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The Influence of Applying Green Marketing Mix by Chemical Industries; VOSviewer Analysis

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Abstract

Marketing mix is a form of strategy in combining various kinds of marketing activities in order to create a maximum combination so that the most satisfying results will appear. Green marketing mix emphasizes the consideration of environmental and development friendly aspects sustainable (sustainability). Chemical industries are often the root cause of environmental damage, therefore the influence of applying green marketing in chemical industries is become interesting theme to be analyzed. To provide a better mapping in this research area, the using of VOSviewer is recommended. Having the purpose to systematically analyzing and demonstrating bibliometric data, VOSviewer enable to identify directions and symptoms of research and growth of knowledge in various disciplines. It's described step-by-step analysis to create an easier utilization of VOSviewer for the first-time user. This study provides data analysis regarding the green marketing application in chemical industries throughout five years (2017-2021) by utilizing mapping tools in the VOSviewer. Qualitative descriptive was used to describe the bibliometric analysis performance by producing network visualization of this topic. 988 relevant published journals were found ranging from 2017-2021, which were then grouped into seven clusters. After grouping the journal data, we discovered that the total number of articles published on the topic of green marketing mix in chemical industries from 2017 to 2021 is 192. The conclusion resulted that the novelty in green marketing mix topic is still wide open to learn, since it's related to various field.

Keywords: *Bibliometric, Green Marketing Mix, Chemical Industries, VOSviewer*

1. Introduction

Green marketing is a marketing process that refers to the environment. So, this marketing process must have benefits for the environment or nature. In other words, this is marketing that does not harm nature and the environment [1]. Furthermore, the products promoted with this green marketing method are products that must be environmentally friendly. The production process must also not damage the environment. For example, the product is free from materials that are toxic to the environment. Or this product can also be recycled and made from recycled materials. It could also be that this product is intentionally designed to be reusable. In essence, green marketing has a goal to maintain the sustainability of nature. Thus, products marketed through this method must also be products that are nature-friendly and environmentally friendly [2]. From the chemical industry's point of view, considerable investment is needed to conduct green marketing mix. Indeed, the chemical industry has been the main highlight related to high risk in environmental damage issue. An organization will be willing to invest if it believes that such investment will increase market acceptability and revenues [3]. The organization may also be willing to contribute to safeguarding the natural environment. Some organizations have already come out with green products and are investing in creating awareness for green consumerism [4,5]. Being environmentally responsible helps businesses to reduce their exposure to social criticism and appeal to the customers looking for green products and services [6,7]. Much research has been done on green marketing strategy, green consumerism, and green human resource development [8-11]. However, there is a lack of study to map the study of green marketing mix in chemical industries. The proper mapping in the research of this area enable to measure emerging opportunities and challenges to apply green marketing mix in chemical industry. In this respect, it is important to understand perceptions, initiatives, and challenges perceived by manufacturing industries in India in respect of green marketing practice. In the era of big data, the software to help scientific task is urgently needed. Bibliometric analysis as a scientific purpose method aims to design and build information systems and networks, information processing efficiency, identification and efficiency measurement of bibliographic services, predicting publishing trends and establishing empirical laws that form the basis for theory development in information science. VOSviewer as one of a software application used in bibliometric analysis display a mapping to get various information regarding the development of science that has been carried out [1]. VOSviewer is a free computer program available for, visualizing, and exploring bibliometric knowledge maps [12]. VOS stands for VOSviewer is Visualization of Similarities. Algorithm used in this program is almost the same as Multi-Dimensional Scaling (MDS). VOSviewer generated clusters are automatically displayed in color on the map. The cluster algorithm operates with a parameter (ɣ) which can be changed for get more or less clusters. Cluster density and color can be displayed with VOSviewer [12]. The advantage of VOSviewer compared to other analysis applications is this program use text mining functions to identify combinations of noun phrases that relevant to mapping and integrated clustering approaches to examine network co-citation data and co-occurrence [13,14]). Although many programs for analyzing text units and matrix similarity, the advantages of VOSviewer are there on its visualization [13]. Program interactive options and functions making it easy to access and explore the network of bibliometric data, such as sum citations or co-occurrence relationships between key terms and concepts [13,14]. The data mapping displayed by VOSviewer has the benefit to (1) designing more economical information systems and networks, (2) Improving the efficiency of the information processing process, (3) Identify and measure the efficiency of existing bibliographic services, (4) Forecasting publishing trends, (5) Finding and educating empirical laws that can provide a basis for the development of a theory in information science. Therefore, VOSviewer and bibliometric analysis is crucial to be apply in various research area, especially in this topic, to map green marketing mix in the chemical industries [5-6]. This study is aimed in analyzing and demonstrating bibliometric

data analysis step by step using VOSviewer systematically. The method used is qualitative descriptive to describe the bibliometric analysis performance by producing network visualization of the green marketing mix topic.

2. Materials and Methods

We used qualitative descriptive method to describe the data used in this study. We gathered journal data which based on research from publications that have been published in Google Scholar-indexed journals. The journal data was related to green marketing mix. To gather the data, we used reference managers application system as the reference, namely Publish or Perish. In this application, we can choose related articles or journals data from Google Scholar. Publish or Perish is used to conduct a literature review of the chosen theme. Therefore, a similar research database is obtained.

The step to map the data was begin from chosing the data base that will be used when data collection, here we use Google scholar. The data mapping was created by filling out the requirements. In this case we use "journal" in the Publication name field, keywords, years and maximum number of results. To summarize, the criteria of the journal are that every journal data must be indexed by Google Scholar and in accordance with the search for the themes needed in this study, which is green marketing mix. The journals related to the chosen topic range from 2017-2021 and 988 articles were discovered within the period of time. The resulted file from Publish or Perish was saved in the form of *.ris format. The saved file was imported to VOSviewer software to create the network map. The results from Publish or Perish then filtered based on term occurrence, we determined that the occurrence to be 10 times among the 988 articles. The filter results showed 192 articles which became the initial data to create the network map.

3. Results and Discussion

3.1. *Research developments in the field of green marketing*

Based on data obtained from a search using the Publish and Perish software, 991 articles on the topic of green marketing mix published in journals between 2017 and 2021 were discovered. Every year, articles on green marketing mix are fairly evenly distributed. The number of published articles in 2017 was 300, in 2018 was 251, in 2019 was 248, in 2020 was 133, in 2021 was 59. Table 1 displays the data for the most cited articles in the field of green marketing mix. Table 1 shows that the most cited article published from various journals in the period is *"Green Marketing": an analysis of definitions, strategy steps, and tools through a systematic review of the literature* written by R. M. Dangelico and D. Vocalelli cited by 355 articles. On the other hand, the findings indicate that the most cited article does not have to be from older years, such as the case with *Effects of COVID-19 on hotel marketing and management: a perspective article* written by Y. Jiang, J. Wen. Jiang's article was published in 2020 but is positioned on the top 20 in the period of 2017 – 2021, and on the topic of Green Marketing Mix. Following that, the research trend of the 988 articles is visualized in Figure 1 As shown in Figure 1, the trend of researching Green Marketing Mix increased from the initial 156 to 182 in 2017-2018, and it keeps increasing into 211 in 2019 and 248 in 2020. However, the trend experiences a decrease into 167 in 2021. Additionally, the peak trend of the research topic is in the year of 2020 while the lowest point is in 2017. From this data, we have created the network map as shown in Figure 2.

