INTERNATIONAL JOURNAL OF MANAGEMENT STUDIES
https://e-journal.uum.edu.my/index.php/ijms

How to cite this article:
Zaki, H. O., & Rosli, N.(2024). A bibliometric citation analysis on green marketing and waste management. *International Journal of Management Studies*, *31*(1), 235-268. https://doi.org/10.32890/ijms2024.31.1.9

A BIBLIOMETRIC CITATION ANALYSIS ON GREEN MARKETING AND WASTE MANAGEMENT

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Received: 12/2/2022 Revised: 3/12/2022 Accepted: 12/3/2023 Published: 31/1/2024

ABSTRACT

The research interest in the field of green marketing and waste management can be demonstrated through the published literature on the topic. However, there is a paucity of extensive and systematic research focusing on the evolution of this discipline in terms of its citation work. The main objective of this study is to explore the status of scholarly works on green marketing and waste management through a bibliometric citation and networking analysis of papers published from 2012 to 2021. The data was extracted from the Web of Science (WOS) utilizing the Preferred Reporting Items for Systematic Review and Meta-Analysed (PRISMA) review process. The VOSviewer software was used to visualize the networking linkages. The findings of descriptive analysis showed that publications and citations related to green marketing and waste management are highest in 2021. Likewise, the networking analysis showed that the

Science of the Total Environment journal has the highest citation counts, while Wan Yinfeng, Wang Junshi, Xu Guoping and Yi Huang are the authors with the highest citation counts, respectively. The findings also uncovered Sinosteel Wuhan Safety & Environmental Protection Research Institute (WSEPRI) as the most cited institution. Co-authorship and co-occurrence analysis were also found to provide significant discoveries. This study offers future scholars' knowledge on the analysis of cited journals, papers, authors, institutions, and countries in the same field. Overall, the study serves as a guide for journal editorial boards on the growth among authors and networking opportunities in the field of green marketing and waste management, especially at the international level.

Keywords: Bibliometric, green marketing, networking, VosViewer, WOS, waste management.

INTRODUCTION

In the past few years, the research on human behaviour and its association with waste management has expanded aggressively (Concari et al., 2022). Furthermore, the growing scholarly works on this subject make it increasingly difficult to comprehend the key areas of interest, top-ranked institutions and authors, and the potential links between the fields and the research gaps. Several authors have conducted bibliometric studies in the field of waste. Among others is a study that looked into the research trends in the field of waste between 1993 and 2008 (Fu et al., 2010). Besides that, some studies have also specifically focused on waste treatment, including an analysis of the reuse and recycling of solid waste between the years 1992 to 2016 (Li et al., 2018) and a study that looked into the features and trends of research in the waste's incineration and energy conversion (Wang et al., 2016). Likewise, a study dealing with food waste from 1997 to 2014 (Chen et al., 2017), a study investigating the characteristics and development of Resources Conservation and Recycling (RCR) over the past 30 years (Ji et al., 2018), and a study that looked into economic aspects of municipal solid waste management system (Medina-mijangos & Seguí-amórtegui, 2020) were also conducted. Some authors attempted to specifically explore the field of environmental management and social marketing (Letunovska et al., 2021); however, research insights in terms of citation works and

networking analysis that focused on green marketing aspects of waste management remain scarce. To solve the mentioned scarcity, therefore, the study emphasized four main research objectives that are separated into two main analysis parts, which include the descriptive analysis as well as the networking analysis. The main research objective is to descriptively analyse the overall counts of the journals, citations, and the h-index of journals in the WOS database from the year 2012 until 2021. Specifically, the study aims to conduct a networking analysis by examining the most prominent journals, articles, authors, institutions, and countries' citations on green marketing and waste management and identifying the most co-occurrences of all keywords mentioned on green marketing and waste management.

Following the objectives, it is anticipated that the outcomes of the bibliometric citation and networking analysis will encourage research publications related to green marketing and waste management to expand and provide opportunities for research collaborations. This study is important as it offers existing and new researchers access to knowledge and insights on citations for journals, papers, and authors. Insights on worldwide networking analysis of journals, papers, authors, institutions, and countries can also be used to strategize research collaborations. This study may also encourage young researchers to engage in novel research ideas in the field of green marketing and waste management. Also, this paper can serve as a useful reference not only for the researchers but, most importantly, for waste management firms to engage in co-industry research. Finally, this research may allow journal editorial boards to keep track of authors' growth and potential in the field of green marketing and waste management research.

LITERATURE REVIEW

The world's population becomes increasingly dependent on consumption, resulting in massive volumes of waste. Each year, approximately 2.01 billion tonnes of municipal solid waste are generated worldwide (Kaza et al., 2018), and 33 per cent of this waste is not managed in an environmentally safe manner. It is also reported that over the next 30 years, worldwide waste is expected to rise by 70 per cent, reaching a whopping 3.40 billion tonnes each year due to rapid urbanization, growth of the population, and economic

development (Kaza et al., 2018). Research has also suggested that green marketing and waste management have grown rapidly through eco-tourism, sustainable and innovative marketing techniques, and green labelling, which are increasingly gaining importance (Kar & Harichandan, 2022).

According to the World Bank Group, food and green waste account for more than half of all waste in low and middle-income nations. Meanwhile, in the high-income nations, due to the higher volumes of packaging waste and other non-organic waste, the proportion of organic waste is roughly 32 per cent. Around 37 per cent of waste is discarded in landfills, 33 per cent is openly dumped, 19 per cent undergoes recycling and composting, and 11 per cent is processed using modern incineration Fields (Kaza et al., 2018). These volumes had a significant impact on the ecosystem, endangering the globe and posing a threat to natural resources. Uncollected waste and improperly disposed waste have a substantial impact on public health and the environment (Abdullah et al., 2021; Kaza et al., 2018). Furthermore, it also results in a long-term economic impact on environmental recovery, which frequently leads to increased costs of developing and operating basic, appropriate waste management systems (Kaza et al., 2018; Sreenivasan et al., 2012).

