Bibliometric Analysis for Mapping Research on Planogram Using VOSviewer

Melinska Ayu Febrianti[1], Qurtubi[1], Harlina Suzana Jaafar[2], Nasruddin Faisol[3] and Azreen Ariff Zulkeflee[4]

[1]*Master of Industrial Engineering, Department of Industrial Engineering, Universitas Islam Indonesia, Yogyakarta, Indonesia*
[2]*Department of Technology and Supply Chain Management, Universiti Teknologi MARA, Shah Alam, Malaysia*
[3]*Department of Quantity Surveying, Universiti Teknologi MARA, Shah Alam, Malaysia*
[4]*Lee Kong Chian Faculty of Engineering & Science, Universiti Tunku Abdul Rahman, Selangor, Malaysia*

Abstract: Planogram is usually employed by modern retail shops to ease operational tasks, such as organizing and managing the storage room and product's display shelf. Less research regarding planograms from the perspective of bibliometric and visualization becomes the main reason why the research has taken place in the first place. Bibliometrics is used in this research as the analysis method to capture the comprehensive figures on the research direction and to find several basic patterns associated with the planogram. Publish or Perish and VOSviewer are also utilized to support the analysis. This study was designated to conduct the analysis and bibliometric visualization towards planogram-related publications by involving 117 international journals. This research indicated the development status and planogram trend from 2011 to 2022. The result of this research is that Elsevier is the publisher that has published the most publications regarding planograms. From a total of 117 publications, the citation hits 5853 citations with 532,09 per year. The number of citations per paper is recorded as 50,03. It is identified an average number of authors in a paper counted as 2,94. The European Journal of Operational Research has published 9 writings, in which, it publishes more writing than others.

1. INTRODUCTION

Product visibility is one of the crucial variables that need to be considered to display the products. Well-displayed products, according to their category, have a bigger opportunity to be noticed by the customers, instead of random placement. The customers will not automatically select the products based on their visibility other factors are also involved. Yet, the visibility could enhance the possibility of purchasing. If the products are unseen, the customers would not even consider whether a product is worth to be bought. Optimizing the shelf space allocation and shop layout is required to maximize the product's visibility and encourage impulsive buying [1]. The location of the shelf, where the products are displayed, has a significant influence on product sales.

Planogram is usually employed by modern retail shops to ease the operational tasks, such as organizing and managing the storage room and product's display shelf. Planogram is an illustration in the form of a diagram of categorization on certain goods, that suggests where the location of products should be displayed along with the minimum quantities that should be offered [2]. The planogram design should be made in detail and explicitly to determine which products and how many products should be placed in a certain spot on the shelves. The planogram can be also used to determine the location of a product to determine the priority scale, based on the Pareto level of the product. As the Pareto defines 20% of items in the shop influence 80% of the sales. Therefore, it can be verified that the products that are listed in the Pareto, dominate the number of displays on the products' shelves. Planogram enables appropriate product merchandising at the right time and place, which eventually ends up with sales [3].

Shelf layout is the final opportunity to influence the shopping decision. Shopping decision is influenced by many factors, among others price, promotion, or new competitors, however, employing the appropriate planogram enables the improvement of the sales possibility. The research regarding planograms generally focuses on store layout, category management, and shelf space management. A recent publication demonstrated the lack of academic work that has been conducted in this domain [4]. Less research on planograms from the bibliometric perspective is the reason to perform the current study. The visualization not only

extracts the important information from the data using data mining techniques but also demonstrates the designated data to the customers, intuitively [5].

Bibliometrics is a statistical method to analyze the research publication quantitatively on certain topics, using a mathematical method [6]. It enables the method to assess the quality of a study, analyze the main field of the research, and predict the direction of future research [7]. The researchers employ bibliometric analysis for various purposes, including identifying the developed trend in articles and journals, collaboration patterns, and research elements, as well as checking the intellectual structure on a certain area of literature [8].

In the last decade, the research related to planograms has increased each year. Yet the number of research is still considered as low if compared to other research topics. In the last 10 years, only 833 planogram-related publications have been identified. While other topics, such as knowledge management [9] or green supply chain management [10] hit 1000 publications in the last decade. It indicates more areas associated with the planogram are still unexplored. Therefore, it takes a comprehensive illustration of the research direction and should be found several basic patterns of research related to planogram using the bibliometric analysis. The research aims to identify the development of research trends by using a planogram and to design the visualization mapping.

2. LITERATURE REVIEW

A. Bibliometric Analysis

The analysis or bibliometric methods (bibliometrics) or often called scientometrics is signified as part of research evaluation methodology, and from various literature published, it is possible to perform the bibliometric analysis by using a certain method [8]. Topics in bibliometric analysis can be properly explained qualitatively and quantitatively [11]. The reliability of bibliometric indicators is influenced by two main aspects, which are database selection that covers several bibliometric databases, several multi-disciplines, and others in certain areas, as well as publication identification based on the addresses given by the authors [12]. The stronger bibliometric indicators on the aggregation level are more suitable to analyze a large group (bigger team) and less suitable for individual evaluation or smaller group of researchers [13].

Bibliometric analysis not only relies on computerization for its processing but should also rely on the insertion of the consecutive data volume, which is arranged statistically [14]. Data that are focused in the bibliometric analysis tend to be massive (such as numbers of citations and publications, the keywords, and topics appearances), even though the interpretations generally depend on the objective (such as performance analysis) and subjective analysis (such as thematic analysis) that are determined by previously informed techniques and procedures [8]. Bibliometric mapping is beneficial for the scientific community and public

since it helps to change the publication metadata to mapping or visualization, which are easier to manage and process to obtain beneficial insights. For instance, to visualize the keywords to identify the research theme or cluster in a specific discipline, to map the author's affiliation from a certain journal to identify the scope of journal geographic, and to map the institutional and international collaboration as a part of the framework in identifying existing technology [15].