Table 1. The Most Cited Articles of Green Marketing Max

Cites	Author	Title	Year	Publisher	Refs
355	R. M. Dangelico, D. Vocalelli	"Green Marketing": an analysis of definitions, strategy steps, and tools through a systematic review of the literature	2017	Elsevier	[15]
338	Y. Jiang, J. Wen	Effects of COVID-19 on hotel marketing and management: a perspective article	2020	emerald.com	[16]
230	X. Font, S. McCabe	Sustainability and marketing in tourism: Its contexts, paradoxes, approaches, challenges and potential	2017	Taylor & Francis	[17]
224	C. N. Leonidou, D. Skarmeas	Gray shades of green: Causes and consequences of green skepticism	2017	Springer	[18]
147	O. Ungerman, J. Dedkova, et al.	The impact of marketing innovation on the competitiveness of enterprises in the context of industry 4.0	2018	pdfs.semanticscholar.org	[19]
143	Y. Namkung, S. Jang	Are consumers willing to pay more for green practices at restaurants?	2017	journals.sagepub.com	[20]
84	G. Kothencz, R. Kolcsár, P. Cabrera-Barona, et al.	Urban green space perception and its contribution to well-being	2017	mdpi.com	[21]
84	F. Loeser, J. Recker, J. Brocke, A. Molla, et al.	How IT executives create organizational benefits by translating environmental strategies into Green IS initiatives	2017	Wiley Online Library	[22]
71	T. Dhanabalan, K. Subha, R. Shanthi, et al.	Factors influencing consumers' car purchasing decision in Indian automobile industry	2018	researchgate.net	[23]
55	R. Thakkar	Green marketing and sustainable development challenges and opportunities	2021	ijmpr.org	[24]
53	V. Gruber, M. Kaliauer, et al.	Improving the effectiveness and credibility of corporate social responsibility messaging: An Austrian model identifies influential CSR content and communication …	2017	journalofadvertisingresearch.com	[25]
41	K. Maichum, S. Parichatnon, K. C. Peng	The influence of environmental concern and environmental attitude on purchase intention towards green products: a case study of young consumers in …	2017	ijbmm.com	[26]
38	S. Widyastuti, M. Said	Consumer consideration in purchase decision of SPECS sports shoes product through brand image, product design and price perception	2017	ijis-scm.bsne.ch	[27]
36	W. Suryani, E. Margery	The Influence Of Social Media Advertising, E-Marketing And Product Quality On The Process of Purchasing Nature Cosmetics	2020	iaras.org	[28]
36	A. Gunawan, S. F. Wahyuni	The effect of marketing mix, service quality, islamic values and institutional image on students' satisfaction and loyalty	2018	marketing.expertjournals.com	[29]
35	Liao et al.	Cognitive, experiential, and marketing factors mediate the effect of brand personality on brand equity	2017	ingentaconnect.com	[30]
35	Y.C. Yang	Consumer behavior towards green products	2017	joebm.com	[31]
34	…, C. Wang, J. S. Roberts, R. C. Green	Personal genomic testing for cancer risk: results from the impact of personal genomics study	2017	ncbi.nlm.nih.gov	[32]
33	Hwang, et al.	Identifying critical success factors for green business parks: Case study of Singapore	2017	ascelibrary.org	[33]
32	Trivedi, et al.	Sustainable marketing strategies: Creating business value by meeting consumer expectation	2018	econstor.eu	[34]

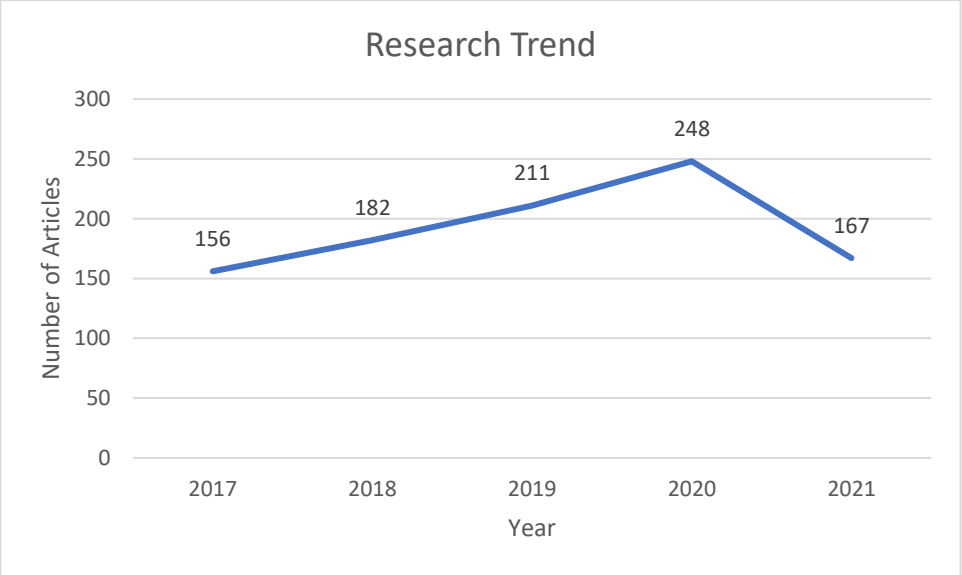

Figure 1. Research trend of Green Marketing Mix during the period of 2017 to 2021

3.2. Network visualization green marketing topic area using VOSviewer

The maximum number of research topic keywords that can be linked to VOSviewer is two [35-39]. Following that, a data set of research articles was compiled in order to examine the relationship between the terms. The information gathered on the subject of green marketing was classified into seven cluster.