In this setting, a new business has begun to show greater promise. The waste management sector has reached unimaginable heights. Waste management refers to the activities and actions that deal with waste products or materials, and it encompasses waste collection, transportation, processing, and disposal (Wan et al., 2019; Zaki et al., 2021; Zaki & Fernandez, 2023). Nowadays, more people, especially new generations, are becoming environmentally conscious. Many international groups are also issuing distress messages through campaigns to raise awareness and make the world's largest consumers more concerned about the environmental effects (Zakaria et al., 2020). The main purpose of conducting a campaign is to educate the public on waste management and how to reduce carbon emissions. While most people have some basic knowledge of waste management, including recycling, waste disposal, and hazardous waste handling, some others do not. Traditionally, a common approach is to communicate with the prospect through some form of communication channels, such as email, social media, or phone calls. Hence, efficient marketing approaches

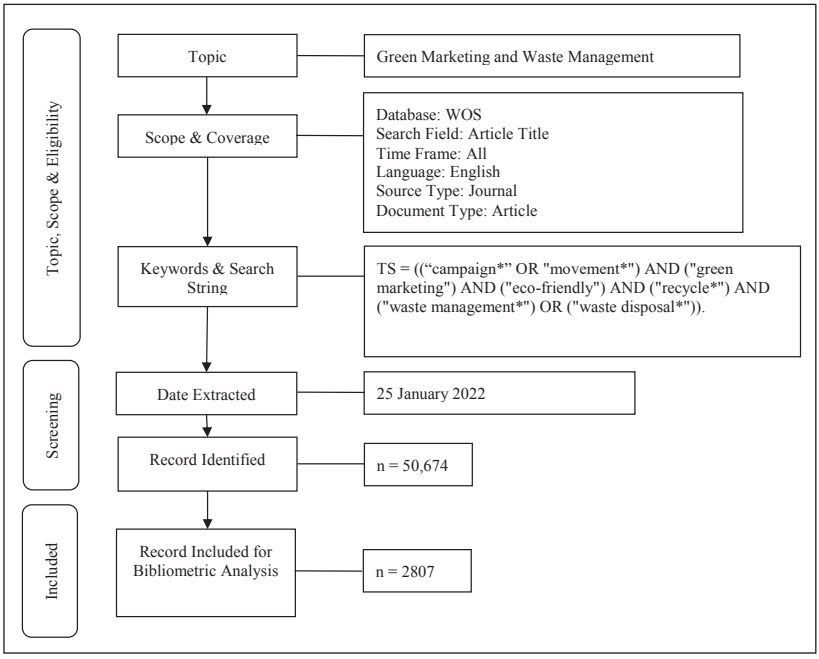
such as green campaigns are required to increase the visibility of the message and boost people's awareness about environmental issues and how to prevent them from happening.

METHODOLOGY

In this study, papers were extracted from the WOS database for the bibliometric citation analysis (Merigó et al., 2015). WOS was chosen as it is widely regarded as the most trustworthy, powerful and reliable database in the world and is guided by the legacy of Dr. Eugene Garfield, the inventor of the world's first citation index (Saleem et al., 2021). The PRISMA review process in Figure 1, which consists of three phases, was used to (1) identify, (2) screen and (3) include or exclude papers that were extracted from the WOS database. The review process was conducted on 22 January 2022 following these three phases.

Figure 1

PRISMA Inclusion and Exclusion Process Flow



In the first phase of Figure 1, a literature search using the WOS database was conducted. The search query includes *TS=((“campaign*” OR “movement*”) AND (“green marketing”) AND (“eco-friendly”) AND (“recycle*”) AND (“waste management*”) OR (“waste disposal*”))*. The search yielded an initial 50,674 number of papers. In the second phase, the 50,674 papers were individually screened according to certain criteria including (1) document types, (2) journals or sources, (3) year, (4) author and (5) language used. Subsequently, the third phase, which is the inclusion and exclusion criteria, was performed (refer Table 1).

Table 1

Article Extraction from WOS with Inclusion and Exclusion Criteria

Criterion	Inclusion	Exclusion
Types of Documents	Article	Retracted paper
	Book and Book chapters	Corrections
	Review	Notes
	Conference paper	Editorial
Journals/Sources	Business and Management	Pure Sciences
	Communication	History
	Environmental Studies	Arts
	Public Environmental and	Engineering
	Occupational Health	Other non-related
Year	2012 - 2021	1970 - 2011
Language	English	Non-English
WOS index	SSCI	ESCI and other indexes

All the information obtained throughout these phases was used as a source for bibliometrics citation and networking analysis. In a nutshell, the study chose research articles, books, and editorial reviews that are published in the English language and indexed in the WOS database. The study only includes journals related to management, business, communication, environmental studies, and public environmental and occupational health research. To ensure the quality and relevancy of the paperwork in this field, the study includes articles in the field of interest that were published in a ten-year period, from 2012 to 2021. The result from the screening, inclusion and exclusion process finally generated a total of 2807 articles to be used for the bibliometrics analysis.

In regards to analytical tool selection, there are several software applications available on the market, such as CiteSpace, IN-SPIRE, Vantage Point, SciMAT and VOSviewer (Cobo et al., 2011, 2012; Concari et al., 2022). The VOSviewer was chosen for several reasons: (1) its user-friendly visualization platform (Cobo et al., 2011) and (2) its ability to accommodate both mapping and clustering of bibliometric networks (Waltman et al., 2010).

RESULTS AND DISCUSSIONS

Descriptive Analysis

The descriptive analysis briefly emphasizes information on the total counts of journals, citations, and h-index of overall journal publications from 2012 to 2021. The inclusion and exclusion via the PRISMA process generated a total of 2807 articles from the preliminary 50,674 articles for the bibliometric citation and networking analysis. One of the most important elements of an article, other than its citation counts, is the h-index. The h-index denotes the researchers' metrics that measure publication productivity and citation impact (Fu et al., 2020). In this study, it is discovered that all the documents extracted from WOS related to waste management are considered for the 101 h-index. This suggests that the researcher has published at least 72 articles and that each has been cited at least 72 times (refer to Figure 2). Consistently, in the period from 2012 to 2021, there is an aggregate number of 2807 of articles with a total of 39,044 times cited on research related to waste management.

Figure 2

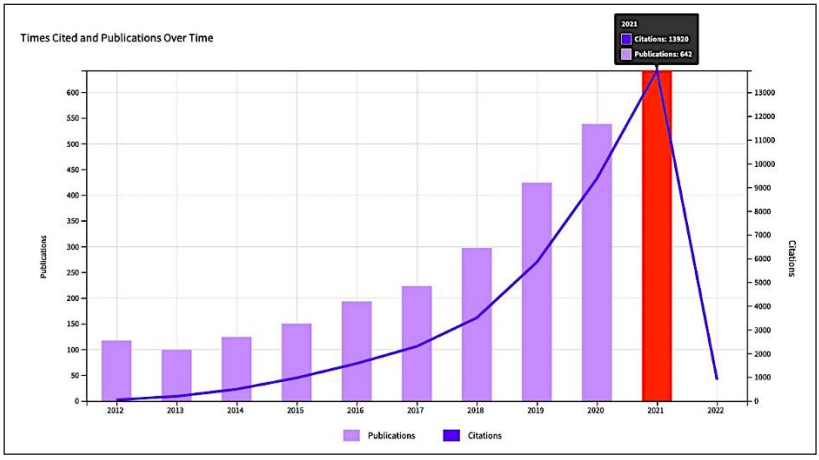
Information on total Citations and h-index Extracted from WOS

Publications	Citing Articles	Citing Articles	13.91	72
82,807	34,577	39,044	Average per item	h-index
Total	Total	Total		
	34,014	38,227		
	Without self-citations	Without self-citations		

Additionally, the citation by years for publication work on waste management from 2012 to 2021 showed a discrepancy in the trend (refer to Figure 3). The final data extraction from WOS revealed that the highest number of publications and citations is in 2021, with 13,920 published document counts and 642 citation counts. Similarly, trends in the publication and citation counts showed an average increase from 2013 to 2016 and a sharp increase from 2017 to 2020, with 11,500 documents published. Looking at these trends, it can be predicted that the number of publications and citation counts on green marketing and waste management will increase tremendously in 2024/2025 in line with the campaigns on green products, green waste, and green consumption.