B. Harzing's Publish and Perish

The term "Publish or Perish" was initially created by Coolidge in 1932 [16]. 'Publish or perish' is a term commonly used to bring up the idea that it is important for a lecturer from the university to publish his scientific journal associated with the research, and failure to publish will give a bad impact on his future career [17]. That neologism was created, referred to immense and excessive pressure among academicians for immediately and persistently publishing the research for his "survival" or "welfare" in the academic system. In other words, the term can be defined as the pressure in an academic atmosphere for continuing publishing the results of studies, in terms of one's career advancement or survival [18].

Harzing's Publish or Perish is a software program that collects and analyzes academic citations. Tarma Research Program Pty Ltd, located in Melbourne, created and owned the copyright of PoP software (Publish or Perish). The PoP software was well-designed by Profesor Anne Wil Harzing and available free for operation system Windows, Linux, or macOS. This software employs various sources to get raw citations to be later analyzed and presented in the form of citation metrics, including numbers of papers, the total of citations, and h-index [19]. PoP provides a fast and easy way to produce important output characteristics and 18 bibliometric indications and scientometrics from the Google Scholar and other scientific databases. The users can change the result list provided in the small and efficient grid format by using PoP. It enables the dynamic sequences from a group of eight elements of metadata, untick items, and fast indicators re-calculation, which makes it easy to find and delete duplicate entries [20].

This software includes well-designed capabilities and an intelligent user interface. The result list or selected subset can be downloaded or exported from PoP to any kind of bibliography format, including BibTex, EndNote, and RIS, as well as in the format of comma-separated values (CSV) to be further processed in spreadsheets and database management tools. For bibliometric and scientometric analysis, the export option is considered an advantage. The indicator of the results and other information can be copied and pasted with or without a result list. A button can be pressed to select an item without citation. The individual item can be selected or canceled by highlighting it and using the button of tick/delete the selection to choose or cancel the option.

C. Google Scholar

Google Scholar (GS) is a scientific search engine from Google, the most popular and the strongest search engine in the world. As one of the scientific literature searching tools and citations monitoring, GS has drawn attention from the scientific world [21]. The strength of the link, between the terms in searching and how often or how recent work is being mentioned, determines how GS presents the result of the search [22]. GS indexes almost all works available on the web in any kind of language, including articles, journals, academic books, chapters, and non-peer-reviewed contents, such as conferences, work papers, thesis, and dissertations.

Google Scholar is considered as an open product, dynamic but not entirely controlled and automatic [23]. Scopus has positioned itself as controllable: from human intervention, close, more static and has been designed for direct competition with WoS [24]. Yet, the scope of GS is better towards subject special sources if compared to the paid database, such as WOS and Scopus [21]. Google Scholar is presumed as a useful bibliometric data source [25]. Google Scholar enables users to find new authors from various fields, trace the individual article's citation, and develop a public researcher's profile. It also provides other services, such as the ability to sort the papers based on date, access the complete texted article, and receive the new research by email [26], [27].

Pekdemir and Jensenius agree that the academicians mostly use the GS to access the citations for literature study, to make it easier in accessing the number and having a simple search interface [22], [27]. Yet, on the other side, GS is unable to access/scan every database and sometimes displays the wrong citation numbers. Another problem related to the author's name overlapping eventually will delay the search. The publication, such as books or conference proceedings are treated inconsistently, either in literature or GS. Neuhaus revealed that Google Scholar is left behind in delivering the recent information, and the database contains a lack in a certain scientific/academic subject if compared to others [28]. Nevertheless, Google Scholar is a platform that informs and spreads the research, guides the users towards future research, and establishes the academic network to enable collaborations [26].

D. VOSviewer

VOSviewer is a free software first developed by Eck and Waltman [29]. VOSviewer is a web-based application that can easily run on many hardware and operating systems that can be started directly from the internet. VOSviewer can present and visualize specific information about the bibliometric graphic map, so it is easier to interpret a relation or network [29]. This tool includes a graphic user interface that is easy to be used and enables the user to analyze the bibliometric map, deeper [30].

VOSviewer uses the VOS mapping approach to make a map, in which VOS stands for visualization of similarity. VOSviewer can display the constructed map by using the acceptable mapping technique. Finally, the application could present the map using the VOS mapping technique and the multidimensional scaling approach [31].

VOSviewer can be used to establish the scientific papers network, journals, researchers, research institutions, country, keywords, and concepts. Co-authorship, co-occurrence, citation, bibliographic coupling, and co-citation connection can be used to relate items in the network. VOSviewer can also receive the bibliography database file and reference manager file as inputs to establish the network. VOSviewer has already had Aan PIs that can be utilized to download the data. It could present the map in three different ways: network visualization, overlay visualization, and density visualization. When working with a large map consisting of hundreds of elements, the zooming and scrolling function enables the map to be examined in detail.

1) Network Visualization

An item in network visualization is presented by its label and circle. The weight of an item determines the label size and the surrounding circle. The more weight an item, the bigger label, and item circle will be. The label for several items might not be seen. It is performed to prevent the label to be overlapped. The color of an item is determined by the originated cluster. The link is represented by the line that connects each item. The closer the position of the two journals, the stronger the correlation. The inter-journal strongest co-citation link is also represented by a line [32].

