed by red and green. As per betweenness and PageRank value; the five most collaborated author is Yusliza followed by Renwick et al.

The betweenness centrality index defines how many times the node is situated in the nearest probable distance from other nodes in the network. The higher betweenness of the node plays a vital role in collaborating with a network (Leydesdorff et al., 2018). Figure 6 indicates, significantly less collaboration between the authors; most of the articles are published independently.

Figure 6   Author collaboration analysis (see online version for colours)
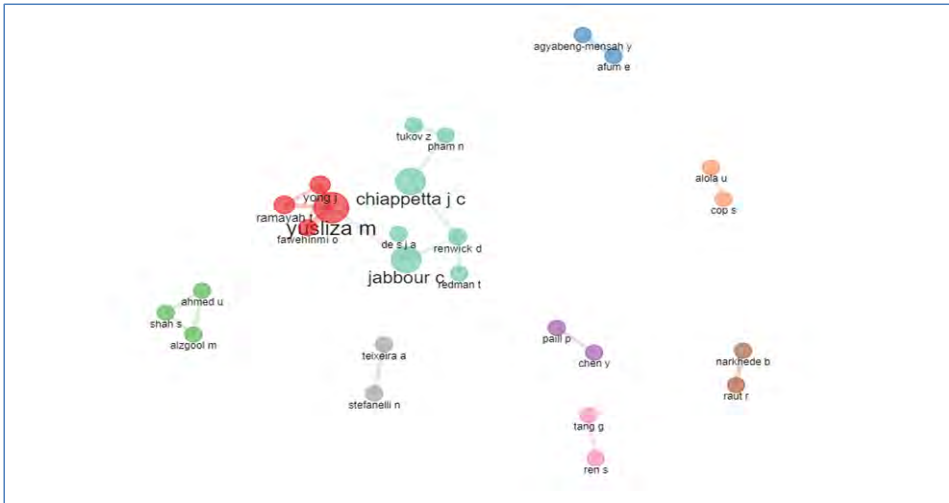
3.4 Keywords statistics

3.4.1 Most frequently used keywords

Keyword analysis is conducted to determine the most frequently used phrases/words in the title of the articles, abstract and keywords. Out of 591 authors of the collected database, the top 50 keywords are analysed, as shown in Figure 6. Figure 7 indicates that the ten most frequently used keywords are GHRM (frequency 87), green HRM (frequency 40), environmental performance (frequency 35), sustainability (frequency 31), environmental management (frequency 25), green training (frequency 14), human resource management (frequency 14), environmental sustainability (frequency 12), GHRM (frequency 11), and corporate social responsibility (frequency 10). The GHRM and green HRM keywords have appeared because they are included in the searching criteria of the Scopus and WOS database.

Figure 7   Frequency of keywords (see online version for colours)

3.4.2 Co-occurrence of keywords

Keywords in a research paper show the important content of the research. To find out the borders and research hotspot, the intensity and co-occurrence analysis of words is conducted (Ye et al., 2020). In the analysis done using biblioshiny software, 50 nodes are indicated which represent top 50 author keywords and minimum number of edges shown is 3, representing number of co-occurrences of keywords. Figure 8 shows that only three clusters are formed of red, blue, and green colours, but only 27 keywords are identified with a minimum of 3 co-occurrences. The circle's diameter is proportional to the degree of co-occurrence of keywords. The top two keywords in each cluster are GHRM and environmental performance in the red cluster; sustainability and environmental management in the blue cluster; and green HRM and environmental sustainability in the green cluster. Five keywords that have the highest betweenness and PageRank follow GHRM (211.896016826721 and 0.23969454690222), green HRM (106.371095544726 and 0.117112653182916), sustainability (79.5474571649772 and 0.102538718613904), environmental management (26.8848792018553 and 0.0810084681730047), and environmental performance (16 and 0.0622784979767027).