Figure 3

Citations by Years Extracted from WOS from 2012 to 2021



Networking Analysis

Citation on Most Cited Journals

Regarding the most cited journals, from the 2807 articles published between 2012 and 2021, the top 20 journals in the field of green marketing and waste management presented a wide-ranging number of documents and citations. Table 2 summarises publication patterns for 10 years, exhibiting numerical information on document counts, citations, and total link strength correspondingly for the top 20 journals.

The outcomes revealed that the Science of the Total Environment journal has the highest citations (946) and total link strength (13). Following this is the Journal of Environmental Management, with 808 citations and 10 total link strengths. These two journals have grown in their citation and number of documents, which leads to total link strength mainly due to their long presence since the 1970s until now. Such is true, as Ahmed et al. (2004) mentioned that oldest journals have a higher tendency for higher citations, consequently increasing collaboration strength between authors.

In comparison, some of the lowest cited journals include the Journal of Environmental Protection and Ecology with 55 citations, the International Journal of Environmental Research with 50 citations, The Polish Journal of Environmental Studies, and the Management of Environmental Quality journal with 58 citations, respectively. This revealed that the number of researches on green marketing and waste management published in these journals is smaller than the top 2 journals, thus leading to low collaboration or link strength between authors. Other than that, these journals focused more on the technical part of waste management, such as biochemical and radioactivity, rather than on the management or business perspective. This may demotivate article submissions from management and business researchers. Furthermore, as outlined by SCImago, these journals were only established after the year 2007. Therefore, the coverage from 2007 till today limits the citation counts for the journals.

Conclusively, from 2012 to 2021, the outcomes also revealed that although citation counts for the Science of the Total Environmental journal are more than the Journal of Environmental Management, the number of documents and total link strength for the Journal of Environmental Management is much higher. This implies that citation count does not govern the increase in documents and link strength among authors or journals. In general, over the 10 years, there has been undeniably an increase in the citation counts, published documents, and link strength for collaborations for journals covering research on green marketing and waste management research. This indicates that there is a decent progression of citation trends for journals listed in Table 2. In a nutshell, in terms of link strength, it can be observed that alongside the 10 years, the Science of the Total Environment journal and the Journal of Environmental Management, among others, have the strongest total link strength, indicating high citation counts, which are above 800.

Table 2

Most Cited Journals on Green Marketing and Waste Management from 2012-2021

Journals		Document	Citation	Total Link Strength
1	Science of the Total Environment	37	946	13
2	Journal of Environmental Management	44	808	20
3	Seventh International Conference on Waste Management and Technology	7	442	2
4	Journal of Material Cycles and Waste Management	40	347	11
5	Environmental Science and Pollution Research	43	313	11
6	International Journal of Environmental Research and Public Health	26	270	10
7	Environment International	5	232	4
8	Environmental Pollution	8	191	3
9	Chemosphere	16	182	1
10	Journal of Environmental Radioactivity	6	160	0
11	Journal of Environmental Engineering and Landscape Management	5	151	0
12	Environmental Engineering and Management Journal	21	119	4
13	BMC Public Health	4	70	2
14	Critical Reviews in Environmental Science and Technology	4	68	2
15	Environmental Monitoring and Assessment	8	62	1
16	Environmental Technology	6	59	2
17	Management of Environmental Quality	7	58	1
18	Polish Journal of Environmental Studies	8	58	0
19	Journal of Environmental Protection and Ecology	6	55	0
20	International Journal of Environmental Research	5	50	0

Citation on Most Cited Authors

Given most cited authors, it is found that authors also have the disposition to be cited by researchers in the same field. Table 3 has shortlisted the top 20 authors being frequently cited from 2012 to 2021. In these 10 years, Wan, Wang, Xu, and Yi respectively received 318 citations. This is followed by Li with 230 citations and Tansel with 171 citations, who, among others, have received some of the highest citations from their research articles.

Table 3

Most Cited Authors in the Field of Green Marketing and Waste Management from 2012-2021

	Authors	Document	Citation	Total Link Strength
1	Wan, Yinfeng	1	318	0
2	Wang, Junshi	1	318	0
3	Xu, Guoping	1	318	0
4	Yi, Huang	1	318	0
5	Li, Jinhui	4	230	8
6	Tansel, Berrin	1	171	34
7	Zeng, Xianlai	2	145	6
8	Kahraman, Cengiz	1	111	4
9	Keshavarz Ghorabaee, Mehdi	1	111	4
10	Onar, Sezi Cevik	1	111	4
11	Oztaysi, Basar	1	111	4
12	Yazdani, Morteza	1	111	4
13	Zavadskas,Edmundas Kazimieras	1	111	4
14	Sillanpaa, Mika E. T.	1	104	0
15	Yang, En-Hua	1	97	0
16	Zeng, Guangming	2	95	2
17	Chiang, Joseph F.	1	93	6
18	Yang, Congren	1	93	6
19	Wang, Xue	1	92	0
20	Aminabhavi, Tejraj M.	1	84	1

The data from the Google Scholar profile has shown that Wan, Wang, Xu, and Yi, who are professors in environmental engineering, had

been involved in research writing since early 2000. Thus, this presents their high number of citations, document counts, as well as their total link strength compared to others. Whereas at the bottom 20, Yang, Wang and Aminabhavi exhibit the lowest citations received, which are below 90 counts respectively (refer to Table 3).

Consistently, several reasons for the author receiving high citations include the research engagement period (Ahmed et al., 2004; Oppenheim & Renn, 1978). The earlier an author publishes research papers, the more reliable the knowledge is, which leads to researchers citing such papers. Similarly, the older and more reliable the paper, the more quality and authentic it becomes, granting more citations. This then inspires research collaborations between authors of the highest citations, thus reinforcing the networking links. Nevertheless, it may be biased to compare authors' citations between the early researcher and the new researcher in the field. Authors such as Tansel, for instance, have lower citation counts as compared to Wan, Wang, Xu, and Yi in waste management research. Yet, her collaboration network illuminates others in the field with 34 total link strengths and compared to the rest with null total link strengths. On a simple note, although citation on itself can increase in number when it is being cited, a collaboration between authors may also contribute to the increase in author's citation counts.