2) Overlay Visualization

It is similar to network visualization, except that its elements are colored differently. In overlay visualization, things can be colored in two ways. If an item has a score, the item's color is determined by score, with the default color starting from blue (the lowest score) to green then yellow (the highest score). If on the other side, a thing has a color that is determined by a user, an item is determined by the item's color that is determined by a user. The overlay visualization is unavailable if an object has no score or color determined by a user [32].

3) Density Visualization

There are 2 types of density visualization, which are the item's density and cluster density. The radio button of item density and cluster density at the setting panel can be used to alter between two types of density visualization. Item in density visualization is represented by its label, the same as in the network and overlay visualization. The color within each dot of the item's density visualization represents the material's density in a designated position. In default, the color ranged from blue to green, later to yellow. The larger number of the object in the dot's environment, the bigger item's weight nearby, the closer the dot becomes yellow. On the contrary, the smaller items in a dot's environment, the lower weight an item nearby, and the color will be closer to the blue [32].

3. RESEARCH METHOD

In this study, the researchers employ the data derived from international publications in the Google Scholar database. The papers are limited ranged from 2011 to 2022. Types of publication is international publication collected by using Harzing's Publish or Perish software. The terms that are used as keywords are "planogram", "planogram design", "planogram optimization". The initial search by PoP is limited only to 1000 bibliography attachments or one search iteration only. Yet, from a total of 1000, only 117 meet the criteria to be later employed. The result of searching using PoP could be seen in Figure 1. The result of the sorting is saved in Research Information Systems (.ris) format.
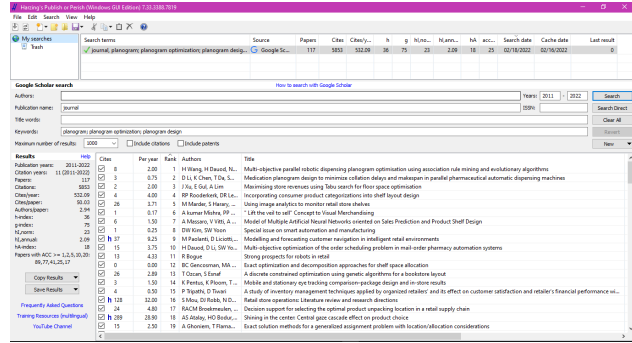
Later, the bibliometric analysis with development trend visualization on publication of planogram theme is performed by employing the VOSviewer software. VOSviewer is a computer program addressed to visualize the bibliometric map. The text-mining function can be utilized to visualize a network or relation (co-relation) in an article citation. This software offers an interface that enables detailed exploration of the bibliometric map. Previous research used the VOS mapping technique. VOSviewer could represent the map that was previously made by using the appropriate mapping technique.

4. RESULT AND DISCUSSION

Science mapping is a method of visualization on science subjects related to bibliometrics. It is performed by establishing a landscape map that could present science-related themes [31]. This section demonstrates the visual mapping graph of 117 planogram articles that were published to investigate the result of the meta-analysis. The findings on keyword mapping analysis are used to classify the important or unique term, identified in a certain publication. Mapping is a technique to identify the item of knowledge, as well as the configuration, dynamics, inter-dependency, and interconnection [31].

A. Bibliometric Analysis of Publication Output

There are 833 publications about planogram topics identified in the Google Scholar database from 2011 to 2022 by using Harzing's Publish or Perish. The type of publication that is derived from the collected data is illustrated in Figure 2, while the year distribution for publication can be seen in Figure 3.

There are 833 publications associated with planogram topics, identified from Google Scholar database between 2011 to 2022, that cover 723 (86,79%) original research article, 77 (9,24%) books, 17 (2,04%) review article, 12 (1,44%) reports, and 4 (0,48%) other form of publications including letters, editorial, and correction. Among others, 53 (6,36%) papers were published in 2011, 42 (5,04%) in 2012, 48 (5,76%) in 2013, 49 (5,88%) in 2014, 79 (9,48% in 2015, 80 (9,60%) in 2016, 91 (10,92%) in 2017, 81 (9,72%) in 2018, 93 (11,16%) in 2019, 97 (11,64%) in

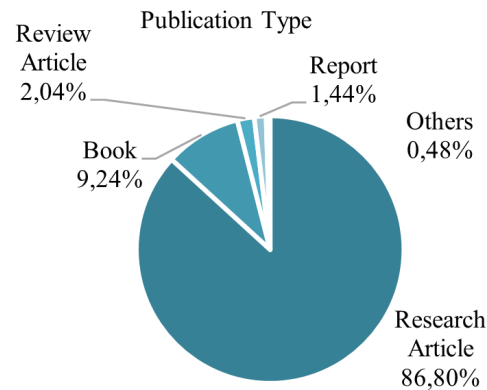Figure 1. The result of searching by using Harzing's Publish or Perish

Figure 2. Type of publication

2020, 104 (12,48%) in 2021, and 16 (1,92%) in 2022. Out of all published papers, only 117 publications that classified as international journal with English as the writing language. The percentage of publication sources can be seen in Figure 4.

