



Department of Digital Business

Journal of Artificial Intelligence and Digital Business (RIGGS)

Homepage: <https://journal.ilmudata.co.id/index.php/RIGGS>

Vol. 4 No. 2 (2025) pp: 4127-4133

P-ISSN: 2963-9298, e-ISSN: 2963-914X

Mapping and Visualizing Bullwhip Effect Research with a Bibliometric Analysis

Gayuh Lemadi¹, Dian Eko Adi Prasetyo², Lutfiani³

^{1,2,3}Industrial Engineering Study Program, Faculty of Science and Technology, As-Syafiiyah Islamic University

¹gayuhlemadi.fst@uia.ac.id, ²dianeko.fst@uia.ac.id, ³lutfiani.fst@uia.ac.id

Abstract

The Bullwhip Effect occurs due to demand information distortion from the retail level up to suppliers, ultimately resulting in inefficiencies and losses within the supply chain. The purpose of this paper is to present a bibliometric literature review related to the Bullwhip Effect as a key issue in supply chain management. Article data were collected from the Google Scholar database spanning from 1997 to 2025, yielding a total of 1,000 articles. A significant portion of the research originates from Indonesia, with findings indicating that most articles are indexed in SINTA 4, while no Scopus-indexed publications were found between 2015 and 2025. Reference management was conducted using the Publish or Perish and Mendeley software tools. The bibliometric analysis was carried out in five stages: (1) Initial keyword selection, (2) Initial search results, (3) Filtering of search results, (4) Compilation of preliminary statistics, and (5) Data analysis. The three most frequently co-occurring keywords with "Bullwhip Effect" were supply chain, impact, and model. Further data classification was performed using VOSviewer software, which was employed to identify the most frequently cited publishers and to map research opportunities related to supply chain studies, particularly those aimed at mitigating the Bullwhip Effect.

Kata kunci: Bullwhip Effect, Bibliometric Analysis, Publish or Perish, Mendeley, Google Scholar, Vosviewer

1. Introduction

Supply chains represent a networked structure of interconnected functions that transform inputs such as natural resources, raw materials, and components into final products, which are then delivered to end customers. The supply chain network consists of suppliers, manufacturers, distributors, and retailers, all of whom are connected through the flow of information and goods[1]. The efficiency of a supply chain system depends heavily on coordination and managerial decision-making, which have become increasingly challenging due to the growing complexity of modern supply chain systems. A supply chain functions as a networked structure of interconnected processes that transform inputs such as natural resources, raw materials, and components into finished products, which are then delivered to end customers. [2]. The transfer of information among members of the supply chain system often leads to information distortion and unexpected demand fluctuations. This typically results in order quantities that exceed actual sales. Greater variations in demand distortion are observed at upstream suppliers, creating a significant gap between upstream orders and downstream demand. This phenomenon is known as the Bullwhip Effect.[3]

The Bullwhip Effect is not a new phenomenon; numerous researchers from various disciplines have extensively studied it. However, Forrester (1968) is widely recognized as the first to formally investigate this phenomenon. Upon closer examination, the Bullwhip Effect emerges as one of the most critical issues addressed within the context of supply chain management[4]. The Bullwhip Effect has several negative impacts on the supply chain, including production errors, inventory buildup, slow product turnover, cost inefficiencies, and various other issues that collectively reduce the overall competitiveness of the supply chain[5]. Investigations conducted by Patil & Prabhu and Jiang et al. on both domestic and international companies reveal that approximately two-thirds of firms experience the Bullwhip Effect, indicating that this phenomenon is a common occurrence among businesses.[6][7]

There are four main causes of the Bullwhip Effect: demand forecasting, order batching, rationing and shortage gaming, and price fluctuations[8]. The Bullwhip Effect can be mitigated through four key approaches: information sharing or the implementation of the Collaborative Planning, Forecasting, and Replenishment (CPFR) model; shortening or restructuring the supply chain; applying fixed cost measurement; and promoting price stability[9]. However, to date, existing research has only been able to reduce the impact of the Bullwhip Effect; no approach

has successfully eliminated it entirely. This is largely due to the high complexity and vulnerability of supply chain systems, which make the complete eradication of the Bullwhip Effect extremely difficult to achieve.

