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The use of supply chain operations reference (SCOR) in measuring the performance of supply chain management in the agribusiness sector

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ABSTRACT

Introduction: This article uses a literature review study approach sourced from previous research and relevant to the topic of this research, namely the Supply Chain Operation Reference (SCOR) model. This research aims to (1) analyze the trend of SCOR Model research in the field of Agribusiness (2) identify supply chain management performance indicators (3) identify variables considered in measuring supply chain management performance (4) analyze the effectiveness of SCOR measuring supply chain management performance, especially in the field of Agribusiness. **Methods:** This study conducted a literature review of 32 articles from 2014-2023 in the fields of management, business, and agriculture. Data analysis used bibliometrics and a Systematic Literature Review sourced from the Scopus database with the help of VOSviewer and R-Studio software. **Results:** The results showed that the trend in the number of SCOR model studies fluctuated, which was dominated by articles sourced from Scopus with the main keywords that appeared were Supply Chain Management and SCOR Model. All articles carried out four main business processes namely Plan, Source, Make, and deliver with the priority of reliability attributes as the main improvement priority. **Conclusion:** Most of the supply chain performance levels of the articles analyzed are in the average category.

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INTRODUCTION

Continuous improvement and effective performance management are fundamental aspects of supply chain management. Therefore, performance measurement is a must. This measurement is the basis for determining the direction of improvement, the goals to be achieved by the organization, as well as the organization's relative position to competitors (Pujawan, 2005). One relevant measurement model is the Supply Chain Operation Reference (SCOR), which comprehensively reviews important aspects of supply chain management. The implementation of the SCOR model has been widely recognized to improve business processes and overall performance in supply chain management (Akkawuttiwanich & Yenradee, 2018).Therefore, many companies have adopted this model (Zhao, 2011), as done by Fredrik Persson and Jonas Bengtsson (2010), Bal *et al.* (2013) in the field of construction, Sutawijaya *et al.* (2016) in manufacturing, Sarjono *et al.* (2017) and Ardiansyah & Aspiranti (2020) in transportation and agriculture.

Supply chain issues in agribusiness are highly complex and challenging, especially in implementing the SCOR (Supply Chain Operations Reference) model in the agricultural sector. One of the main challenges is the difficulty in measuring supply chain performance due to the variability of agricultural products which are perishable and highly influenced by external factors such as weather, season, and inconsistent harvesting processes. This results in a high level of waste, with an estimated 1.3 billion tons of food wasted globally each year (FAO, 2019), and most of this waste occurs at the stage of distribution of agricultural products where infrastructure and efficient management are still lacking. In addition, the complexity of the agricultural supply chain involving various parties, from farmers, collectors, processors, and distributors, to retailers, creates challenges in effective coordination and collaboration, thus hampering the achievement of operational efficiency and responsiveness to dynamic market demands. Limited data and transparency at every stage of the supply chain make it increasingly difficult to accurately evaluate performance and often lead to poor decisions in resource allocation.

To address these challenges, this study aims to identify and bridge existing gaps through the application of the SCOR model adapted for the agribusiness context. The SCOR model will be used to map and improve key processes in The supply chain, from raw material procurement to production and distribution, with an emphasis on more accurate

performance measurement and data relevance. In this case, the urgent need to implement the SCOR model can help design a more structured management system to minimize waste, increase cost efficiency, and create a system that is more responsive to changing demand and market conditions. The implementation of the SCOR model is expected to provide concrete solutions to create a more efficient, transparent, and sustainable agricultural supply chain. In today's competition, business actors are required to realize that the competition that occurs is competition between supply chain networks. Business actors in a supply chain must be able to deliver products according to consumer desires in terms of quality, quantity, price, time, and the right place, given that competitors in this agribusiness also include those from abroad who in some cases have implemented more advanced agricultural management and technology, among others marked by the still dominant imported fruit in our domestic market. With the characteristics of these agricultural products, appropriate supply chain management must be arranged.