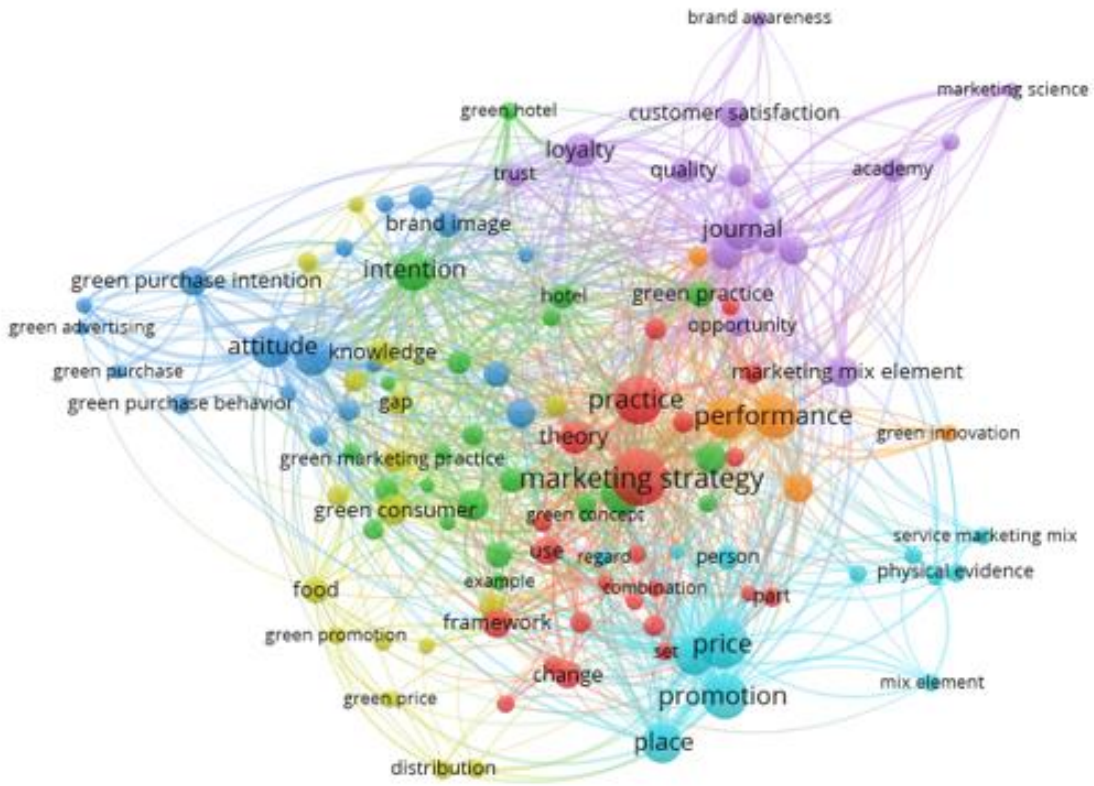

Figure 2. Network map of Green Marketing Mix research

There are 7 clusters in the Network map, each cluster is displayed in a different color. Cluster 1 is represented as red in the map (Figure 3), with Cluster 2 as green (Figure 4), Cluster 3 as blue (dark) (Figure 5), Cluster 4 as yellow (Figure

6), Cluster 5 as purple (Figure 7), Cluster 6 as light blue (Figure 8), and Cluster 7 as orange (Figure 9). Here, each term represented as their own individual nodes in which the size of the node represents the influence in their respective clusters. The strings that connected each nodes indicate the connection of each term, meaning that the term is often used with the connected term.

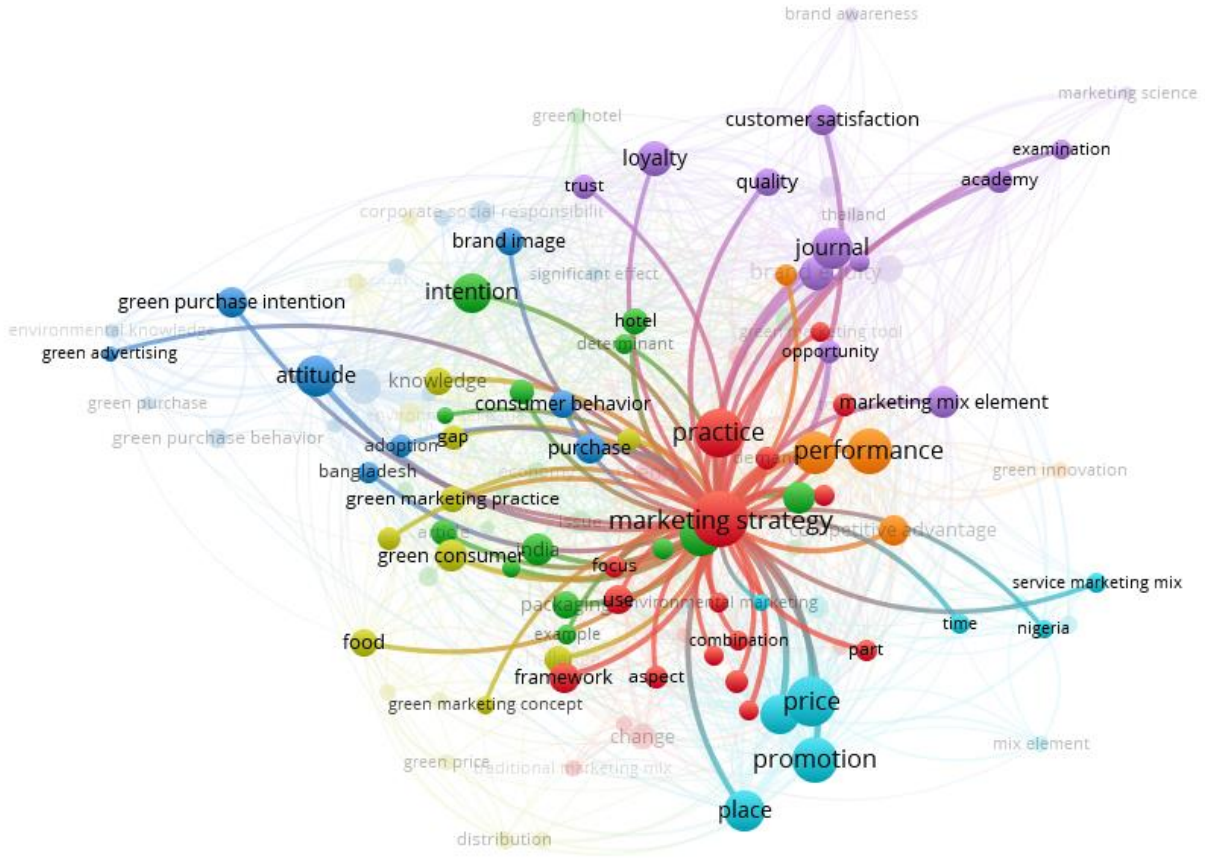

Figure 3. Network map of Cluster 1

Each cluster contains a relationship between two or more terms [40-44]. Marketing Strategy is the most commonly used term in Cluster 1 as a research topic for green marketing. According to Figure 3, marketing strategy are linked to 34 other terms. Green advertising, green purchase intention, attitude, intention, brand image, trust, loyalty, quality, customer satisfaction, journal, academy, examination, opportunity, marketing mix element, performance, practice, customer behavior, gap, purchase, green marketing practice, green consumer, food, focus, use, framework, green marketing concept, aspect, place, promotion, price, combination, part, time, and service marketing mix uncertainty are all terms related to Marketing Strategy keywords. Figure 5 is shown network visualization of Cluster 2.