This study builds upon and updates previous research from 2021, which conducted a bibliometric analysis of the term Bullwhip Effect, by incorporating a broader dataset and more recent publication trends. [10]. The purpose of this paper is to conduct a bibliometric analysis of existing literature on the Bullwhip Effect in order to address identified research gaps and answer the following research questions: Q1: How are articles on the Bullwhip Effect classified?, Q2: What are the research trends related to the Bullwhip Effect?, Q3: What are the main areas of focus in current studies?, Q4: What are the emerging research trends that may present future research opportunities?. To achieve this objective, the study systematically describes and analyzes previous literature on the Bullwhip Effect (BE), documents the research stages, and utilizes Google Scholar (GS) and Publish or Perish (PoP) software for data collection. Furthermore, VOSviewer and Python are employed for data processing and visualization, providing a comprehensive overview of the publication landscape and potential research directions.

2. Research Methods

This research takes the form of a literature study conducted using the mind mapping method, as outlined in the study by Tranfield et al[11]. In addition to the mind mapping method proposed by Tranfield et al., another viable approach is the more systematic, implicit, and reproducible method described by Barry et al[12]. The analysis in this study is a bibliometric analysis grounded in a scholarly approach, with a greater emphasis on qualitative research involving information media, scientific articles, and books[13]. This study adopts the stages of bibliometric analysis as introduced by Fahimnia et al[14], which are as follows:



Figure 1. Bibliometric Framework

2.1. Define appropriate search terms

The literature review study was conducted starting in June 2025 using the PoP software (version 8.18), combined with searches in Google Scholar as the primary database. For the keyword field, the term “Bullwhip Effect” was used, while for the publication title field, the word “Journal” was included within the PoP software. Since the Bullwhip Effect was first introduced in 1965, no specific year range was entered in the year filter of the software. As a result, a total of 1,000 articles were retrieved.

2.2. Initial search results

The initial search results are not surprising, as some articles may not appear or be properly linked when the keyword “Bullwhip Effect” is entered. However, several articles were retrieved directly using the “Bullwhip Effect” keyword in the PoP software, as shown in Table 1 below:

Table 1. Unfiltered search, Top ten articles identified from PoP

Authors	Cites	Title	Year
HL Lee, V Padmanabhan, S Whang	7097	Information distortion in a supply chain: The bullwhip effect	1997
HL Lee, V Padmanabhan, S Whang	5424	The bullwhip effect in supply chains	1997
F Chen, Z Drezner, JK Ryan	2945	Quantifying the bullwhip effect in a simple supply chain: The impact of forecasting, lead times, and information	2000
R Metters	1029	Quantifying the bullwhip effect in supply chains	1997
J Dejonckheere, SM Disney, MR Lambrecht	1015	Measuring and avoiding the bullwhip effect: A control theoretic approach	2003
SM Disney, DR Towill	952	The effect of vendor managed inventory (VMI) dynamics on the Bullwhip Effect in supply chains	2003
HL Lee, V Padmanabhan, S Whang	900	Comments on “Information distortion in a supply chain: The bullwhip effect”	2004
R Croson, K Donohue	795	Behavioral causes of the bullwhip effect and the observed value of inventory information	2006
J Dejonckheere, SM Disney, MR Lambrecht	715	The impact of information enrichment on the bullwhip effect in supply chains: A control engineering perspective	2004
F Chen, JK Ryan, D Simchi-Levi	683	The impact of exponential smoothing forecasts on the bullwhip effect	2000

2.3. Refinement of the research results

In the next step, each article retrieved from PoP was examined by sorting the papers to identify and remove irrelevant ones, while selecting those deemed relevant for further analysis and inclusion. The results of this filtering process are presented in Table 2. After sorting, a total of 70 relevant articles were obtained.