B. Bibliometric Analysis of Citation

One of the basic characteristics of scientific activities is citation analysis. It is mostly based on the correlation between scientific products and citation. The method of mathematics, statistics, comparative, inductive, abstraction,
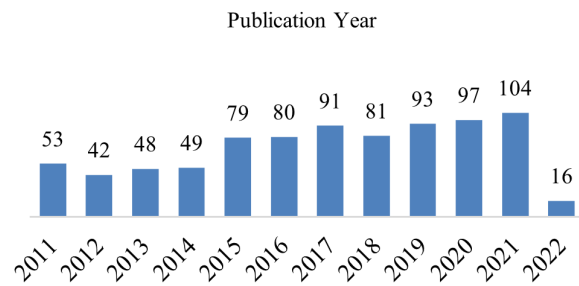

Figure 3. Year of publication
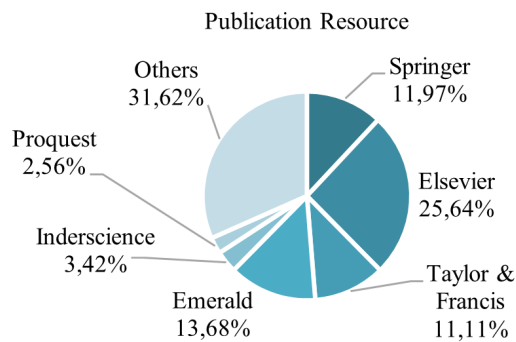
Publication Resource

Figure 4. Source of publication

generalization, and logics are employed in citation analysis. The method is used to determine the characters that are attached to the bibliometric analysis method by analyzing various scientific journals, articles, citation objects, and phenomena being cited [33]. By this practice, the strategy can be applied to various circumstances, and increase significantly. In the policy and the system of the research, more citations are used as the performance indicator [34]. Garfield suggested that the frequency of journal citation is the function, which not only signifies the scientific significance of the published material but also the number of publications released every year [35].

It is found out of 117 publications, from the result of document extraction using Harzing's Publish or Perish software, 14 (11,97%) were written by a single author, while others are identified as the collaborated research. From 117 publications, the citation reaches 5853 hits with a total citation per year of as many as 532,09. Average citation is originated from the division of total citations with numbers of years or numbers of journals that have been published. It compensates for the academic time/active journal that provides a fair comparison to the junior academicians. Besides, the number of citations is recorded as 50,03. The total average of citations per paper is counted by dividing total citations by total numbers of papers. The total average of authors per paper is counted by the addition of total authors involved in determining results, which are later divided by the numbers of papers. In this research, it is revealed a total average of authors per paper as 2,94. This indicates whether the author writes or the journal is written independently or collaboratively.

The most-cited document is an article written by Grewal, D., Ailawadi, K. L., Gauri, D., Hall, K., Kopalle, P., & Robertson, J. R. entitled "Innovations in retail pricing and promotions" derived from Journal of Retailing 87 of 2011 [36]. Since its publication in 2011, the document has been cited with 383 citations, with average citations of 34,82 per year. The total average of citations per author is calculated by initially dividing citations for each publication with the numbers of authors for designated publication. Later, the

generated citations are added. From 117 documents, it is documented that the most-published articles or writings are originated from the European Journal of Operational Research with 9 writings.

C. Bibliometric Analysis of Co-Authorship

The bibliometric mapping that is supported with VOSviewer software finds the condition, as illustrated by Figure 5. The bigger and the brighter the form indicates the authors who publish more papers about planograms.

The map can be used to conclude the authors who publish the most. The size of the label and circle of the author is determined by the value of the author. The higher value is represented by the larger size of the label and circle of an author. For several authors, the label is hidden to avoid table overlapping. The cluster density is affected by the brightness of the yellow color. The yellow color is specified by the number of objects associated with the other items.

Several authors are indexed as the single author, while the others collaborate with other academicians, which generate many clusters with varied densities. Nevertheless, the authors with relatively high density publish more research about planograms if compared to the low-density authors, therefore this result can be used as future references. According to the findings, the bigger and more outstanding an author is, the more writings have been published. Based on the bibliometric mapping, Sang Won Yoon is recorded as the most-productive author, in terms of planogram, as illustrated in Table I.

The co-authorship relationship represents the condition of whether an author has been collaborated with others, in terms of paper writing. Analyzing the co-authorship information helps the identification of a group of people who collaborate intensively. SW Yoon is identified in the first position, as he succeeded to collaborate with other 20 authors. The second place is occupied by K Kouda with a total collaboration of 17, followed by Y Fujita and H Nakamura who collaborate with other 16 authors, M Paolanti who collaborate with 15 authors, as well M Iki and R Pietrini who elaborate the research with other 11 authors.

D. Bibliometric Analysis of Trend Topics

This section intends to analyze the content, pattern, and trend of clusters of documents by measuring the power of a term and calculating the numbers of keywords that occur at the same time in the articles based on title, abstract, and the combination between titles and abstract.

1) Title Keyword

It can be revealed from the documents' title originated from GS, 812 terms are obtained. By activating the threshold of a minimum of 5 occurrences, only 153 terms were finally identified. Yet, as calculated by the VOSviewer, only 114 relevant terms can be visualized, as seen in Figure 6.