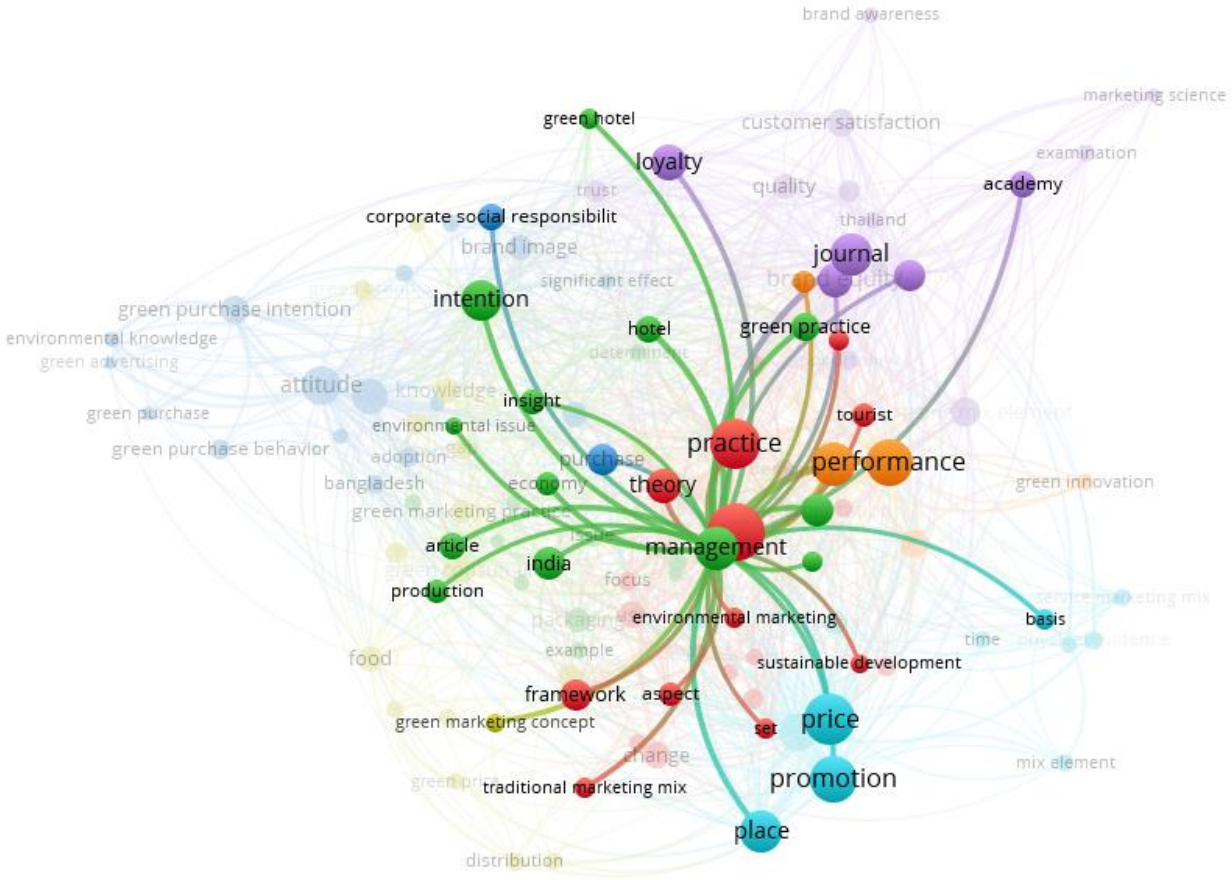

Figure 4. Network map of Cluster 2

Management is the most commonly used term in Cluster 2 as a research topic for green marketing. Management is linked to 27 other terms in Figure 4. Green hotel, loyalty, corporate social responsibility, journal, academy, green practice, hotel, intention, inside, practice, tourist, performance, theory, article, production, framework, green marketing concept, traditional marketing mix, aspect, set, price, promotion, place, environmental marketing, sustainable development, and basis are all terms related to keyword management. Figure 5 is shown network visualization of Cluster 3.

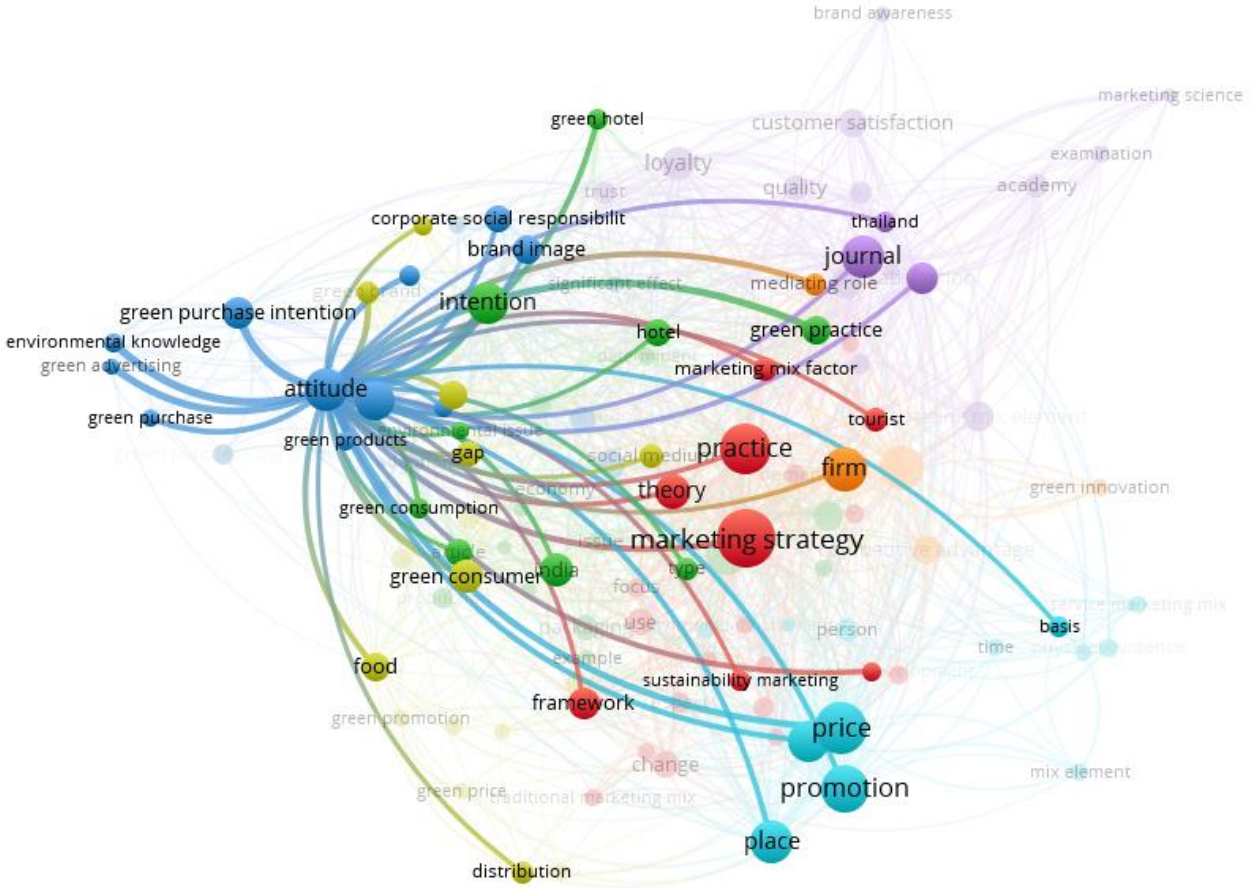

Figure 5. Network map of Cluster 3

In cluster 3, Attitude is the main node or keyword that is most widely used as a research topic in green marketing and has links with other terms. Based on the results of the network visualization in figure 5, there are 29 other terms that are directly connected to the main node, including: environmental knowledge, green purchase intention, green purchase, green products, green consumption, green consumer, gap, food, distribution, framework, place, promotion, price, basis, sustainability marketing, marketing strategy, theory, practice, firm, tourist, marketing mix factor, hotel, green practice, journal, thailand, intention, brand image, corporate social responsibility, green hotel. But apart from that, there are several keywords that are not directly connected to the main node, such as the terms green advertising and green purchase behavior. This is because these nodes have stronger connections to other nodes in different clusters. Figure 6 shows a visualization of the cluster 4 network.