Table 2. Detailed Sorting Criteria

Sort search	Number of articles
Research From 1997 - 2025	1000
Research From 2015 - 2025 (Last 10 Years)	500
Research on the Asian Continent	327
Research conducted in Indonesia	95
Research indexed by Sinta and Scopus	70

The filtering process resulted in 70 articles deemed relevant based on the research indicators, specifically those conducted in Indonesia and indexed in SINTA or Scopus. Consequently, 930 articles were excluded from the initial dataset of 1,000 articles due to various factors. As shown in Table 3, a comparison was made between the initial dataset and the refined dataset to identify the journals most relevant to the study.

Table 3. Continue the matrix by PoP

Data PoP	Initial search	Refinement search
Input data	Journal, Bullwhip Effect from 1997 to 2025	Journal, Bullwhip Effect from 2015 to 2025
Source	Google Scholar	Google Scholar
Years	(1997-2025) 28 years	(2015-2025) 10-year-old
Papers	1000	70
Citations	54875	283
Cites/year	1959,82	28,30
Cites/ paper	54,88	4,04
Authors/paper	2,48	2,46
h-index	89	9
g-index	225	12
hI, norm	59	6
hI, annual	2,11	0,60
hA-Index	22	3

2.4. Compiling the initial data statistics

The data downloaded and collected in PDF format were stored using the Mendeley reference management software. Each article was then manually reviewed to ensure metadata completeness, including article type, title, authors, year of publication, volume, pages, abstract, and keywords. The verified set of 70 articles was subsequently exported as a .ris file. The dataset comprising articles relevant to the research specifications, particularly those focused on Indonesia and indexed in Sinta and Scopus shows a positive trend in Bullwhip Effect publications from 2015 to the present (2025), as illustrated in Figure 2. Next, the data were processed using Python version 3.11 and Visual Studio Code version 1.76, applying a quadratic regression model with a confidence level of 0.9. The resulting trend equation is: $Y = -519,046.04 + 513.576x - 0.13x^2$, as shown in Figure 2 below:

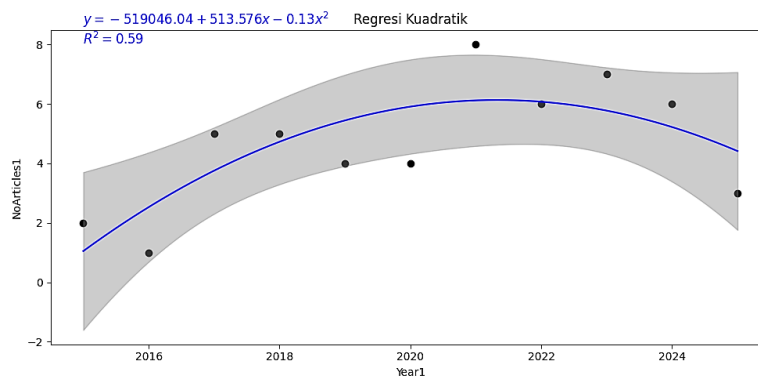


Figure 2. Article Trends from 2015 to 2025

Based on the data analysis presented in Figure 3, articles indexed in SINTA demonstrate the highest level of productivity, with SINTA 4 being the most dominant category in terms of publication count. In contrast, among the Scopus-indexed publications, the majority consist of articles without quartile classification, totaling five publications. Nevertheless, the trend in Scopus publications shows positive development, marked by the appearance of a recent article indexed in Q1 in 2025. This indicates a promising direction for future research efforts aiming for publication in reputable Scopus-indexed journals.