TABLE I. The Most-Influenced Authors in Planogram Studies

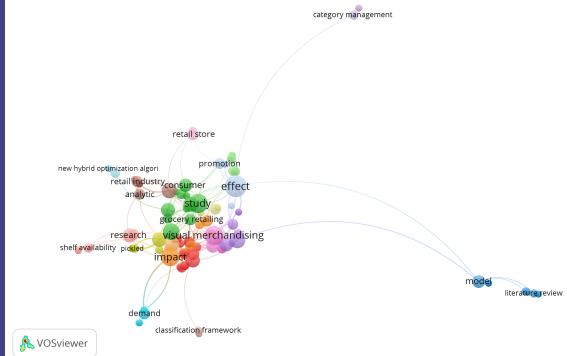| No	Author	Total Link Strength
1	SW Yoon	20
2	K Kouda	17
3	Y Fujita	16
4	H Nakamura	16
5	M Paolanti	15
6	M Iki	11
7	R Pietrini	11

Figure 5. Co-Authorship

Figure 6. The mapping of term co-occurence on title

The terms represented by bigger forms indicate that they are employed more on journals' titles related to planograms. Figure 6 indicates the higher frequency of co-occurrences on planograms. The lines represent the connection, in which the terms in the title often emerge concurrently. 5 terms appear the most, which are "effect" with 43 appearances, "visual merchandising" with 35, "study" with 34 times, "impact" with 31 times, and "approach" with 26. From the figure, it can be notified 18 themes (clusters) under different colors. Cluster detail that is based on the title keywords, described in Table II.

Each cluster has different numbers of the subject key. It indicates the variation of the planogram research field. From Table II, it is found that clusters 1 and 2 have the biggest number of keywords, 13 and 11 words, consecutively. It signifies that the theme of clusters draws more attention from the researchers. In other words, keywords in clusters 1 and 2 are acknowledged as the most often used in terms of planogram research.

2) Abstract Keyword

It can be revealed from the documents' title originated from GS, 2063 terms are obtained. By activating the threshold of a minimum of 5 occurrences, only 153 terms were finally identified. Yet, as calculated by the VOSviewer, only

97 relevant terms can be visualized, as seen in Figure 7.

The terms represented by bigger forms indicate that they are employed more on journals' abstracts related to planograms. Figure 7 indicates the higher frequency of co-occurrences on planograms. 6 terms appear the most, which are "retail store" with 26 times of appearances, "example" with 24, "system" and "number" with 23 times, as well as "approach" and "customer" with 20 times. From the figure, it can be notified 10 themes (clusters) under different colors. Cluster detail that is based on the abstract's keywords, described in Table III.

Each cluster has different numbers of the subject key. It indicates the variation of the planogram research field. From Table III, it is found that clusters 1 and 2 have the biggest number of keywords, 16 and 13 words, consecutively. It signifies that the theme of clusters draws more attention from the researchers. In other words, keywords in clusters 1 and 2 are acknowledged as the most often used in terms of planogram research.

3) All Keywords

The bibliometric analysis reveals several terms commonly used in scientific papers. The bigger the circle signal, the more keywords are presented. The Association

TABLE II. Keyword-Based Cluster on Title

Cluster	Total Keywords	Selected Keywords
1	13	Application; art; case; case study; design; development; hyper heuristic; industry; machine; planogram; relationship; state; trade marketing
2	11	Analysis; approach; choice; consumer; customer satisfaction; grocery retailing; health; shelf; store; study; visual attention
3	9	Decision support system; literature review; model; multiple artificial neural networks; product shelf design; research direction; retail assortment; retail store operation; sales prediction
4	7	Category captainship; category management comparative analysis; pickled preserved vegetable; retailer; space management; subcategory
5	7	Calorie turnover; evidence; framework; India; sale; shelf space management intervention; supermarket
6	7	Demand, inventory control; joint optimation model; retail operation; shelf display; spatial relationship; supply planning
7	7	Consumer buying pattern; customer experience; determinant; impact; layout; product choice; retail shoppability
8	7	Analytic; change; influence; marketing strategy; retail industry; sigma approach; technological advance
9	7	Concept; retailing; significant; strategic marketing; veil; visual merchandising; weapon
10	6	Logistics rationalization; participative methodology; practice; research; shelf availability; supply chain improvement
11	6	Examination; negative effect; search; shopping experience; special edition packaging; stock
12	5	Adjacent competitor; brand sale; consumer impulse buying behavior; effect; promotion
13	4	Consumer buying behavior; ordering process case; retail; value stream mapping
14	4	Category management; opportunity; scope; supplier retail business strategy
15	4	Goods; new hybrid optimization; optimal allocation; shop
16	4	Big data; data; predictive analytic; role
17	3	Classification framework; comprehensive review; retail shelf space planning
18	3	Product allocation; retail store; space dimensioning

TABLE III. Keyword-Based Cluster on Abstract

| Cluster	Total Keywords	Selected Keywords
1	16	Account; anterior view planogram; approach; brick; considerationl contrast; delivery plan; development; effect; hand; india; participant; retailing; structure; supermarket; visual merchandising
2	13	Area; category manager; input; planograms; price; pricing; program; promotion; retail manager; shelf space management; shopper; store level; store planogram
3	12	Algorithm; annealing; automated planogram; carrefour; good; heuristic; hyper-heuristic; investigation; layout plan; set; shelf space allocation; shelf space allocation problem
4	11	Analysis; article; choice; color; diary product; experiment; focus; food; implementation; planogram design; practice
5	9	Customer; example; hundred; internal problem; locality; retail store; simple planogram change; speed; version
6	9	Challenge; computer; monitoring planogram compliance; part; product category; retail planogram; system; type; value
7	8	Case; customer service; factor; major element; planogram analysis; reality; resource
8	8	Ability; attention; manager; point; purchase material; reason; shelf layout; store shelf planogram
9	6	Capacity; definition; number; retail environment; state; visual representation
10	5	Change; company; interest; marketer; range
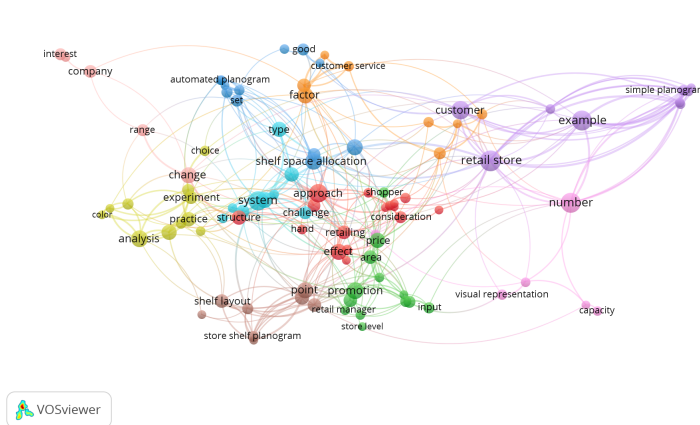
Figure 7. The mapping of term co-occurence on abstract