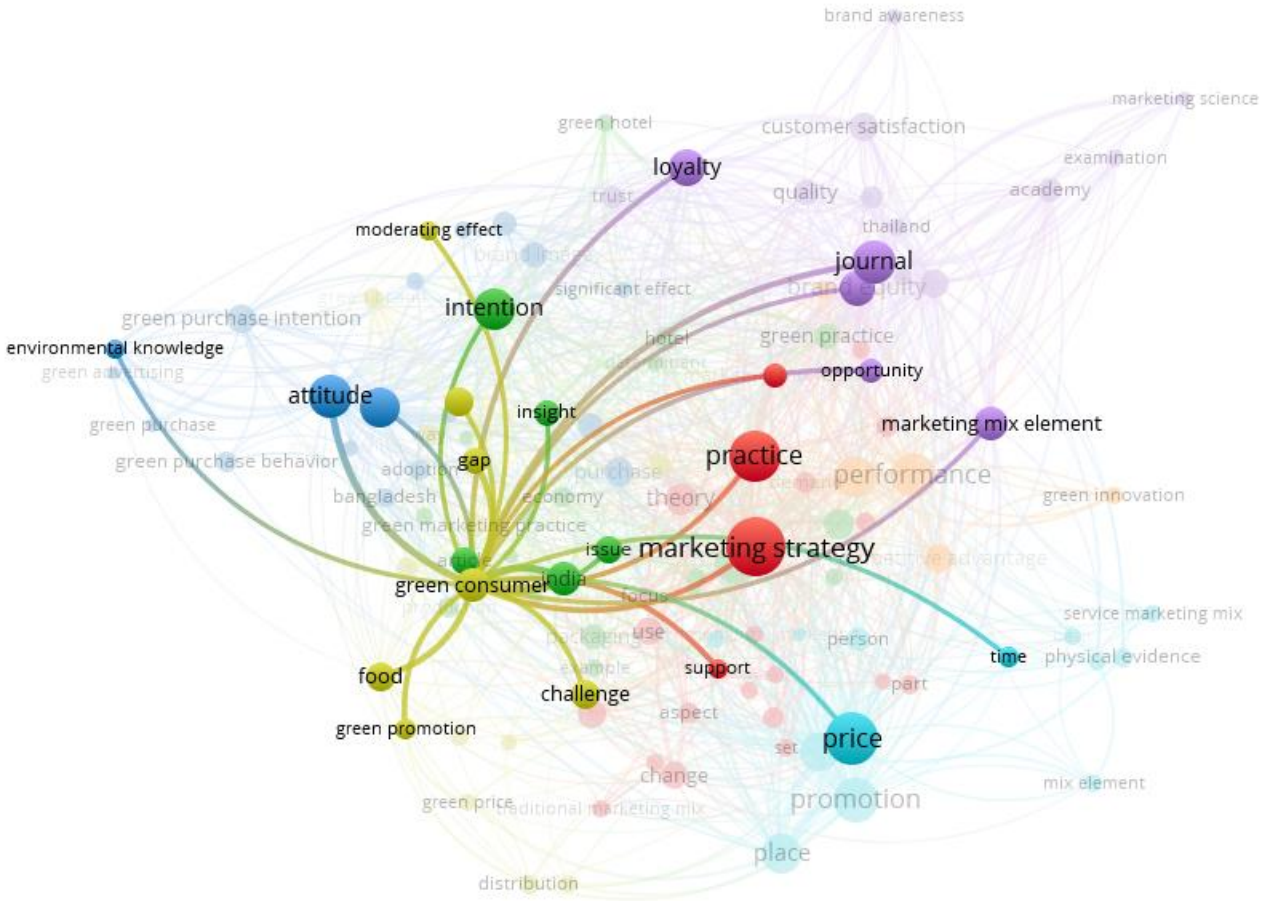

Figure 6. Network map of Cluster 4

In cluster 4, the term green consumer is the main node or keyword that is most widely used as a research topic in green marketing and has links with other terms. Based on the results of the network visualization in figure 6, the term green consumer is directly related to 19 terms in other clusters, including: environmental knowledge, attitude, food, green promotion, challenge, gap, moderating effect, marketing strategy, support, practice, issue, insight, intention, price, time, marketing element, opportunity, journal, and loyalty. Apart from that, keywords that are not directly connected to the main node, such as the terms green price, distribution and green marketing practice. This is because the connection of these nodes has a stronger relationship with the main nodes in different clusters. Figure 7 shows the results of network visualization in cluster 5.