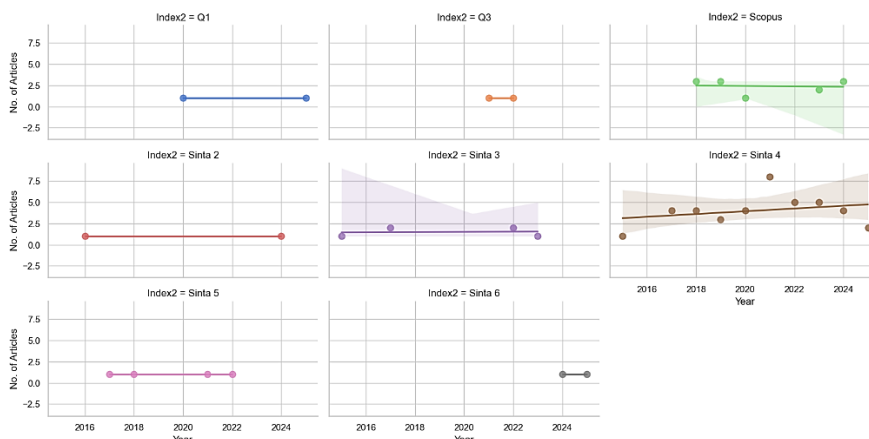


Figure 3. Articles according to Sinta And Scopus Indices

The classification of data based on publishers shows that Ejournal (an Indonesian journal platform) is the publisher with the highest number of articles indexed in SINTA. Meanwhile, for Scopus-indexed publications, the majority are still dominated by major international publishers such as Elsevier and Springer, as illustrated in Figure 4.

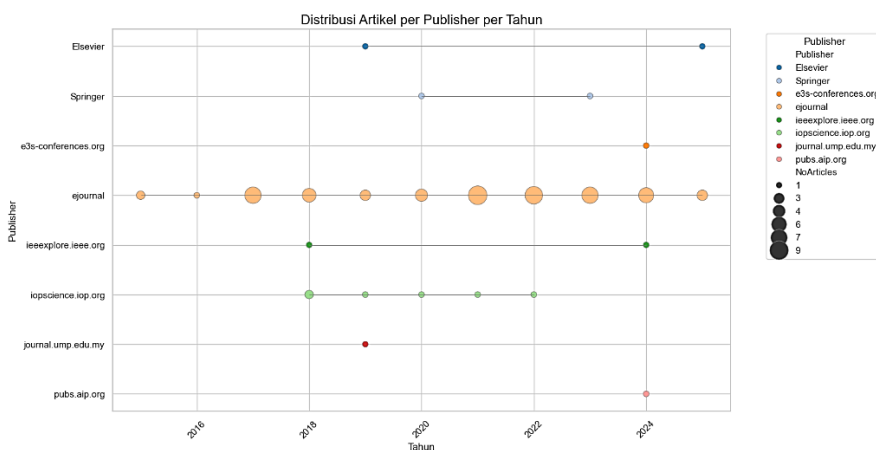


Figure 4. Trend Publisher

2.5. Data analysis

This article presents a bibliographic analysis of the term Bullwhip Effect based on data retrieved from the Google Scholar database. The data collection was conducted using the Publish or Perish software, developed by Professor Anne-Wil Harzing in 2006 under Tarma Research Software Pty Ltd, Melbourne [15]. The search was carried out using Publish or Perish version 8.18 on June 18, 2025, yielding an initial result of 1,000 articles with a total of 54,875 citations, averaging 1,959.82 citations per year. After applying refinement and filtering criteria, the dataset was narrowed down to 70 articles (a 93% reduction), with 283 total citations (a 99.48% decrease) and an average of 28.3 citations per year (a 98.55% decrease), along with a corresponding change in the H-index. The complete dataset from Publish or Perish is presented in Table 3..

3. Results and Discussion

VOSviewer was first developed in 2010 by Nees Jan van Eck and Ludo Waltman, and is designed to visualize bibliometric maps (see <http://www.vosviewer.com>). The classification in VOSviewer is based on keywords and the clustering of distinct data sets. Graphical visualizations using VOSviewer are generated by converting data

into RIS file format. Subsequently, co-occurrence analysis was selected as the primary method for keyword analysis in VOSviewer, using a comprehensive counting method. The minimum number of keyword occurrences can be adjusted as needed to meet the predefined threshold requirements.