"One method of measuring supply chain performance is the SCOR model. The SCOR model provides a methodology, diagnosis, and benchmarking tools used to help organizations make comprehensive and rapid improvements in supply chain processes (APICS, 2017). This model has become a reference for many researchers in measuring supply chain performance. Some relevant studies involving the SCOR model include those by Sellitto *et al.* (2015), Kusrini and Miranda (2019), Yuniaristanto *et al.* (2020), Bire (2021), and Lemghari *et al.* (2018). In the performance section, SCOR focuses on measuring and assessing the results of supply chain process execution. The research that has been carried out reveals the importance of applying the SCOR Model in improving supply chain performance in various industrial sectors. Sellitto *et al.* (2015) emphasized the use of the SCOR Model to evaluate performance in the manufacturing sector with a focus on quality, cost, and time. Kusrini and Miranda (2019) applied this model to the retail sector, suggesting the integration of information technology to improve transparency and efficiency. Yuniaristanto *et al.* (2020) examined the application of the SCOR Model in the food and beverage industry, which resulted in a reduction in waste and an increase in responsiveness to market demand. Bire (2021) highlighted the benefits of the SCOR Model in the logistics sector to manage shipments and inventory more flexibly. Lemghari *et al.* (2018) focused on the adaptation of the SCOR Model in a global context, proposing modifications to address international challenges such as regulatory differences and political risks. Overall, this research shows that the SCOR Model is an effective tool for optimizing supply chains, increasing efficiency, and reducing risk in company operations across various industries. The main difference between this study and previous studies lies in the sector focus and the methods used. Previous studies have focused more on the manufacturing, retail, logistics, and global sectors, while this study focuses on the field of agribusiness using a more systematic analytical approach through bibliometrics and literature review. In the agribusiness sector, the specific challenges faced by supply chains, such as dependence on seasonality and product diversity, make the application of the SCOR Model need to be adapted to local conditions that are more varied and different compared to other industrial sectors.

The section has three elements, namely performance attributes, metrics, and process/practice maturity, to understand, evaluate, and diagnose supply chain performance (APICS, 2017). However, the actual utilization is done up to certain elements only. Sarjono *et al.* (2017) utilized up to level-1 metric elements, Peña-Orozco and Rivera (2017) up to level-3 metrics, Yuniaristanto *et al.* (2020) up to level-2 metrics, and Francisco Rodrigues and Carpinetti (2019) focused on the performance attributes element. Managing supply chain management is not an easy job; sometimes in the process, it is faced with complex problems. Therefore, other models or methods are implemented and combined with the SCOR model. Some of these methods, such as those carried out using SNORM normalization calculations by Nurhandayani and Noor (2018) to assist in the Analytical Hierarchy Process (AHP), and Surjasa, Dadang, and Irawati (2017) utilized a measurement model with a combination of quantitative and qualitative approaches (OMAX). Although the SCOR model provides advantages, such as being able to identify performance indicators (Surjasa, Dadang, & Irawati, 2017) and reducing consistent failures (Lemghari *et al.*, 2018), the model also has shortcomings or limitations. For example, Ricardianto *et al.* (2022) found that the management of metrics is still difficult, and Zhao (2011) noted a relatively weak relationship between the Plan process and Make.

The Supply Chain Operations Reference (SCOR) model is a supply chain language, which can be used in various contexts to design, describe, configure, and reconfigure various types of commercial business activities. The application of the SCOR model is within certain limits flexible and can be customized to increase productivity to meet customer needs. The Supply Chain Council (SCC) of the USA introduced the first Supply Chain Operations Reference (SCOR) in 1997. The model is organized around five processes: Plan, Source, Make, Deliver, and Return, and four levels of process detail (Supply Chain Council, 2012). SCOR is a process reference model that combines concepts in business process reengineering, benchmarking, and process measurement. The achievement of supply chain objectives will be analyzed through indicators in the performance attributes of reliability, responsiveness, supply chain costs, and asset management. As a cross-industry de facto standardized diagnostic tool for supply chain management. SCC has published its eleventh version.

The stages of the SCOR Model are a schematic representation of the SCOR Model (Supply Chain Operations Reference Model), which is used to map and manage various processes in the supply chain. The SCOR Model was first introduced by APICS (American Production and Inventory Control Society) and aims to provide a standardized

framework for measuring and improving supply chain performance. The model consists of five main processes: Plan, Source, Make, Deliver, and Return, which are depicted in a flowchart involving relationships between suppliers, companies, and customers, both internal and external. In the first stage, Plan, the company plans the entire supply chain flow, including production capacity planning, demand management, and procurement planning. Source is the stage of procuring goods or raw materials, which can come from internal or external suppliers. After the raw materials are available, the Make stage is the production process where goods are processed into finished products according to market demand. The next stage is delivery, where finished products are delivered to customers, both internally (within the company) and externally (outside customers). Finally, Return includes the process of returning defective or non-conforming products from the customer to the company, and can continue to the supplier for further returns. The SCOR Model integrates the various activities that occur in the supply chain from suppliers to customers and provides a framework that companies can use to measure, evaluate, and improve their operational efficiency.