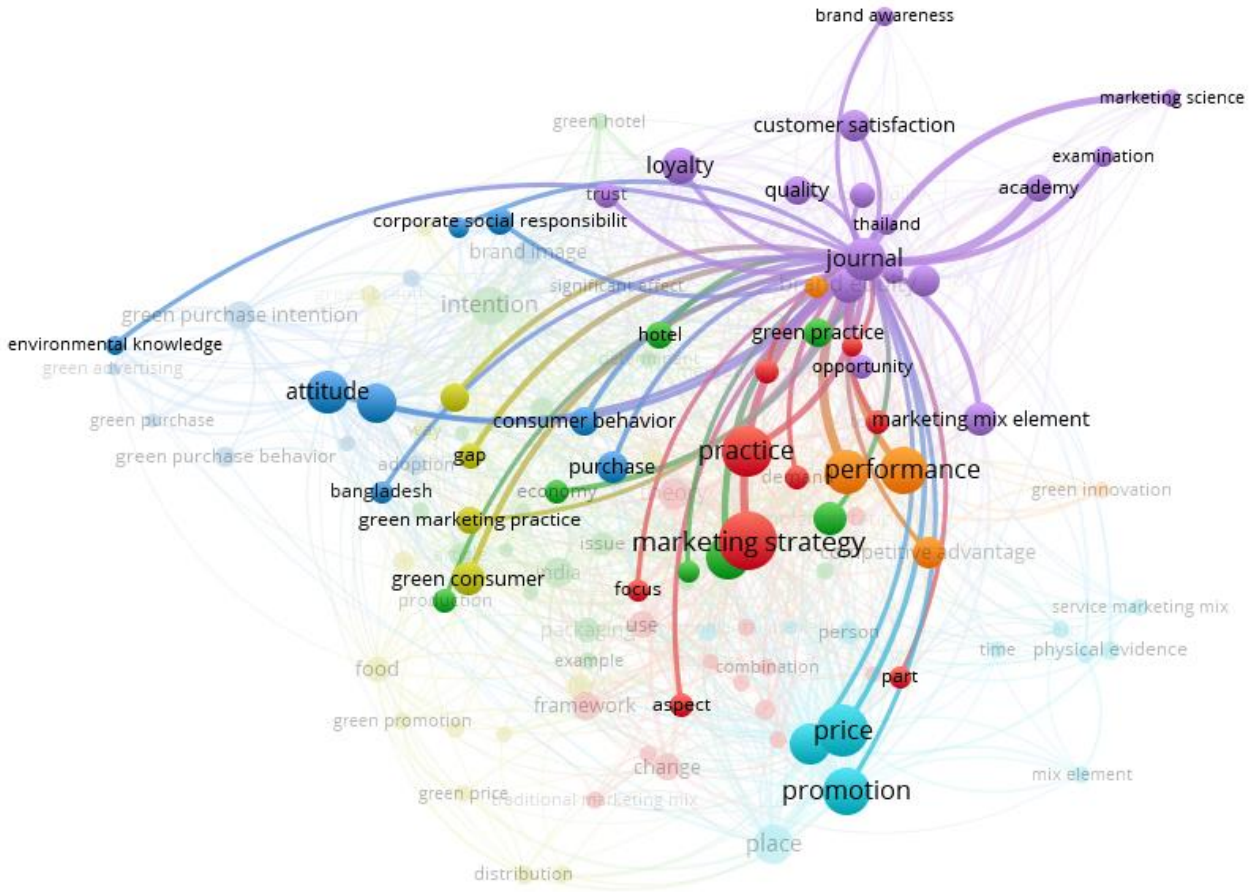

Figure 7. Network map of Cluster 5

Figure 7 showed that "journal" was the major node in Cluster 5 which connected to a total 46 nodes. In cluster 5, green marketing was connected indirectly to the major node. The major node also connected to other clusters, for example:

Cluster 1 such as marketing strategy, focus, aspect, practice, part, etc.

Cluster 2 such as production, hotel, economy, green practice, etc.

Cluster 3 such as environmental knowledge, attitude, corporate social responsibility, purchase, etc.

Cluster 4 such as gap, green marketing practice, green consumer, etc.

Cluster 5 such as trust, loyalty, quality, consumer satisfaction, brand awareness, marketing science, examination, marketing mix element, etc.

Cluster 6 such as price, promotion, etc.

Cluster 7 such as performance, competitive advantage, etc.

Then, cluster 5 consists of 16 items such as academy, brand awareness, brand equity, customer satisfaction, examination, journal, loyalty, marketing mix element, marketing science, opportunity, quality, retailer, satisfaction, service quality, thailand, trust.

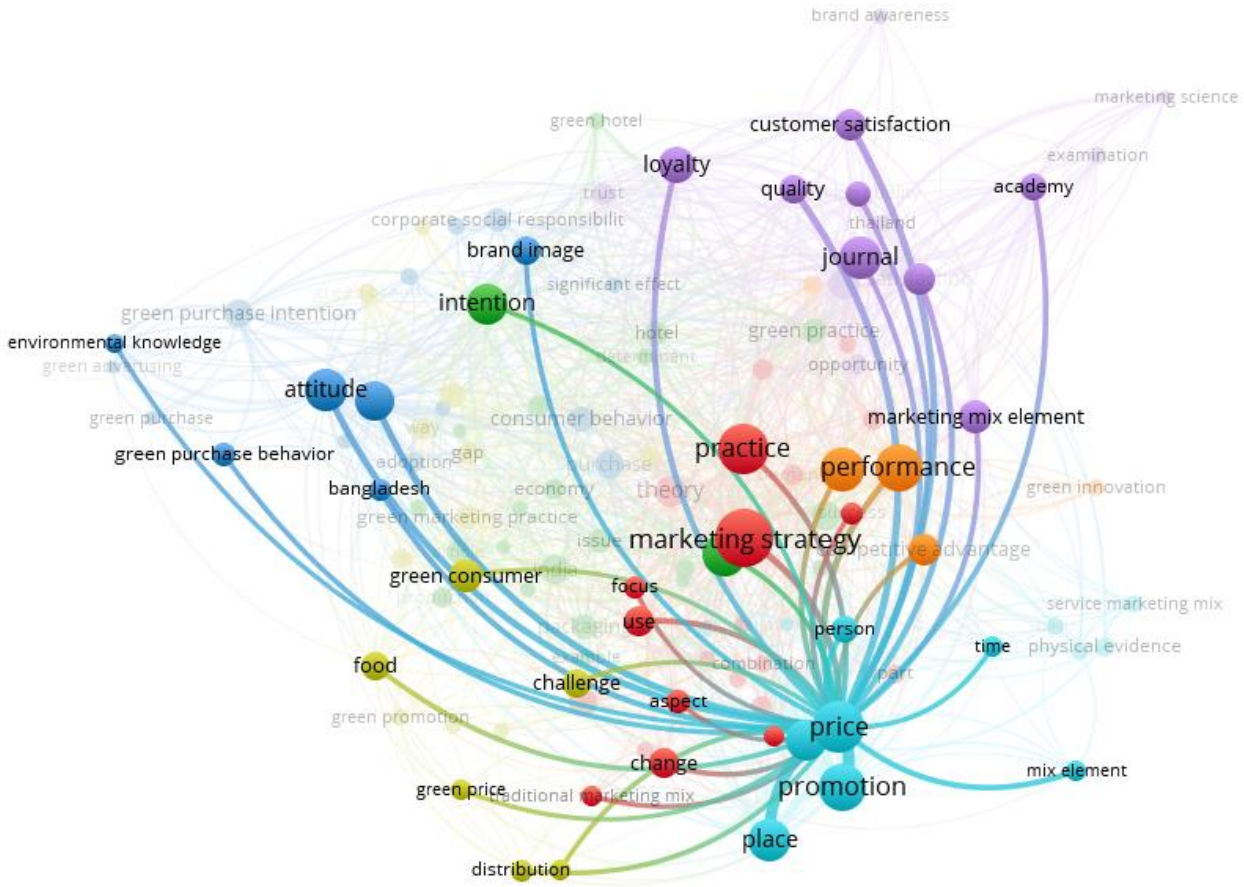

Figure 8. Network map of Cluster 6

As shown in Figure 8, “price” was the major node in Cluster 6 which connected to a total 41 nodes. In cluster 5, green marketing was connected indirectly to the major node. The major node is also connected to cluster 1 such as marketing strategy, focus, use, aspect, change, practice, etc.