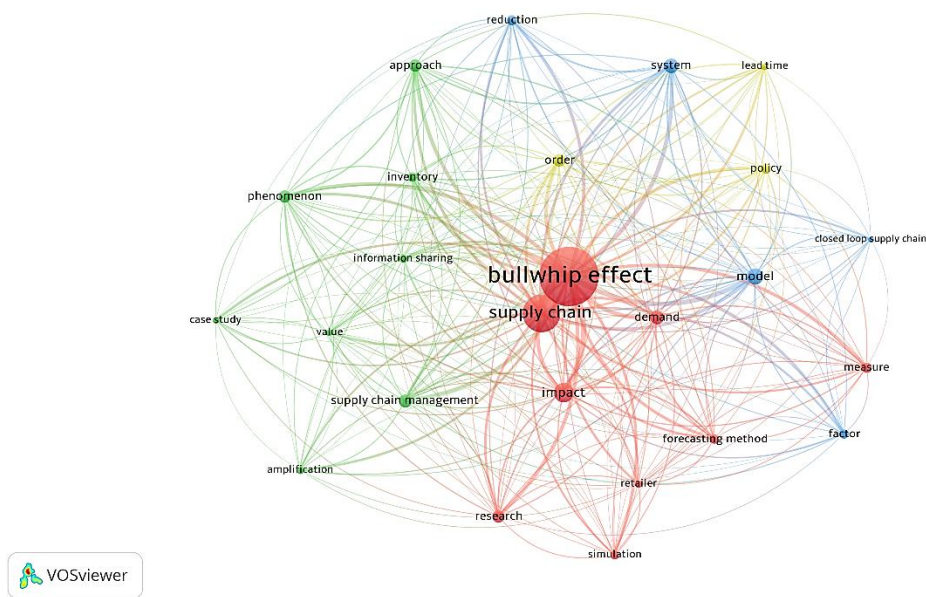


Figure 5. Network Visualization

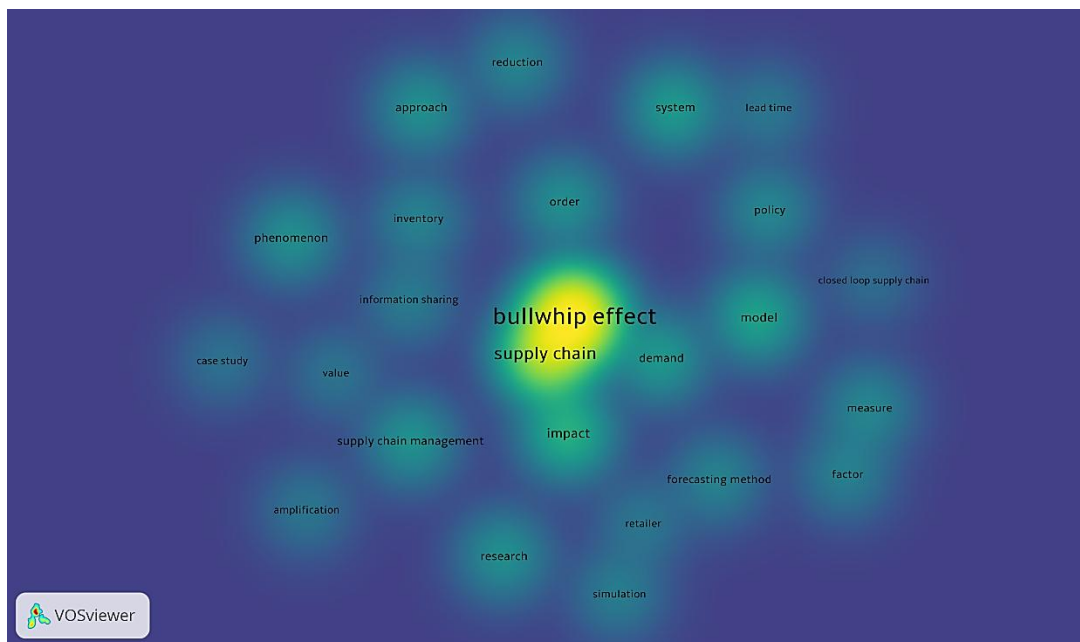


Figure 6. Density Visualization

The visualization generated by VOSviewer consists of three display types. The first is the network visualization, as shown in Figure 5, which illustrates the relationships between keywords. The second is the overlay visualization, which depicts research trends over time by assigning colors based on publication year; the more yellow the visualized item, the more recent the research activity, as illustrated in Figure 6. The third is the density visualization, which represents research concentration: areas with a high frequency of studies are shown in red, while areas with lower frequencies appear in green, also shown in Figure 6. A comparison of clustered data is presented in Figure 7, where keyword clusters are formed based on co-occurrence frequency and processed using

VOSviewer. The classification of studies is further illustrated in Figure 5, where the size of each node corresponds to the number of occurrences. VOSviewer automatically assigns different colors to keyword groups, allowing the identification of thematic clusters. This classification provides an initial answer to the first research question of this study:

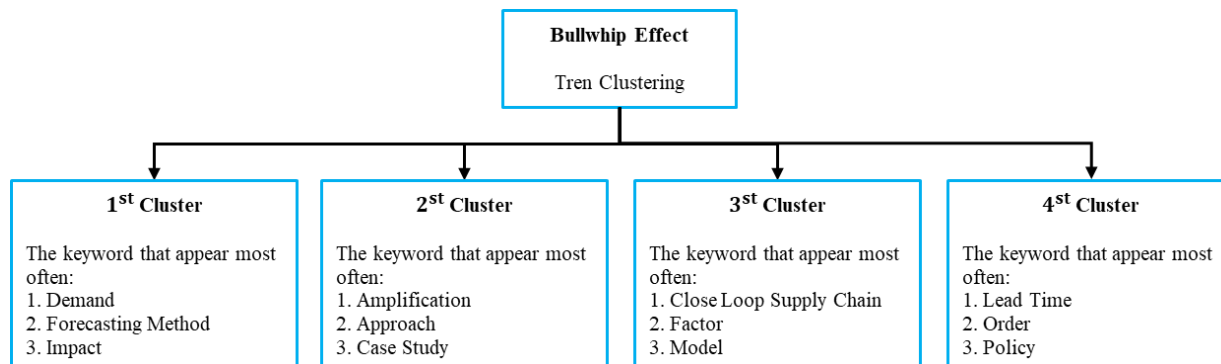


Figure 7. Bullwhip Effect Trends Articles