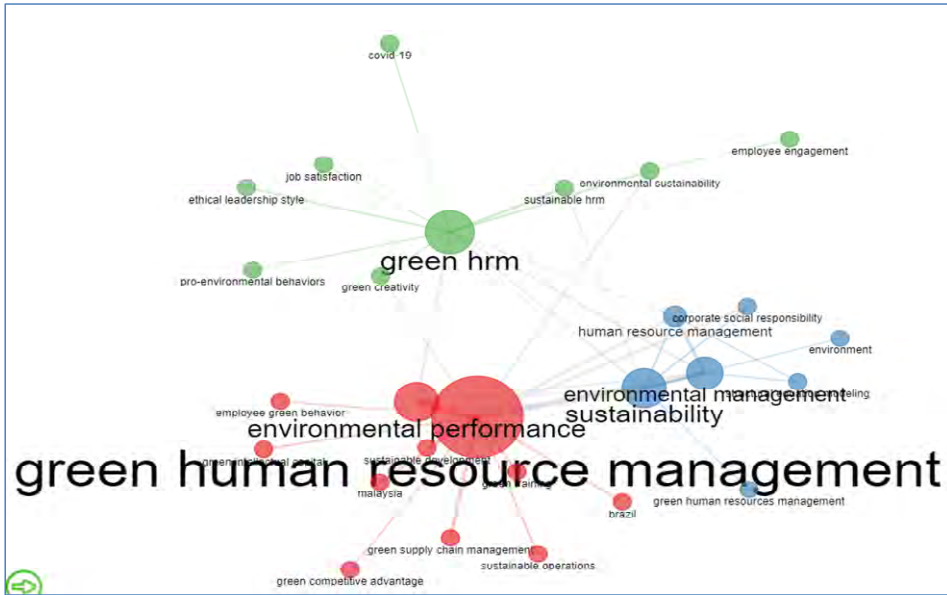**Figure 8**   Co-occurrence analysis of keywords (see online version for colours)

Table 4   Affiliations of GHRM articles

Institutions	Country	No. of documents
Montpellier Business School	France	16
Universiti Sains Malaysia	Malaysia	12
Universiti Malaysia Terengganu	Malaysia	11
Nottingham Trent University	England	6
University of Milan	Italy	6
University of the Punjab	India	6
Abu Dhabi University	UAE	5
An-Najah National University	Palestine	5
Dalian Maritime University	China	5
Shandong University	China	5

3.5   Affiliation and global analysis

3.5.1   Most relevant affiliation

The most relevant affiliation is measured in terms of the productivity of an article by the institution. Table 4 represent the top 10 most relevant institution out of 224 articles and 358 affiliations. Montpellier Business School from France has contributed the highest number i.e. 16 manuscripts, followed by Universiti Sains Malaysia and Universiti Malaysia Terengganu, both are from Malaysia with 12 and 11 articles respectively. Nottingham Trent University from England have 6 articles, University of Milan from Italy contributed 6 papers. As individually Malaysia, with two institutes out of 10, has the

highest number of articles i.e. 23. Table 4 found that 7 out of 10 affiliations are from the Asian continent, and they produced aggregately 49 articles, implying that these Asian countries and their institutions are more concerned towards GHRM.

3.5.2 Affiliation collaboration analysis

The collaboration of affiliation is a vital aspect of bibliometric analysis, as it helps to identify the collective contribution of the organisations. This analysis has been executed through biblioshiny software, with a number of nodes 50, representing the top 50 affiliations, and the minimum number of edges 2, representing 2 collaborations between the affiliations. The analysis revealed that only 21 affiliations are found with at least 2 collaborations, and 7 clusters are formed as shown in Figure 9. The top 3 largest clusters are red, blue, and green. Top 5 institutions that have the highest betweenness and PageRank are, Universiti Sains Malaysia, Montpellier Business School, Universiti Malaysia Terengganu, Shandong University, and Rutgers University.