Cluster 2 such as intention, green practice, etc.

Cluster 3 such as environmental knowledge, attitude, green purchase behavior, brand image, bangladesh, etc.

Cluster 4 such as green consumer, food, challenge, green price, distribution, etc.

Cluster 5 such as marketing mix element, loyalty, consumer satisfaction, etc

Cluster 6 such as price, promotion, place, person, time, mix element, etc

Cluster 7 such as performance and competitive advantage, etc.

Then, cluster 6 has 13 items such as basis, element, mix element, nigeria, person, physical evidence, place, present study, price, promotion, regard, service marketing mix, time

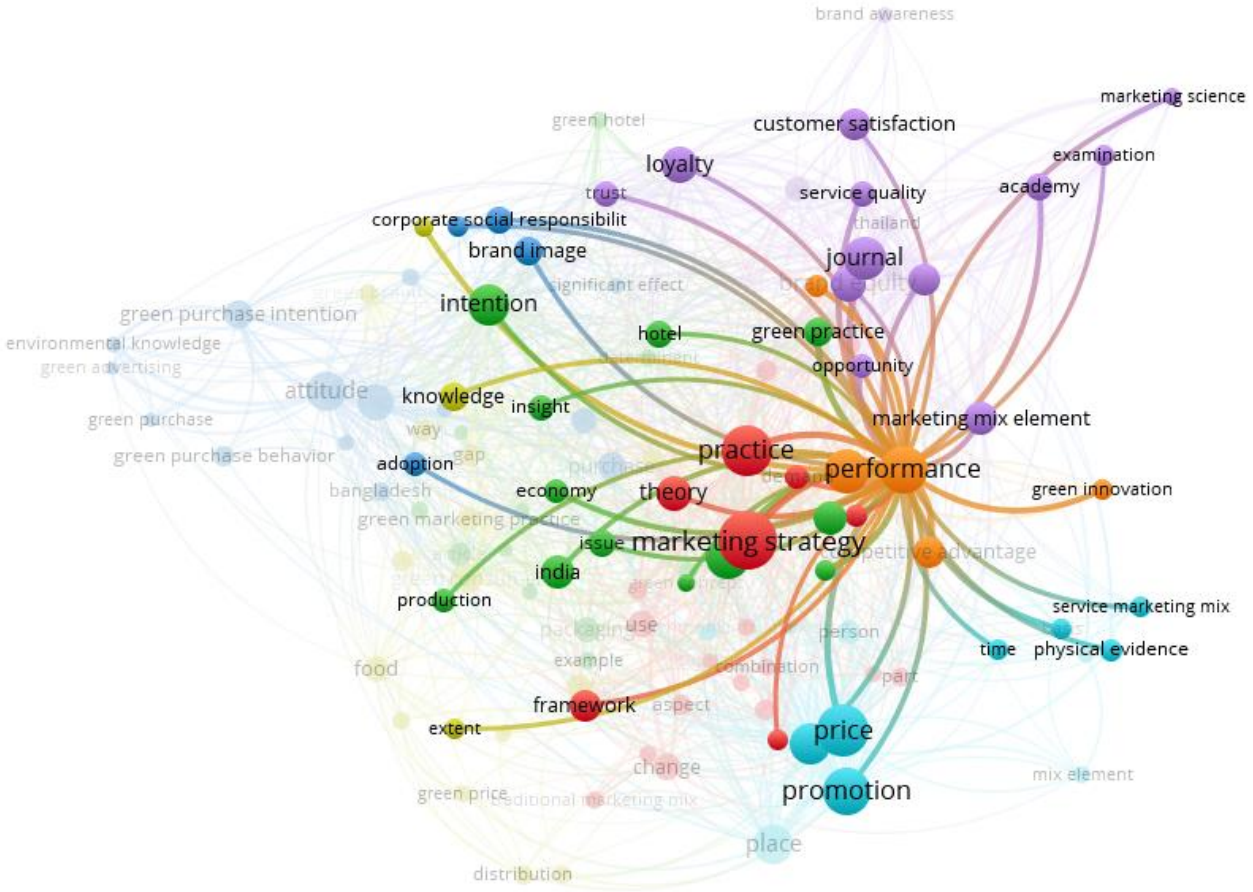

Figure 9. Network map of Cluster 7

Cluster 7 has 36 items: promotion, price, time, physical evidence, service marketing mix, green innovation, marketing strategy, framework, extent, production, india, issue, theory, practice, performance, marketing mix element, academy, examination, marketing science, journal, green practice, opportunity, economy, production, adoption, insight, hotel, service quality, customer satisfaction, loyalty, trust, corporate, social responsibility, brand image, intention, knowledge.

3.3. *Overlay visualization green marketing topic area using VOSviewer*

In the VOSviewer application, besides being able to display maps in the form of Network Visualization, they can also display maps in the form of overlays [45-50]. This mapping focuses on the level of novelty of the terms in the research conducted. Figure 10 illustrates the novelty of the term in green marketing mix research. The mapping in Overlay Visualization shows how popular a term is from year to year. Different colors in the Overlay Visualization indicate the update of the term in a certain time period. In this study we used the years 2017 to 2021. Darker colors, closer to purple, indicate that the term was studied closer to 2017. While lighter colors closer to yellow are terms that are more recent from the study.