Citation on Most Cited Articles

Regarding most cited articles, it is evident that articles that have been published in the earlier years received more citations all year round. The article entitled "Phytoremediation of heavy metals-concepts and applications," written by Ali et al. (2013) with a total citation=1746 and an average citation per year=194, makes it one of the high-volume works known and cited by many. Some other prominent articles with a total citation of more than 500 and citation per year of more than 100 include journals titled "A review on chemical coagulation/flocculation technologies for removal of colour from textile wastewaters" published by Verma et al. (2012), and "Exposure to pesticides and the associated human health effects" published by Kim et al. (2017) (refer Table 4). Dividing the total citations received for the article by the year it is being published generates the average number of citations per year. This suggests that the older the paper and the more it gets cited, the citations per year will also rise for a

particular article (Ahmed et al., 2004; Oppenheim & Renn, 1978). Nonetheless, though the idea of higher citation counts is determined by the period of publication, it cannot be generalised for uncommon cases of unreliability. For example, some of the older articles such as "Carbon in Canada's boreal forest - A synthesis" written by Kurz et al. (2013), and "Is eco-friendly unmanly? The green-feminine stereotype and its effect on sustainable consumption" by Brough et al. (2016) (refer to Table 4), received lower total citation counts hence lowering the articles' citation per year, mainly because the articles' research motivation may not be relevant to management and business research. The unavailability of the information, framework, and other means of materials in the online database (i.e., closed-access articles) may also contribute to the irrelevancy of the articles, thus lowering citation opportunities.

Table 4

Most Cited Article Title in the Field of Green Marketing and Waste Management from 2012-2021

	Article Title	Authors	Year	Total Citation	Average Citation Per Year
1	Phytoremediation of heavy metals-concepts and applications	Ali, H., Khan, E., & Sajad, M. A.	2013	1746	194
2	A review on chemical coagulation/flocculation technologies for removal of colour from textile wastewaters	Verma, A. K., Dash, R. R., & Bhunia, P.	2012	1081	108.1
3	Exposure to pesticides and the associated human health effects	Kim, K. H., Kabir, E., & Jahan, S. A.	2017	542	108.4
4	Corporate social responsibility and shareholder reaction: The environmental awareness of investors	Flammer, C.	2013	451	50.11
5	The characterization of feces and urine: A review of the literature to inform advanced treatment technology	Rose, C., Parker, A., Jefferson, B., & Cartmell, E.	2015	422	60.29

(continued)

	Article Title	Authors	Year	Total Citation	Average Citation Per Year
6	Environmental impact of estrogens on human, animal and plant life: A critical review	Adeel, M., Song, X., Wang, Y., Francis, D., & Yang, Y.	2017	380	76
7	An overview of utilization of steel slag	Yi, H., Xu, G., Cheng, H., Wang, J., Wan, Y., & Chen, H.	2012	318	31.8
8	Assessing heavy metal pollution in the surface soils of a region that had undergone three decades of intense industrialization and urbanization	Hu, Y., Liu, X., Bai, J., Shih, K., Zeng, E. Y., & Cheng, H	2013	301	33.44
9	Soil contamination with cadmium, consequences and remediation using organic amendments	Khan, M. A., Khan, S., Khan, A., & Alam, M.	2017	240	48
10	Ecotoxicological effects of microplastics on biota: a review	Anbumani, S., & Kakkar, P.	2018	208	52
11	Biotechnological advances in bioremediation of heavy metals contaminated ecosystems: an overview with special reference to phytoremediation	Mani, D., & Kumar, C.	2014	208	26
12	Microplastics in freshwater river sediments in Shanghai, China: A case study of risk assessment in mega-cities	Peng, G., Xu, P., Zhu, B., Bai, M., & Li, D.	2018	181	45.25
13	Mapping the frontiers and front lines of global environmental justice: the EJAtlas	Temper, L., Del Bene, D., & Martinez-Alier, J.	2015	173	24.71
14	Biological approaches to tackle heavy metal pollution: A survey of literature	Jacob, J. M., Karthik, C., Saratale, R. G., Kumar, S. S., Prabakar, D., Kadirvelu, K., & Pugazhendhi, A	2018	171	42.75

(continued)

	Article Title	Authors	Year	Total Citation	Average Citation Per Year
15	Sources and distribution of microplastics in China's largest inland lake - Qinghai Lake	Xiong, X., Zhang, K., Chen, X., Shi, H., Luo, Z., & Wu, C	2018	171	42.75
16	From electronic consumer products to e-wastes: Global outlook, waste quantities, recycling challenges	Tansel, B.	2017	171	34.2
17	Assessing the toxicity and biodegradability of deep eutectic solvents	Wen, Q., Chen, J. X., Tang, Y. L., Wang, J., & Yang, Z.	2015	169	24.14
18	High-efficiency extraction of bromocresol purple dye and heavy metals as chromium from industrial effluent by adsorption onto a modified surface of zeolite: Kinetics and equilibrium study	Aljerf, L.	2018	165	41.25
19	Is eco-friendly unmanly? The green-feminine stereotype and its effect on sustainable consumption	Brough, A. R., Wilkie, J. E., Ma, J., Isaac, M. S., & Gal, D	2016	164	27.33
20	Carbon in Canada's boreal forest - A synthesis	Kurz, W. A., Shaw, C. H., Boisvenue, C., Stinson, G., Metsaranta, J., Leckie, D., Dyk, A., Smyth, C., Neilson, E.	2013	156	17.33

Citation on Most Cited Institutions

The number of cited institutions is also important in determining the total citation counts of research work in green marketing and waste management. Accordingly, based on the Clarivate insights, author affiliations on their published article form the institutional citation counts. This suggests that an article is credited to the institution if the article comprises at least one author's institution address (Ahmi, 2021). With only one published document and zero total link strength, Sinosteel Wuhan Safety & Environmental Protection Research

Institution has the highest citation count of 318. This is followed by Tsinghua University and Florida International University with 247 and 171 citation counts, respectively (refer to Table 5). Such result is evidence that authors affiliated with these universities have affiliated their institutions in all their articles, at least while serving the universities. This also implies that the authors of the affiliated universities were actively engaging their institutions' names to assist in growing citation counts for their institutions.