Figure 9 Affiliations collaboration analysis (see online version for colours)
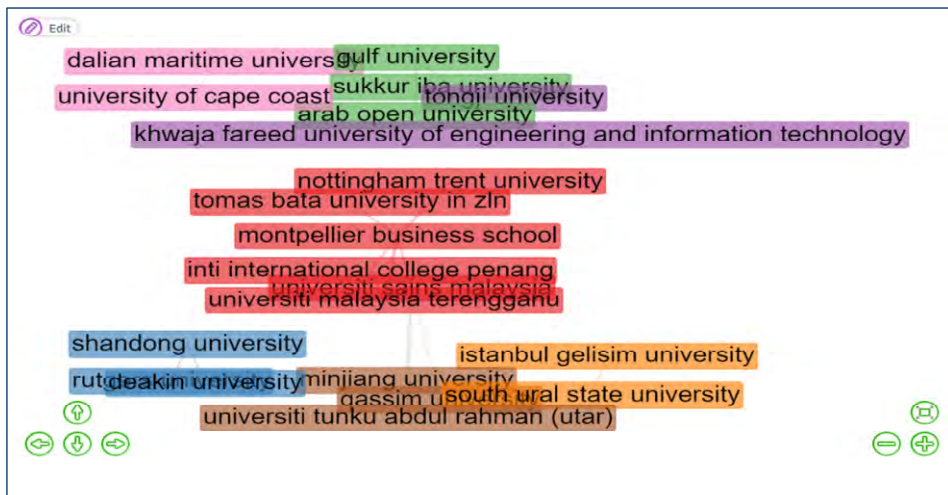
3.5.3 Geographical location of affiliation

The authors' institutions are obtained from excel file, downloaded from Scopus and WOS databases. For each institution, their exact location where they are situated is used for analysis; further, with the help of Google sheet and geocoding, the longitude and latitude of the organisations has been identified and through Google maps the visualisation in the world map is obtained as shown in Figure 10. The red dot in Figure 9 represents the organisation's location, a total of 358 affiliations have contributed to GHRM, and their frequency of participation is 552. The top five contributing affiliation countries are Malaysia, whose frequency is 75, China whose frequency is 68, Pakistan whose frequency is 51, India frequency is 39, and Brazil whose frequency is 35. Out of the top 5 most frequent affiliation countries, four are from the Asian continent; their contribution is around 42% of the total contribution.

Figure 10   Geographical location of the affiliation (see online version for colours)
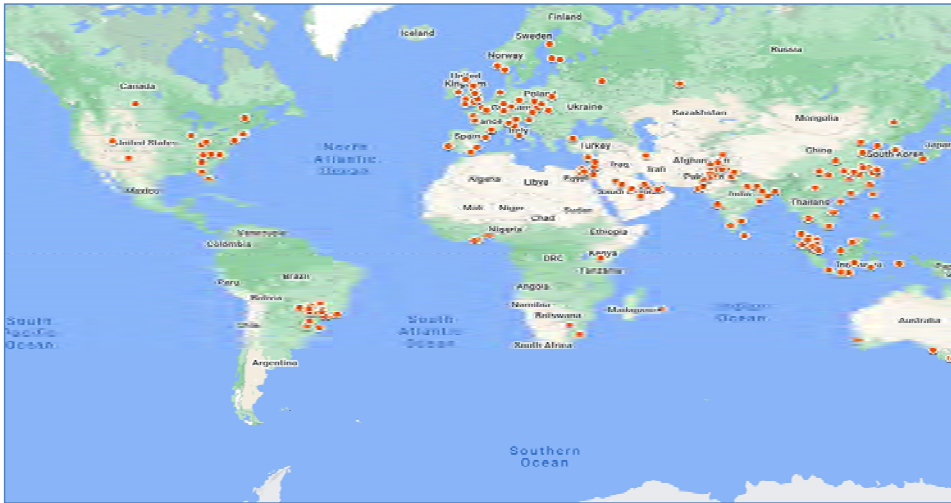
3.5.4 *Most relevant countries*