Figure 8. Network visualization

Figure 9. Overlay visualization

line between terms indicates their familiarity. The network visualization is displayed in Figure 8 that employs 75 terms contained in titles and abstracts of 117 publications, which are derived from GS.

Based on Figure 8, several clusters are recognized and can be associated with other keywords, based on analysis using VOSviewer on the planogram-themed keywords. 6 clusters are identified, cluster 1 colored red with 18 types, the second cluster colored green with 17 types, the third cluster colored blue with 14 types, the fourth cluster colored yellow with 10 types, the fifth cluster colored purple with 10 types, the sixth cluster colored light blue with 6 types. If the keywords are located in the same cluster, it means that the topic is correlated or studied concurrently. But if the keywords are in a different cluster, it is confirmed that keywords are discussed separately. This condition is considered as the research gap that might be discussed in future research. The specific title term that is mostly used in the program coordination article is "planogram" with total occurrences of 176 and total link strength of 525. The attribute of total link strength demonstrates the strength of the total co-occurrence link of particular keywords over others [32]. The overlay visualization of 75 terms can be seen in Figure 9.

From Figure 9, it can be notified in what year more publications discussed planogram based on the keywords. The publication of 2015 and below is indicated by the purple color, 2016 publication is illustrated with the color of purple, 2017 publication with green color, 2018 to 2022 publication is indicated with yellow. Figure 10 illustrates the density visualization of 75 terms that were previously occupied.

Based on Figure 10, it is obtained that the term "planogram" is the most-used keyword. Cluster density is influenced by the brightness of yellow. It indicates that the
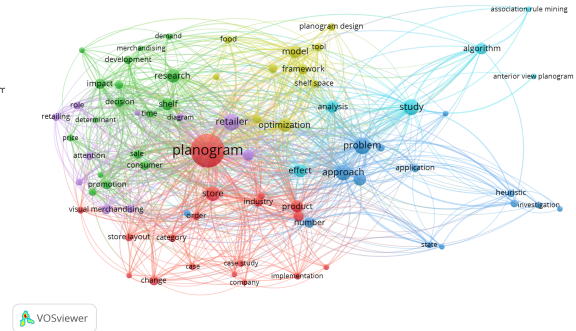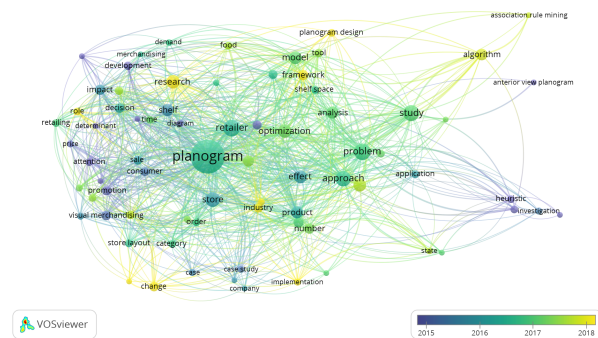
yellow color in the map is determined by the number of objects that correlated with other items. The faded color on several items, visualize the rareness of research that specifically discusses the item. It can be seen from Figure 10, the terms that are seldom used in titles and abstracts related to planograms, such as association rule mining, anterior view planogram, product category, shelf space allocation, food, demand, and application. This considers a research gap that potential to be used for further research related to planograms. The bibliometric analysis of trend topics summary can be seen in Table IV.

5. CONCLUSION

The bibliometric technique is commonly used to identify significant themes in every research, knowledge expansion, or current research and is beneficial to identify the distinctiveness for future research. This research conducts the analysis and bibliometric visualization on planogram-related publications that involve 117 international journals. It can be concluded that Elsevier is the publisher that has published the most publications regarding planograms. From a total of 117 publications, the citation hits 5853 citations with 532,09 per year. Besides, the number of citations per paper is recorded as 50,03. From this research, it is identified an average number of authors in a paper counted as 2,94. The most-cited document is written by Grewal, D., Ailawadi,

TABLE IV. Bibliometric Analysis of Trend Topics Summary

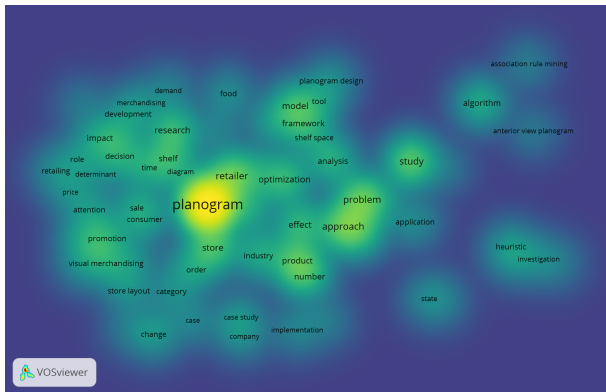|	Cluster	Terms Visualized	The Most Appear Terms
Title Keywords	18	114	Effect; visual merchandising; study; impact; approach
Abstract Keywords	10	97	Retail sotre; example; system; number; approach; customer
All Keywords	6	75	Planogram; retailer; store; problem; approach; product