Table 5

Most Cited Institutions in the Field of Green Marketing and Waste Management from 2012-2021

	Institutions	Document	Citation	Total Link Strength
1	Sinosteel Wuhan Safety & Environmental Protection Research Institution	1	318	0
2	Tsinghua University	7	247	5
3	Florida International University	1	171	22
4	Ryerson University	2	167	0
5	Nanyang Technological University	3	149	0
6	Hunan University	3	148	3
7	Allameh Tabataba'i University	2	114	1
8	Istanbul Technical University	1	111	1
9	European University of Madrid	1	111	1
10	Vilnius Gediminas Technical University	2	111	1
11	Bhabha Atomic Research Centre	1	104	0
12	Chinese Academy of Sciences	5	104	4
13	Lappeenranta-Lahti University of Technology	1	104	0
14	University of Eastern Finland	1	104	0
15	Huazhong University of Science & Technology	5	102	14
16	Macau of University Science & Technology	3	100	4
17	Zhejiang University of Technology	1	97	0
18	University of Malaya	3	95	1
19	State University of New York Oneonta	1	93	3
20	Rochester Institute of Technology	1	92	0

Contrariwise, some of the institutions with low citation counts comprise the University of Malaya with 95 citations, Suny Collage

Oneonta with 93 citations, and Rochester Institute of Technology with 92 citation counts (refer to Table 5). Nonetheless, a lower citation count for an institution does not mean poor performance; thus, it only shows that the authors do not address the university affiliations in their research work, or perhaps the university only engages in industrial research that does not affiliate publication. For instance, Florida International University may have the highest total link strength of 22 compared to others, but this may not reflect their affiliation citation counts of 171, as this can be that of on-hand industrial collaboration.

Citation on Most Cited Countries

Concerning most cited countries, author contributions to both the research and industry account for the citation counts (Donthu et al., 2020). The outcomes in Table 6 showed that China has the highest citation counts of 1657, followed by India and the USA, with 761 and 684 citation counts, respectively. This implied that these three countries had the largest contributors to research documents from 2012 until 2021, hence increasing the likelihood of higher citation counts. Ultimately, China tops the list, rendering the country the most productive and influential author with affiliated countries in the field of green marketing and waste management research. The SCImago country rankings also highlighted that from 2013 until now, China has been ranked first in environmental sciences and waste management research. To date, China has an h-index of 256 and citations per document of 2.13 for all articles related to the above-mentioned research field.

Conversely, Finland, Pakistan and Poland have the bottom 20 lowest citation counts of 110, 109, and 105, respectively, from 2012 to 2021 (refer to Table 6). This does not mean these countries do not engage in any research; however, this could unassumingly suggest that authors in the three countries are less affluent and less dominant in conducting waste management-related research. Another possible reason for the low total citation counts is that Finland and Poland, which reign under the Scandinavian circles, engage much of their research among their European circles (Eydal et al., 2016). Similarly, having already had an excellent waste management system limits the need for these countries to engage in further research (Eydal et al., 2016), thus limiting citation counts. Likewise, a lack of implementation on waste management

could also demotivate research engagement for a country such as Pakistan, hence restraining chances for country citation.

Table 6

Most Cited Countries in the Field of Green Marketing and Waste Management from 2012-2021

	Countries	Document	Citation	Total Link Strength
1	People's Republic of China	92	1657	53
2	India	53	761	14
3	USA	45	684	34
4	England	28	404	9
5	Canada	14	370	2
6	Italy	27	291	3
7	Australia	20	289	7
8	Iran	28	278	4
9	Malaysia	22	278	10
10	Japan	26	257	9
11	Spain	18	246	5
12	Singapore	5	176	0
13	Turkey	13	162	6
14	France	8	139	0
15	Romania	18	139	6
16	Lithuania	5	124	4
17	Thailand	11	113	9
18	Finland	2	110	0
19	Pakistan	13	109	9
20	Poland	14	105	1

Furthermore, Table 6 also shows the total link strength from 2012 to 2021 among the top 20 countries. As expected, China also tops the total link strength at 53, hence being one of the prominent sources for references in the field of green marketing and waste management. Such an outcome is evident in China's effort to scale up its solid waste law by implementing Innovative Green Development Programs such as waste sorting system (i.e., waste separation, waste transportation, waste disposal, and waste disposal campaigns) across its major

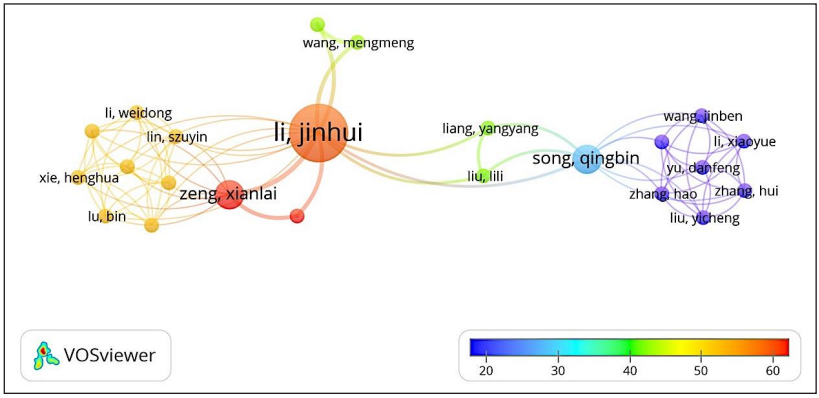
cities such as Beijing and Shanghai (Lee et al., 2020). Currently, environmental campaigns and waste management activities are run in all households and organisations in several major cities in China in an effort to zero waste in 2030 (Lee et al., 2020). With the waste policy being amended, it encourages more researchers in the field to solve any upsurging issues and to come out with better waste implementation.

Co-authorship Analysis between Authors

A co-authorship is a collaborative effort between individual researchers and other researchers, institutions, and countries (Ponomariov & Boardman, 2016). Co-authorship builds relationships and networking among a community of researchers through total link strength. Given co-authorship between authors, Table 7 shows that the authors with the most link strength in the field of green marketing and waste management from 2012 to 2021 include Li Jinhui, with 4 total link strengths, followed by Lu Weisheng, Watanabe Kohei, Widyaningsih Niluh, and Al-Khatib Issam with 3 total link strengths respectively. This denotes that the higher the value of the total link strength, the stronger the networking link between the authors. On that account, Li Jinhui is seen as a researcher who not only has high documents and citation counts but also has been working extensively with other researchers on issues of waste management.

Figure 4

Co-authorship between Authors on Green Marketing and Waste Management from 2012-2021



On the other hand, Bruner, Foschi, and Kral to name a few, have the lowest total link strength compared to the top five authors (refer to Table 7), indicating a lower collaboration effort done with researchers in the field. The low total link strength of an author, however, may not reflect their poor performance as an author can be those who are new in the related research field or perhaps those who intend to focus more on individual research contributions.