The contribution of the country towards GHRM determines its relevancy. In this analysis both productivity and total citation of the country is considered. Table 5 clearly shows the top 10 contributing countries; Malaysia is the most productive country which has published 28 articles, followed by China with 26 articles, India with 22 articles, Pakistan with 19 articles, and the UK with 18 articles. Even though the UK is not the most productive country but it's the most cited country all over the world with 860 total citations. Also, there are few countries that have published a good number of articles but have less citation, such as Indonesia which has 7 published papers, but the citation is only 5. Hence, out of this analysis it can be concluded that mainly developing, and Asian countries are actively participating in GHRM.

Table 5   Countries in order of their relevance

Country	No. of articles	Total citation
Malaysia	28	402
China	26	564
India	22	227
Pakistan	19	240
UK	18	860
Australia	17	309
Brazil	12	379
USA	10	293
France	9	281
Indonesia	7	5

4 Conclusions and implication

The paper presents a constructive review of GHRM. There have been more than two hundred articles written in the last decade. Also, few literature review papers are published in the field of GHRM. In the present study, bibliometric analysis method is used to identify the annual production of papers, source of the articles, authors influence, co-citation of authors, authors collaboration, most frequently used words, co-occurrence of words, most relevant affiliations, the collaboration of affiliation, geographical location of the institution, and most relevant country on the GHRM related literature in the Scopus and WOS database from 2010 to 2021. The biblioshiny software is used to analyse, quantitively the bibliographic data to visualise the present trends of GHRM. The major findings are as follows.

Firstly, annual production trends of GHRM shows a significant rise after 2016 and further rapid growth from 2019 till date, which indicates that the GHRM topic is getting more attention among researcher at present. The sources of articles are also analysed, and the top 3 most contributing sources found are *Journal of Cleaner Production*, *Sustainability* (Switzerland), and *International Journal of Manpower*. Analysis of authors found that lot of authors are highly productive and can maintain the high h index, but significantly less collaboration is revealed between the authors; except few highly collaborative authors such as Yusliza et al. (2019) which implies that most of the articles are published independently.

In keyword analysis, 50 most frequently used words are analysed, and it is found that 5 most trending words are GHRM, green HRM, environmental performance, sustainability, and environmental management. These keywords help the researchers to explore this area. Affiliation and global analysis identified the top 10 most contributing institutes out of which top 3 are Montpellier Business School, Universiti Sains Malaysia and Universiti Malaysia Terengganu. Further, the location analysis of all the institutions found that most of the contributing affiliations are situated in Asia and the top three countries are Malaysia, China, and India.

This article gives an overview of the present state of GHRM research, including developing trends, notable authors, and significant publication sources. This is crucial for academics and researchers who want to keep up with the most recent advancements and efficiently sort through the enormous amount of GHRM literature. Additionally, bibliometrics analyses citation trends and publication reach to quantify the effect of GHRM research, allowing for an evaluation of the field's significance and relevance. It may provide policymakers and regulatory authorities with information on the most recent trends and best practises in GHRM, by analysing prominent publications and authors, policymakers may identify experts in the area whose insights assist the creation of GHRM-related policies. This data may also be used by policymakers and organisations to match their goals and policies with the most recent research trends and best practises in green HR.

5 Limitation and Scope for future research

As most of the articles have certain limitation, so this research is also not an exemption. Its major limitation is related to bibliometrics analysis. The data collected and analysed, is limited to only WOS and Scopus database from 2010 to 23 July 2021; therefore, the

data from different databases and at different times frame may vary the findings. The study is limited to the article and review papers in business management and accounting, environmental studies. Further, the search range of this paper is limited to title, abstract, and keywords. So, future research can be conducted by using different databases or extending the databases used. Also, the search range can be increased.

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