The SCOR model can evaluate the supply chain through the concept of describing the core processes of plan, source, make, deliver, and return which are configured with the actual business of the company. Through the SCOR model approach, the company's performance is expected to be measured properly so that the owner can determine improvements from the lowest supply chain indicators. The writing of this paper aims to (1) Measure the SCOR model research trend in agribusiness in the last 10 years (2) Analyze supply chain management performance indicators (3) Identify variables considered in measuring supply chain management performance (4) Analyze the effectiveness of SCOR in measuring supply chain management performance, especially in agribusiness.

METHODS

The research method used is the systematic literature review. This research systematically reviews relevant literature in certain fields. The stages of the systematic literature review focus on (1) formulating the research problem formulation, (2) conducting a literature search, (3) evaluating relevant literature, (4) analyzing data, and (5) reporting the study results obtained. Bibliometric analysis and Prism diagrams were also used in answering the research objectives and visualizing the discussion results.

Data sources used

The data sources in this study include databases that are widely known in the academic world, such as Scopus and ScienceDirect. Both databases provide relevant literature, both in the form of journal articles and proceedings that support the topic of this research. Scopus, in particular, is used to search for published scientific articles related to the topic of SCOR (Supply Chain Operations Reference) measurement and supply chain management. The literature search process was carried out using relevant keywords and appropriate filters.

Keywords and search strategy

The search strategy focused on keywords relevant to the research topic, such as “Scor measurement,” “supply chain operations reference,” “Scor model,” and “supply chain management measurement.” The search was carried out using a special search string in the Scopus and ScienceDirect databases, namely:

> TITLE-ABS-KEY (scor AND model AND supply AND chain AND management) AND (LIMIT-TO (SUBJAREA, “BUSI”) OR LIMIT-TO (SUBJAREA, “ECON”) OR LIMIT-TO (SUBJAREA, “AGRI”)) AND (LIMIT-TO (DOCTYPE, “ar”)) AND (LIMIT-TO (LANGUAGE, “English”))

In addition, the search was limited to literature published between 2014 and 2023, focusing on the subject areas of business, management, and agriculture, as well as documents in the form of articles in English and open access.

Inclusion and exclusion criteria

Inclusion criteria include articles published between 2014 and 2023, with subjects related to supply chain management, SCOR measurement, and SCOR models. Exclusion criteria include articles that do not fit the topic, such as articles published before 2014, articles that are not relevant to the field of business, management, or agriculture, as well as literature that is not in English or not available in open access.

Article selection procedure

The first step of SLR is to determine the keywords, determine the restrictions that are strict enough to get the desired journal articles such as the year of literature in the 2014 – 2023 time range, and subject areas that include Business, Management, and Agriculture. The document type is in the form of an article, the publication stage is at the final stage, and the keywords searched are Scor measurement, supply chain operations reference, Scor model, and supply chain management measurement. The language used is only English, and only on open access literature. The article selection procedure is carried out with a screening stage, where only articles that meet the inclusion criteria are selected for further analysis. This process involves searching for and filtering articles using the Scopus and ScienceDirect databases. Of the 143 articles found, screening was carried out to obtain 32 articles relevant to the

research topic. The articles were then selected based on their relevance to the topic and their quality.

Data analysis approach

The data obtained through literature searches were analyzed using a bibliometric analysis approach. Bibliometric analysis is a study that measures the development of research and literature in a field using statistical methods. Bibliometric analysis is a study that measures the development of research and literature in a particular field either quantitatively or qualitatively using statistical methods (Hakim, 2020). This approach allows researchers to assess research trends, influences, and the relevance of literature in the context of the topic under study. In addition, the Prism diagram is also used to visualize the results of the discussion and provide a clearer picture of the relationship between the analyzed articles (Figure 1). This research was conducted systematically by following the rules of the literature review process to avoid the subjective understanding bias of the researcher (Ferrari, 2015). The literature review is one of the research methods used to collect data or sources related to a topic to be researched with data that can be obtained from various sources such as journals, books, theses, and other literature: Journals, books, theses, and other literature (Aisyah & Ghozali, 2020). The data used in this study comes from scientific publication databases, namely ScienceDirect and Scopus.