Table 7

Top 20 Authors Partnering on Green Marketing and Waste Management Research

	Authors	Documents	Citations	Total Link Strength
1	Li, Jinhui	4	230	4
2	Lu, Weisheng	3	83	3
3	Watanabe, Kohei	3	19	3
4	Widyaningsih, Niluh	3	8	3
5	Al-Khatib, Issam A.	3	6	3
6	Zeng, Xianlai	2	145	2
7	Bao, Zhikang	2	80	2
8	Alfano, Rossella	2	75	2
9	Caporale, Oreste	2	75	2
10	Illario, Maddalena	2	75	2
11	Montuori, Paolo	2	75	2
12	Nardone, Antonio	2	75	2
13	Triassi, Maria	2	75	2
14	Iacovidou, Eleni	2	71	2
15	Ohandja, Dieudonne-Guy	2	71	2
16	Voulvoulis, Nikolaos	3	71	2
17	Song, Qingbin	2	57	2
18	Brunner, Paul H.	2	40	2
19	Foschi, Eleonora	2	40	2
20	Kral, Ulrich	2	40	2

Moreover, the link strength achieved by Li Jinhui can be seen in Figure 4, where he is shown to have collaborated massively with various authors from various circles in the last 10 years. The figure

also illustrates that Li Jinhui had collaborated mostly with researchers from China due to their similar purpose, which is to fulfil the country's improvement in waste management implementation. The lines suggest that the more they collaborate, the more likelihood their link will grow strong. An increase in link strength, however, may not be a determinant of an increase in citation counts (Ahmi, 2021). However, collaborating with authors from all parts of the world may enlarge not just networking but also expand knowledge sharing on green marketing and waste management efforts.

Co-authorship Analysis between Countries

A co-authorship between countries emphasised the social network of collaboration between countries globally. In the field of green marketing and waste management, the leading country with the highest co-authorship is China, with 44 total link strengths, followed by the USA, with 26 total link strengths (refer to Table 8). This outcome is in line with China's engagement in the Innovative Green Development Programs across its major cities, such as Beijing and Shanghai (Lee et al., 2020). Their immense collaborative effort is also portrayed in the high number of citation counts of 1657 and the high number of published documents of 92 in research related to waste management. On top of this, being long in the field, it is apparent that a country has been referred for collaboration more than any other country (Ahmi, 2021). An average collaborative effort is then followed by England and Japan, with 18 and 15 total link strengths separately, respectively. In essence, this outcome indicates that each country participated in numerous research collaborations that link to each other in the same field over the 10-year period.

Other than that, countries such as Brazil, Indonesia, Italy, South Korea, Vietnam, and France are amongst the bottom 20, with the lowest total link strength of 5 counts respectively (refer to Table 8). Low total link strength, however, may not indicate insignificant research performance. Countries such as South Korea, for instance, may not have the urgency to recreate their waste management policy as they already have a good waste management system and infrastructure since the early 90's (Yoo, 2021). This simply implies that although their total link strength is only 5 counts, over the 10 years, they did at least receive an average citation count. Late engagement in research

on waste management can also be a plausible reason for low total link strength for a country such as France. France only began its zero waste management activities and waste policy rectification as early as 2010. The country is currently still progressing in improving its system, infrastructure, and policies on waste segregation, such as recycling and disposal (Kovacic & Benini, 2021).

Table 8

Top 20 Authors Partnering on Green Marketing and Waste Management Research

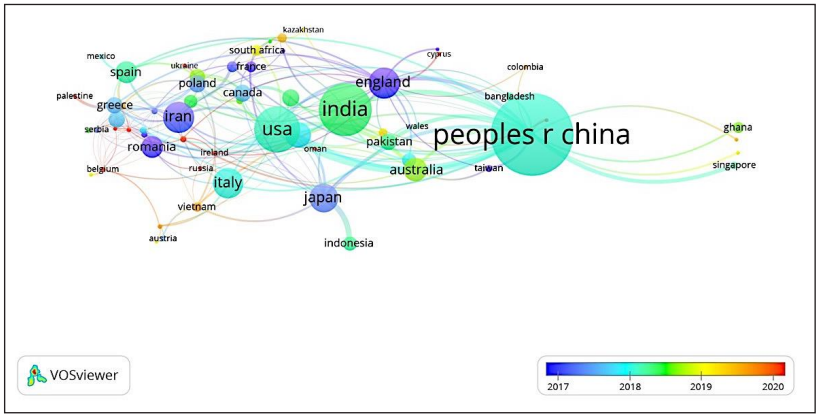
	Countries	Documents	Citations	Total Link Strength
1	People's Republic of China	92	1657	44
2	USA	45	684	26
3	England	28	404	18
4	Japan	26	257	15
5	India	53	761	13
6	Malaysia	22	278	11
7	Greece	13	88	9
8	Australia	20	289	8
9	Poland	14	105	8
10	Iran	28	278	7
11	Pakistan	13	109	7
12	Spain	18	246	7
13	Canada	14	370	6
14	Germany	10	85	6
15	Brazil	12	53	5
16	Indonesia	11	29	5
17	Italy	27	291	5
18	South Korea	14	72	5
19	Vietnam	7	57	5
20	France	8	139	5

The collaborative effort between countries in green marketing and waste management research from 2012 to 2021 is also illustrated in Figure 5. As explained earlier, China has the highest and strongest links of networking in the said field, and this is represented by the big, coloured node. Correspondingly, the node shows various coloured lines linking to other countries, suggesting that on the global platform,

China has also been collaborating with various countries, at least from 2017, compared to other countries. As known earlier, the USA, England, Japan, and India, with subsequent strongest link strength, are also shown in big, coloured nodes linking to China. Overall, it can be concluded that these countries have a very strong collaborative effort in research related to green marketing and waste management at the international level. Nonetheless, a few countries, such as Indonesia, Iran, and Australia, to name a few, represented in small colour nodes, have shown contemporary engagement in research collaboration in the field beginning in 2017 until now.

Figure 5

Co-authorship between Countries on Green Marketing and Waste Management from 2012-2021



Co-authorship Analysis between Institutions

A co-authorship between institutions works as an active mechanism to drive research collaboration and encourage professional networking (Ponomariov & Boardman, 2016). From the analysis, Tsinghua University is shown to have the highest total link strengths of 7 counts in the field of green marketing and waste management over the ten-year period (refer to Table 9). Being founded in 1928, it is indisputably that the university's School of Environment has engaged in collaborative efforts with various other institutions. It is evident through their joint research programs, such as joint research with top

universities, international training programs, joint research centres with enterprises, collaboration with international organizations, and dual degree research collaboration programs in environmental and waste management areas. Similarly, the Chinese Academy of Science, Islamic Azad University, Tongji University, and the University of Tokyo, which were founded in the 1900s, are second with a total link strength of 5 counts in waste management-related research (refer to Table 9).