Figure 10. Density visualization

K. L., Gauri, D., Hall, K., Kopalle, P., & Robertson, J. R. entitled "Innovations in retail pricing and promotions" originated from the Journal of Retailing 87 of 2011 [36]. Since its publication in 2011, the document has been cited 383 times. The European Journal of Operational Research has published 9 writings, in which, it publishes more writing than others. Based on the bibliometric mapping, the most-published writing related to planogram owned by Sang Won Yoon. He also has collaborated with other 20 authors in planograms studies.

The difference of cluster that is determined by color on the network visualization can be employed as the research opportunity. From density visualization, a research gap is found from the existing keywords that have never been studied before, such as association rule mining, anterior view planogram, product category, shelf space allocation, food, demand, and application. This study provides an opportunity for researchers to be able to explore more about planograms, a term that is rarely used in planogram research. It is hoped that with this, the development of science related to planograms can be more developed and expanded.

Despite the fact of inspiring findings from bibliometric analysis and publication visualization related to planograms, this research deals with several limitations. The data only rely on journals disregarding other types of publications, such as proceedings, paper reviews, and reports. Besides, the documents are derived from a single source, which is Google Scholar. It is suggested that future research could perform bibliometric analysis related to planograms by engaging the documents from different literature databases or considering other types of publication.

REFERENCES

[1] T. Flamand, A. Ghoniem, and B. Maddah, "Integrated assortment planning and store-wide shelf space allocation: An optimization-based approach," *Omega*, vol. 81, pp. 134–149, 2018.

[2] T. Bianchi-Aguiar, A. Hübner, M. A. Carravilla, and J. F. Oliveira, "Retail shelf space planning problems: A comprehensive review and classification framework," *European Journal of Operational Research*, vol. 289, pp. 1–16, 2021.

[3] P. M. Madhani, "Lean six sigma deployment in retail industry: enhancing competitive advantages." [Online]. Available: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4002472

[4] S. Mou, D. J. Robb, and N. DeHoratius, "Retail store operations: Literature review and research directions," *European Journal of Operational Research*, vol. 265, pp. 399–422, 2018.

[5] H. Liao, M. Tang, L. Luo, C. Li, F. Chiclana, and X. J. Zeng, "A bibliometric analysis and visualization of medical big data research," *Sustainability*, vol. 10, p. 166, 2018.

[6] X. Y. Leung, J. Sun, and B. Bai, "Bibliometrics of social media research: A co-citation and co-word analysis," *International Journal of Hospitality Management*, vol. 66, pp. 35–45, 2017.

[7] Y. Yu, Y. Li, Z. Zhang, Z. Gu, H. Zhong, Q. Zha, L. Yang, C. Zhu, and E. Chen, "A bibliometric analysis using vosviewer of publications on covid-19," *Annals of translational medicin*, vol. 8, p. 816, 2020.

[8] N. Donthu, S. Kumar, D. Mukherjee, N. Pandey, and W. M. Lim, "How to conduct a bibliometric analysis: An overview and guidelines," *Journal of Business Research*, vol. 133, pp. 285–296, 2021.

[9] M. Gaviria-Marin, J. M. Merigó, and H. Baier-Fuentes, "Knowledge management: A global examination based on bibliometric analysis," *Technological Forecasting and Social Change*, vol. 140, pp. 194–220, 2019.

[10] B. Fahimnia, J. Sarkis, and H. Davarzani, "Green supply chain management: A review and bibliometric analysis," *International Journal of Production Economics*, vol. 162, pp. 101–114, 2015.

[11] T. Hao, X. Chen, G. Li, and J. Yan, "A bibliometric analysis of text mining in medical research," *Soft Computing*, vol. 22, pp. 7875–7892, 2018.

[12] S. Wang, M. Zhang, T. Hu, X. Fu, Z. Gao, B. Halloran, and Y. Liu, "A bibliometric analysis and network visualisation of human mobility studies from 1990 to 2020: emerging trends and future research directions," *Sustainability*, vol. 13, p. 5372, 2021.

[13] K. Rørstad, D. W. Aksnes, and F. N. Piro, "Generational differences in international research collaboration: A bibliometric study of norwegian university staff," *Plos one*, vol. 16, p. e0260239, 2021.

[14] O. Ellegaard and J. A. Wallin, "The bibliometric analysis of scholarly production: How great is the impact?" *Scientometrics*, vol. 105, pp. 1809–1831, 2015.

[15] I. Tanudjaja and G. Y. Kow, "Exploring bibliometric mapping in nus using bibexcel and vosviewer," 2018.

[16] E. A. Bateman and R. Teasell, "Publish or perish: research productivity during residency training in physical medicine and rehabilitation," *American Journal of Physical Medicine Rehabilitation*, vol. 98, pp. 1142–1146, 2019.

[17] I. A. Moosa, "Publish or perish: Perceived benefits versus unintended consequences," 2018.

[18] A. Sandu, A. Frunza, and E. Unguru, "Ethics in research practice and innovation," 2018.

[19] E. Roldan-Valadez, S. Y. Salazar-Ruiz, R. Ibarra-Contreras, and C. Rios, "Current concepts on bibliometrics: a brief review about impact factor, eigenfactor score, citescore, scimago journal rank, source-normalised impact per paper, h-index, and alternative metrics," *Irish Journal of Medical Science*, vol. 188, pp. 939–951, 2019.