The clusters were formed based on frequently occurring keywords, derived from the data processed using VOSviewer. We constructed research clusters on the Bullwhip Effect using VOSviewer and identified four main clusters based on the most frequently appearing keywords. These include Cluster 1, Cluster 2, Cluster 3, and Cluster 4, as illustrated in Figure 7. The classification presented in Figure 7 serves as the answer to the second and third research questions of this study.

4. Conclusion

This study examines articles related to the Bullwhip Effect and successfully identifies 70 relevant publications originating from Indonesia. In the initial stage, approximately 1,000 articles were retrieved from the Google Scholar database using the Publish or Perish (PoP) software. A subsequent filtering process was conducted to narrow the search results, which led to a significant reduction in citation count from 54,875 to 283 citations, representing a 99.48% decrease. Nevertheless, the number of relevant publications demonstrated a positive trend after the filtering process. Research publications in Indonesia remain predominantly indexed in SINTA 4. In contrast, while the number of Scopus-indexed publications is relatively substantial, most of them lack quartile classification (Q1–Q4), indicating suboptimal quality and visibility at the international level. The study acknowledges its limitations, including the sample size and potential subjectivity, despite employing tools such as Publish or Perish, Mendeley, Microsoft Excel, VOSviewer, Python, and Visual Studio Code. Future research may consider expanding the geographical scope, for instance, combining data from Asia and Europe to gain a broader understanding of research productivity, while maintaining consistent keyword usage to ensure analytical comparability.