Table 9

Top 20 Authors Partnering on Green Marketing and Waste Management

	Institutions Engaged in Co-authorship	Document	Citation	Total Link Strength
1	Tsinghua University	7	247	7
2	Chinese Academy of Science	5	104	5
3	Islamic Azad University	9	75	5
4	Tongji University	5	46	5
5	University of Tokyo	5	17	5
6	Aristotle University of Thessaloniki	4	13	4
7	Huazhong University of Science & Technology	5	102	4
8	National Technical University of Athens	4	20	4
9	Universiti Sains Malaysia	4	23	4
10	University of Tehran	7	34	4
11	Birzeit University	3	6	3
12	China University of Geoscience	4	16	3
13	Macau University of Science & Technology	3	100	3
14	National Institute for Environmental Studies	3	28	3
15	South China University of Technology	3	24	3
16	Sukkur IBA University	3	22	3
17	Teikyo University	3	19	3
18	University of Malaya	3	95	3
19	University of the Punjab	3	24	3
20	Universiti Putra Malaysia	3	60	3

These universities are known to have both collaborative efforts with educational institutions as well as with industrial professionals globally in all research fields. Generally, this suggests that the universities have been very active in building networking and research collaborations ever since their establishment, allowing the far-reaching exchange of knowledge in waste management.

In contrast, some of the bottom 20 institutions with the lowest collaborative effort include the University of Malaya, the University of the Punjab, and Universiti Putra Malaysia, with 3 total link strengths, respectively, in green marketing and waste management research (refer to Table 9). Although these universities were founded and established as early as the 1900s, their collaborative works focus mostly on developing theories and knowledge from the pure environmental perspective, such as engaging in eco-friendly products and recycling per se, rather than waste management in specific. This limits their overall collaborative effort in the said field. Irrefutably, having existed long in academia may not be the mechanism to research networking; instead, it is the philosophy of the institutions that dictate the networking or collaborative effort.

The collaboration between institutions can also be seen in Figure 6. The figure shows that Tsinghua University, Tongji University, University of Tokyo, and Universiti Sains Malaysia are among the top research collaborators in the field of green marketing and waste management, depicted by the big colour nodes. Tsinghua University and Tongji University, which are characterised by a light blue node, have engaged in a collaborative effort with other institutions in the field as early as 2016 or slightly earlier. Likewise, the University of Tokyo, shown in the yellow node, had engaged in institutional collaboration in the field as early as 2020. Although the above-mentioned universities have high total link strengths in waste management-related research, other institutions, such as Universiti Sains Malaysia and the National Institute of Environmental Studies, have also shown increasing collaborative work as the nodes grow bigger beginning in 2018.

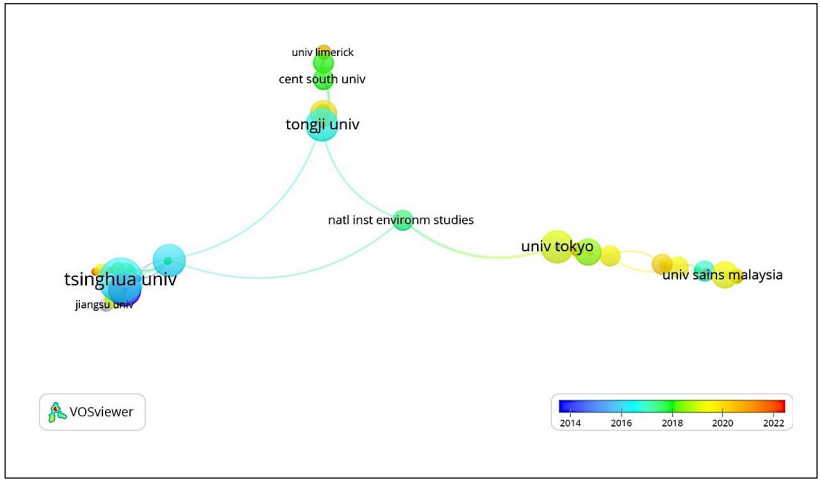
Co-Occurrence Analysis on All Keywords

The final part of the analysis discusses the co-occurrence of all major keywords in the field of green marketing and waste management.

Co-occurrence analysis can be defined as a measurement of the main keywords and the line of networks that links the keywords to other sub-keywords in the field being studied (Cancino et al., 2017; Martinez-Lopez et al., 2018). Some of the top 20 keywords in the waste management-related field showed "waste management" and "management" with 98 and 76 occurrences, respectively. This shows that research on green marketing and waste management uses the word "waste management" in a ten-year period, which appears 98 times in published articles. Likewise, the word "management" has appeared 80 times since articles in the field were published. Other keywords frequently mentioned include "recycling", "waste", "circular economy", and "sustainability". On the other hand, keywords that fall in the bottom 20 include "e-waste", "model", "behaviour", and "system" (refer to Figure 7). Nonetheless, this does not imply a disadvantage in the keywords used; instead, it may suggest that there is a different use of spelling or acronym used for the keywords amongst different researchers and countries.

Figure 6

Co-Authorship between Institutions on Green Marketing and Waste Management in 2012-2021

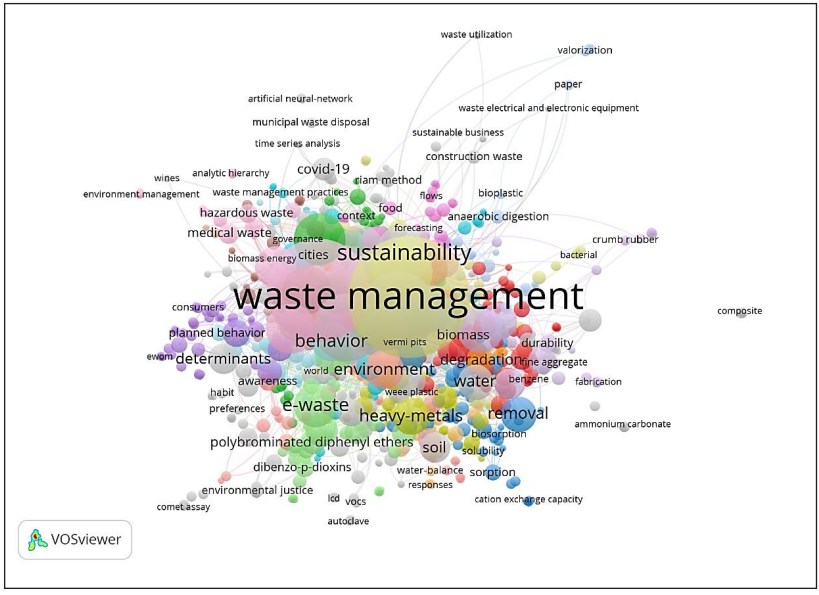


The co-occurrences of all keywords in green marketing and waste management-related fields are depicted in Figure 7. Generally, the