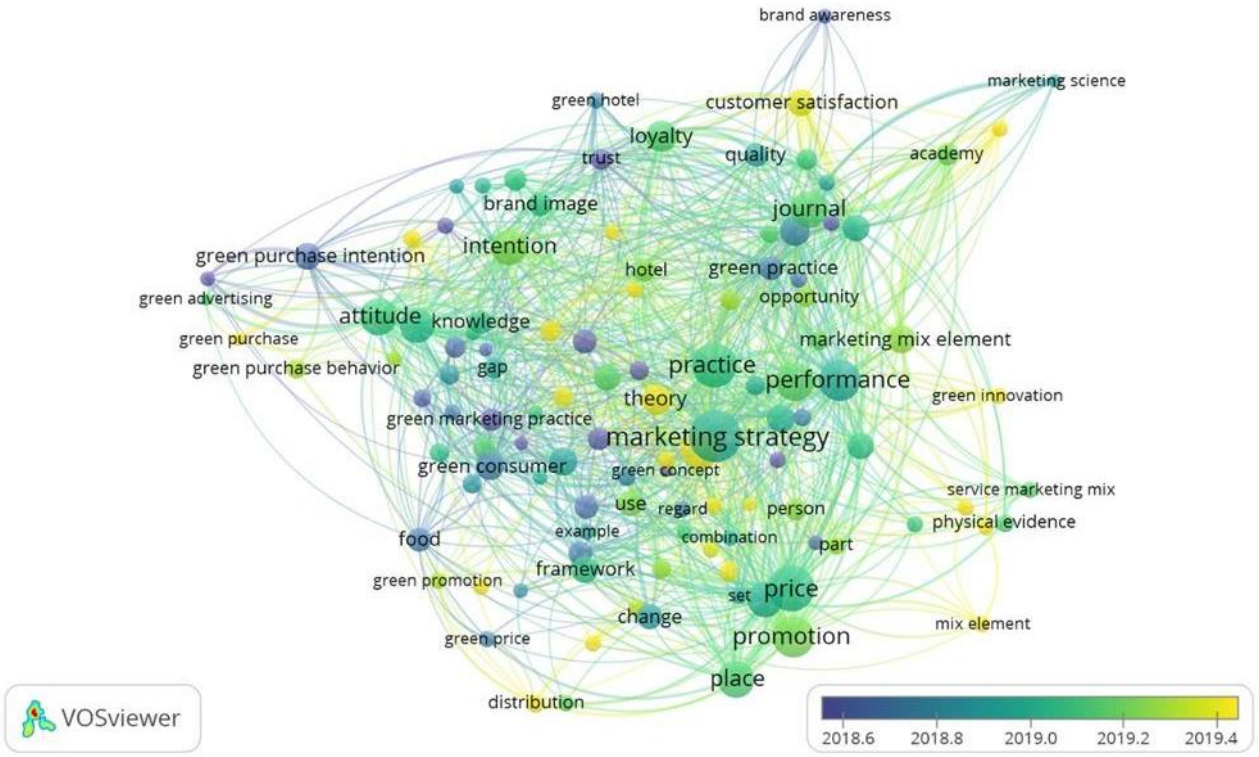

Figure 10. Overlay map of Green Marketing Mix research

3.4. Density visualization green marketing topic area using VOSviewer

Density Visualization is one type of mapping in the VOSviewer application. Each term in this map will be divided based on its popularity in research [51-55]. Figure 11 illustrates the density visualization in green marketing mix. Where it can be seen on the map that the lighter the color, the more popular the research on the term. On the other hand, as the color darkens or fades, research on the term becomes less frequent. Figure 11 shows that there are several yellow patterns with a fairly large diameter. These terms are journal, intention, attitude, green consumer, price promotion, marketing strategy, practice and performance. This means that these terms are terms that are often used in existing studies.

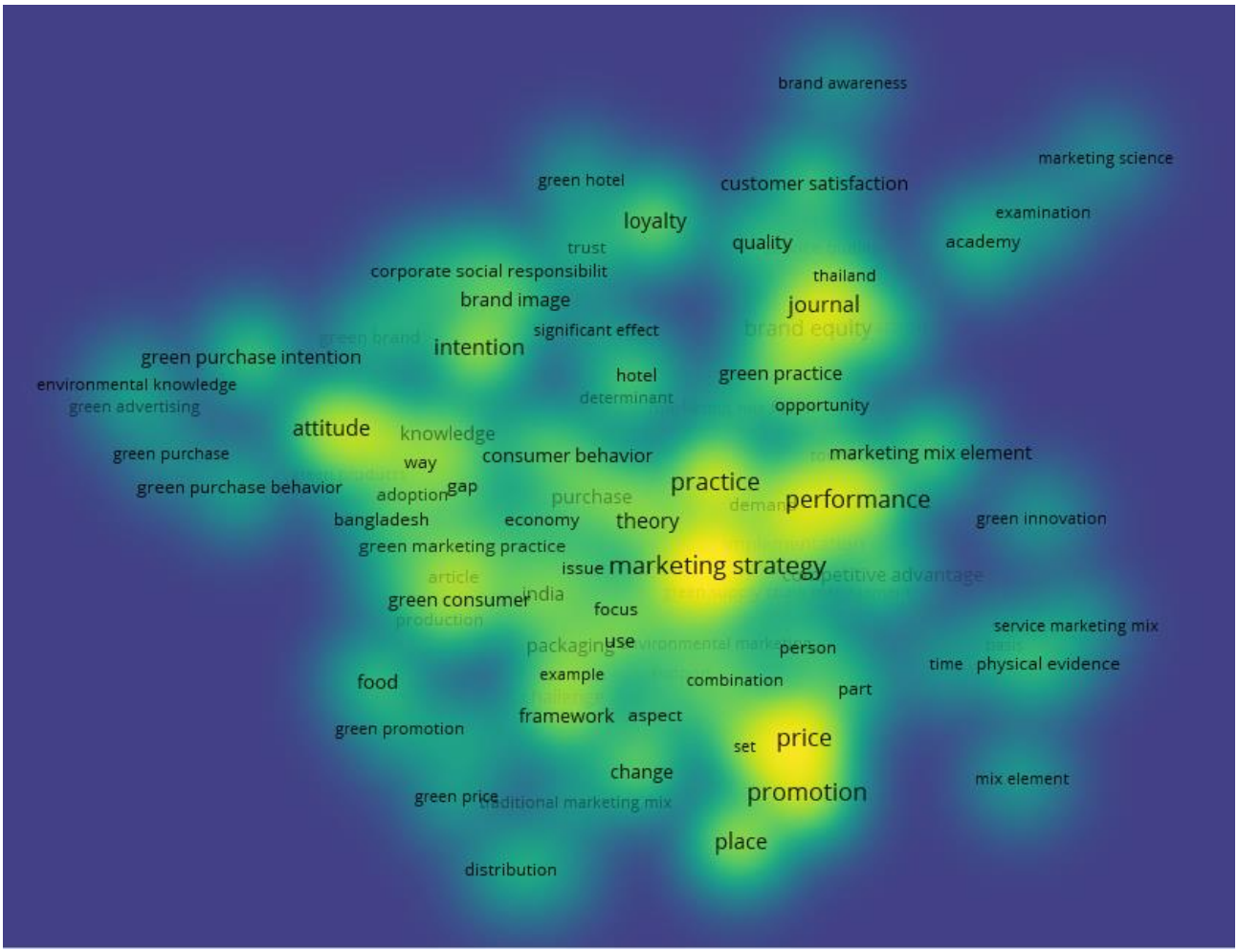

Figure 11. Density map of Green Marketing Mix research

Figure 11 depicts a density map derived from an analysis of all articles published in green marketing mix between 2017 and 2021. The density map depicts a yellow pattern in which the yellower the color and the larger the diameter of the circle, the denser the keywords. This implies that the keyword appears more frequently, and when the colors on the map fade or blend into the green background, this means that the keyword appears less frequently [56-58].

Conclusion

The purpose of this research was to examine the bibliometric literature on green marketing mix. In the search process, the keyword "green marketing mix" is used, which is based on a topic area with titles, keywords, and abstracts. Following the search, 988 articles were discovered to be relevant. The mapping procedure is then completed using VOSviewer. The search yielded 20 papers with the most citations. Based on the results of analysis and mapping with VOSviewer, green marketing mix research with term study was identified as the most studied in the 2017-2021 period. Meanwhile, marketing strategy is the most researched in the field of green marketing mix. The VOSviewer analysis identified seven keyword clusters related to the research topic of green marketing mix. Each cluster contains a main term that is linked to other terms. The recent studies linked green marketing mix to several items such as management, green innovation, customer satisfaction, mix element, etc.

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