Reference

- [1] A. Darmawan, H. W. Wong, and J. Fransoo, "Supply chain network design with the presence of the bullwhip effect," *Int. J. Prod. Econ.*, vol. 286, no. May, p. 109668, 2025, doi: 10.1016/j.ijpe.2025.109668.
- [2] Q. Hu, "Bullwhip effect in a supply chain model with multiple delivery delays," *Oper. Res. Lett.*, vol. 47, no. 1, pp. 36–40, 2019, doi: 10.1016/j.orl.2018.11.009.
- [3] E.-S. Ionel and A.-D. Miron, "Bullwhip Effect Demand Variation and Amplification within Supply Chains," *Proc. Int. Conf. Bus. Excell.*, vol. 17, no. 1, pp. 246–253, 2023, doi: 10.2478/picbe-2023-0026.
- [4] J. W. Forrester, "Industrial dynamics: After the first decade," *Manage. Sci.*, vol. 14, no. 7, pp. 398–415, 1968.
- [5] M. Udenio and J. C. Fransoo, "The bullwhip effect," *Int. Encycl. Transp.*, no. May, pp. 1–12, 2021.
- [6] V. P. Chintan Patil, "Supply chain cash-flow bullwhip effect: An empirical investigation," *Elsevier Int. J. Prod. Econ.*, vol. 267, no. January, 2024, [Online]. Available: <https://doi.org/10.1016/j.ijpe.2023.109065>
- [7] X. P. S. Jiang, C. Pang, X. Liu, "The Bullwhip Effect in Omni-Channel: An Analytically-Grounded Empirical Investigation," *Europe*, vol. 79, no. 0, p. 21, 2024, doi: 10.2139/ssrn.4989712.
- [8] S. Lee, H. L., Padmanabhan, V., & Whang, "The Bullwhip Effect in Supply Chains," *J. Oper. Manag.*, vol. 38, pp. 93–103, 1997.
- [9] M. Rezaeefard, N. Pilevari, F. F. Razi, and R. Radfar, "Reducing the bullwhip effect in supply chain with factors affecting the customer demand forecasting," *Int. J. Serv. Oper. Informatics*, vol. 12, no. 2, pp. 144–183, 2022, doi: doi.org/10.1504/IJSOI.2022.126328.
- [10] A. P. U. Gayuh Lemadi, Hendi Herlambang, "Bibliometric Analysis Of Bullwhip Effect Base On Google Scholar Database," *3 rd Mercu Buana Conf. Ind. Eng. 2021 "Research Dev. based Lit. Rev. ISBN 978-623-93423-1-9 978-623-93423-1-9*, vol. 3, pp. 140–148, 2021.
- [11] D. D. and P. S. David Tranfield, "Towards a Methodology for Developing Evidence-Informed Management Knowledge by Means of Systematic Review *," *Br. J. Manag.*, vol. 14, no. 2, pp. 207–222, 2003, doi: 110.1111/1467-8551.00375.

- [12] E. S. Barry, J. Merkebu, and L. Varpio, "State-of-the-art literature review methodology: A six-step approach for knowledge synthesis," *Perspect. Med. Educ.*, vol. 11, no. 5, pp. 281–288, 2022, doi: 10.1007/s40037-022-00725-9.
- [13] R. Heersmink, J. van den Hoven, N. J. van Eck, and J. den van Berg, "Bibliometric mapping of computer and information ethics," *Ethics Inf. Technol.*, vol. 13, no. 3, pp. 241–249, 2011, doi: 10.1007/s10676-011-9273-7.
- [14] B. Fahimnia, J. Sarkis, and H. Davarzani, *Green supply chain management: A review and bibliometric analysis*, vol. 162. Elsevier, 2015. doi: 10.1016/j.ijpe.2015.01.003.
- [15] Anne Wil Harzing, *The publish or perish book Your guide to effective and responsible citation analysis*. Melbourne, Australia, 2011. [Online]. Available: <https://harzing.com/publications/publish-or-perish-book/pdf>