size of the nodes shows the frequency at which the keywords had been occurring, whereas the lines show relationships among the keywords. The closer the lines are to each other, the stronger the relationship of the keyword is. Figure 6 shows that the keyword "waste management" has the most frequent occurrences and is represented by the biggest yellow node. Being the biggest node, the lines for the "waste management" keyword are closer to other smaller keywords, thus depicting a stronger relationship, mainly with "sustainability", "behaviour", and "environment" keywords. Even if other keywords are smaller, farther and considered to have weaker co-occurrences to the "waste management" keyword, these keywords could grow in their frequency of co-occurrences in the coming years. Typically, this is because many of these smaller keyword nodes are mostly papers published as early as 2017, hence having a small number of co-occurrences. In summary, this provides an opportunity for forthcoming research keyword engagement in the field of green marketing and waste management.

Figure 7

Co-Occurrences of Keywords Related to Green Marketing and Waste Management in 2012-2021



CONCLUSION, IMPLICATIONS, AND DIRECTIONS FOR FUTURE RESEARCH

In conclusion, the 2807 articles in the past ten years on green marketing and waste management extracted from the WOS database have shown to be reliable and distinctive in their citations works and their collaborative effort over a range of journals, authors, institutions, and countries in the field of green marketing and waste management. However, the study is limited as it only considered articles indexed in the Social Science Citation Index (SSCI). Despite this limitation, the study provided a credible and comprehensive summary of the analysis of the most influential research works in the field of green marketing and waste management that is based on the descriptive analysis of the citation works and the networking analysis of citations, co-authorship, and co-occurrences analysis.

Future researchers may expand this study by incorporating other indexes, such as the Emerging Sources Citation Index (ESCI) to facilitate citations of new and inexperienced authors in the field. Besides, future researchers may also consider expanding and utilizing other databases such as Scopus, SCImago, Google Scholar, and journal ranks in the document selection process. Generally, this study is deemed to be significant as it offers future researchers in-depth insights into the citation works for a large number of articles and journals in the field of green marketing and waste management. The outcome of the study would provide pathways and benefit future and young researchers in establishing networking between authors, institutions, and countries according to their research interests. This study also facilitates new researchers to discover new research topics in the field of green marketing and waste management and its related movements. Finally, this study would serve as great guidance for journal editorial boards to keep track of the growth among authors and collaborative project opportunities, especially in the aspect of campaigning for better and greener waste management initiatives.

The extracted papers from the WOS database from 2012 to 2021 generated 50,674 articles. From a total of 50,674 articles, around 2807 articles were finally used for the analysis. With a 101 h-index, the paper publication trends rose from 2012 to 2021, with the highest number of publications and citations occurring in 2021, with 13,920 published document counts and 642 citation counts. Likewise, it is also found that the most productive institutions belong to the University of

California, with 39 documents, followed by Sejong University, with 38 documents and the Chinese Academy of Sciences, with 30 documents published from 2012 to 2021. The rise in published documents and citation counts from authors and institutions indicates a significant avenue for future growth in research on green marketing and waste management. It is anticipated that future researchers will plan their citations and references based on these discoveries.

The study revealed that the most prominent journals in green marketing and waste management research from the period 2012 to 2021 are the Science of the Total Environment journal, with 946 citation counts and total link strength of 13, followed by the Journal of Environmental Management, with 808 citation counts and total link strength of 20. Furthermore, the study also revealed that the most prominent authors with the highest number of citations belong to Wan Yinfeng, Wang Junshi, Xu Guoping and Yi Huang, each with 318 citation counts, respectively. Meanwhile, one of the most cited articles belongs to a publication written by Ali et al. (2013) titled "Phytoremediation of heavy metals concepts and applications" with 1746 citation counts and an average citation of 194 annually. On top of that, it is revealed that the most cited institutions belong to Sinosteel Wuhan Safety & Environmental Protection Research Institution with 318 citation counts, followed by Tsinghua University with 247 citation counts.

In addition, it has also been discovered that in the field of green marketing and waste management research between the period of 2012 to 2021, the country that has the highest number of citations belongs to China, with a staggering 1657 citations counts, besides being among the most productive contributors of research in the field of interest over the last ten years. Hence, besides citing research from prolific authors, it is also recommended for future researchers to cite their research from reliable sources such as the Science of the Total Environment, the Journal of Environmental Management, and other emerging journals. Furthermore, they may also cite research that comes from an institution's repository. This mixture of citation efforts may not only boost the credibility of one's research findings but also improve the reliability of the write-up.

On top of that, in terms of the co-authorship, it is revealed that the most influential author collaboration belongs to Li Jinhui, who holds 4 total link strengths in the field of green marketing and waste management from 2012 to 2021, followed by Lu Weisheng,

Watanabe Kohei, Widyaningsih Niluh and Al-Khatib Issam each with 3 total link strengths respectively. More so, the country with the most collaborative work in the field of green marketing and waste management belongs to China, with 44 total link strengths. This is consistent with the measures that have been taken by the Chinese government that were announced in December 2018 to develop zero-waste cities (Lee et al., 2020). Besides that, the most influential institution belongs to Tsinghua University with seven total link strengths. Similarly, the institution also houses the most influential author who actively participates in research collaboration, Professor Li Jinhui. This indicates that co-authorship in the form of research collaborative effort heavily relies on the establishment or contribution of the field of interest.

Future researchers may consider collaborating with Professor Li Jinhui in research associated with green marketing and waste management to strengthen knowledge depth and the acceptance rate. Besides that, it is also recommended for researchers to collaborate with authors and institutions from China as they have expertise in green marketing and waste management-related fields. Additionally, in terms of co-occurrences of keywords, it is revealed that the keyword of "waste management" is the most frequent, followed by "sustainability", "behaviour" and "environment". This implies that over the past ten years, these keywords have been among the most frequently utilised, thus appearing repeatedly. Nevertheless, the keywords with fewer occurrences are also equally important as they represent an emerging topic that is yet to be explored. Thus, future research may leverage this knowledge and opportunity to plan for their forthcoming research.

ACKNOWLEDGMENT

This research is funded by Universiti Kebangsaan Malaysia (UKM) from grant number EP-2023-005– *Geran Inisiatif Penyelidikan* (GIP). This research paper is new and has not been sent for publication elsewhere.

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