[20] P. Jacsó, "Calculating the h-index and other bibliometric and scientometric indicators from google scholar with the publish or perish software," *Online information review*, vol. 33, pp. 1189–1200, 2009.

[21] G. Halevi, H. Moed, and J. Bar-Ilan, "Suitability of google scholar as a source of scientific information and as a source of data for scientific evaluation—review of the literature," *Journal of Informetrics*, vol. 11, pp. 823–834, 2017.

[22] F. R. Jensenius, M. Htun, D. J. Samuels, D. A. Singer, A. Lawrence, and M. Chwe, "The benefits and pitfalls of google scholar," *PS: Political Science Politics*, vol. 51, pp. 820–824, 2018.

[23] P. Jacsó, "Google scholar: the pros and the cons," *Online Information Review*, vol. 29, pp. 208–214, 2005.

[24] ——, "Testing the calculation of a realistic h-index in google scholar, scopus, and web of science for fw lancaster," *Library trends*, vol. 56, pp. 784–815, 2008.

[25] A. W. Harzing and S. Alakangas, "Google scholar, scopus and the web of science: a longitudinal and cross-disciplinary comparison," *Scientometrics*, vol. 106, pp. 787–804, 2016.

[26] L. R. Zientek, J. M. Werner, M. V. Campuzano, and K. Nimon, "The use of google scholar for research and research dissemination," *New Horizons in Adult Education and Human Resource Development*, vol. 30, pp. 39–46, 2018.

[27] E. Pekdemir, "Google scholar through the eyes of academics," *International Technology and Education Journal*, vol. 2, pp. 1–10, 2018.

[28] C. Neuhaus, E. Neuhaus, A. Asher, and C. Wrede, "The depth and breadth of google scholar: An empirical study," *Portal: Libraries and the Academy*, vol. 6, pp. 127–141, 2006.

[29] N. Van Eck and L. Waltman, "Software survey: Vosviewer, a computer program for bibliometric mapping," *Scientometrics*, vol. 84, pp. 523–538, 2010.

[30] M. J. Cobo, A. G. López-Herrera, E. Herrera-Viedma, and F. Herrera, "Science mapping software tools: Review, analysis, and cooperative study among tools," *Journal of the American Society for information Science and Technology*, vol. 62, pp. 1382–1402, 2011.

[31] A. S. Rusydiana, S. Rahardjo, and W. S. Soeparno, "Mapping research on halal logistics using vosviewer," *Library Philosophy and Practice*, p. 5859, 2021.

[32] N. J. Van Eck and L. Waltman, "Vosviewer manual," 2013.

[33] J. Qiu, R. Zhao, S. Yang, and K. Dong, "Methods of citation analysis," pp. 207–309, 2017.

[34] D. W. Aksnes, L. Langfeldt, and P. Wouters, "Blockchain based cloud computing: Architecture and research challenges," *Sage Open*, vol. 9, 2019.

[35] H. F. Moed, "Implications for the use of citation analysis in research evaluation," *Citation Analysis in Research Evaluation*, pp. 221–225, 2005.

[36] D. Grewal, K. L. Ailawadi, D. Gauri, K. Hall, P. Kopalle, and J. R. Robertson, "Innovations in retail pricing and promotions," *Journal of Retailing*, vol. 87, pp. 543–552, 2011.

Melinska Ayu Febrianti is a fast track program student in Master of Industrial Engineering, Universitas Islam Indonesia. During college, she has published several scientific papers with research areas in logistics, operations research, industrial management, and ergonomics.

Qurtubi is an Assistant Professor in the Department of Industrial Engineering at Universitas Islam Indonesia (UII), Yogyakarta, Indonesia. He obtained his Doctoral Degree from UII in the area of logistics performance. His research interest is in marketing logistics, and supply chain.

Harlina Suzana Jaafar is an Associate Professor in Transport and Logistics at the Centre of Technology and Supply Chain Management at the Faculty of Business and Management, Universiti Teknologi Mara, Puncak Alam Campus, Selangor. She graduated with Advanced Diploma in Business Administration (Transport) from UiTM, MSc in Transport from Cardiff University, UK and PhD in Logistics from Loughborough University, England.

Nasruddin Faisol is a Senior Lecturer of Quantity Surveying at the Faculty of Architecture, Planning and Surveying, Universiti Teknologi MARA (UiTM), Shah Alam, Malaysia, He holds a Diploma and Bachelor of Quantity Surveying from the UiTM and joined UiTM as a lecturer in 1993. Graduated with master's degree in construction management (with Project Management) (with Distinction) from Glasgow Caledonian, UK in 1998 and obtained his doctoral degree from Loughborough University UK in the area of inter-organizational relationships in the construction supply chain.

Azreen Ariff Zulkeflee is an educator/lecturer of Surveying Department at Universiti Tunku Abdul Rahman, Sg Long Campus in Kajang, Selangor, Malaysia. He also a PhD candidate at Faculty of Architecture, Planning & Surveying, Universiti Teknologi Mara, Shah Alam, Selangor, Malaysia. Azreen has spent 4 years working as Quantity Surveyor in the construction Industry. Prior to joining the industry, Azreen was studied in Msc in Construction Management in Loughborough University, Leicestershire, United Kingdom and he has earned a Bachelor of Science in Quantity Surveying from Universiti Teknologi Malaysia, Skudai, Johor, Malaysia.