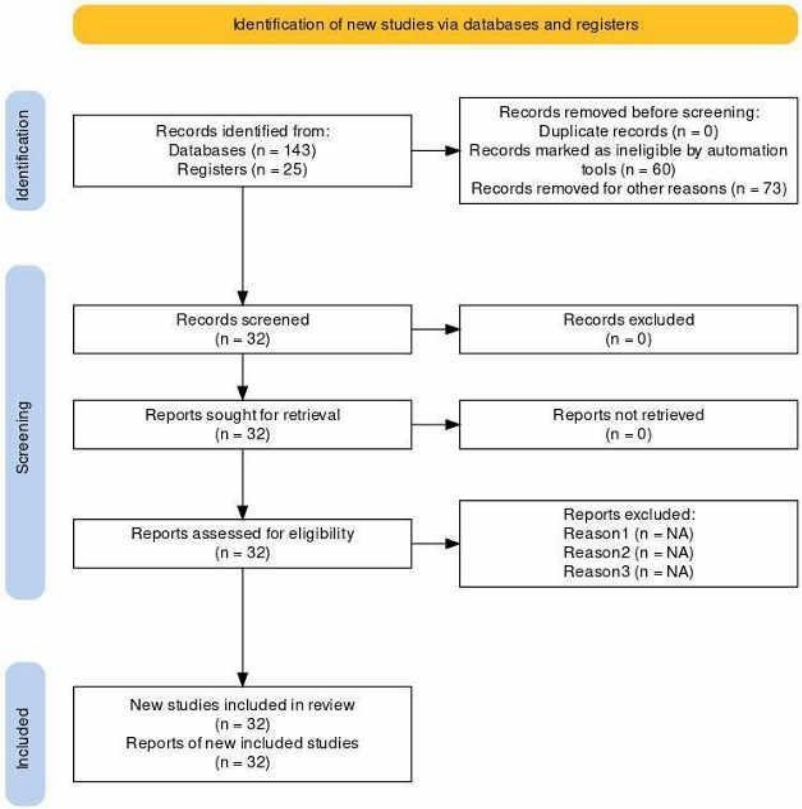

Figure 1. Prism Diagram

Figure 1 is a PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow diagram illustrating the process of identifying, screening, eligibility, and inclusion of new studies for a systematic review. Overall, the diagram shows how a large number of initial records are screened through various stages to ultimately yield a limited number of relevant studies for inclusion in the systematic review.

RESULTS AND DISCUSSION

Trend of SCOR model research in the field of agribusiness

The Supply Chain Operation Reference (SCOR) model is a model developed by the Supply Chain Council (SCC), which is used to measure and improve the company's supply chain performance (Henry & Nusraningrum, 2020; Ehie & Ferreira, 2019; Handayani *et al.*, 2019). The SCOR model provides an assessment of delivery performance and fulfills demand, inventory, and asset management. Not only that, production flexibility, assurance, process costs, and other factors affect the overall performance of the supply chain assessment (Permana *et al.*, 2020). As one of the reference models used, the SCOR model is based on three main elements, including process modeling: a reference to identify a model of a supply chain process for easier translation and analysis; performance measurement: a reference for measuring a company's supply chain performance as a standard; and implementing best practices: a reference to determine the best practices required by the company. The SCOR model contains five main management processes:

Plan, Source, Make, Deliver, and Return. The model can be used to describe very simple or complex supply chains and has been able to describe and provide the basis for supply chain improvement for global and site-specific projects.

Based on the results of the analysis that has been carried out using the R studio application and assistance from the VOSviewer application, it shows a mapping and description of the SCOR Model topic from the Scopus database, and the output results are visualized in various forms of tables, images, or mapping. The visible results are presented in Several forms of discussion including the main information available from the documents, source interactions, titles and authors, three fields plot diagrams, relevant article sources, countries producing the most articles, dominating keywords, conceptual structures, thematic maps, and thematic evolution are further presented. Information that is closely related to keywords, authors, and also the source of reference journals can be analyzed by visualization using the Three Field Plot. This diagram represents relevant author names on the left, keywords in the center, and reference journals on the left as depicted in Figure 2.

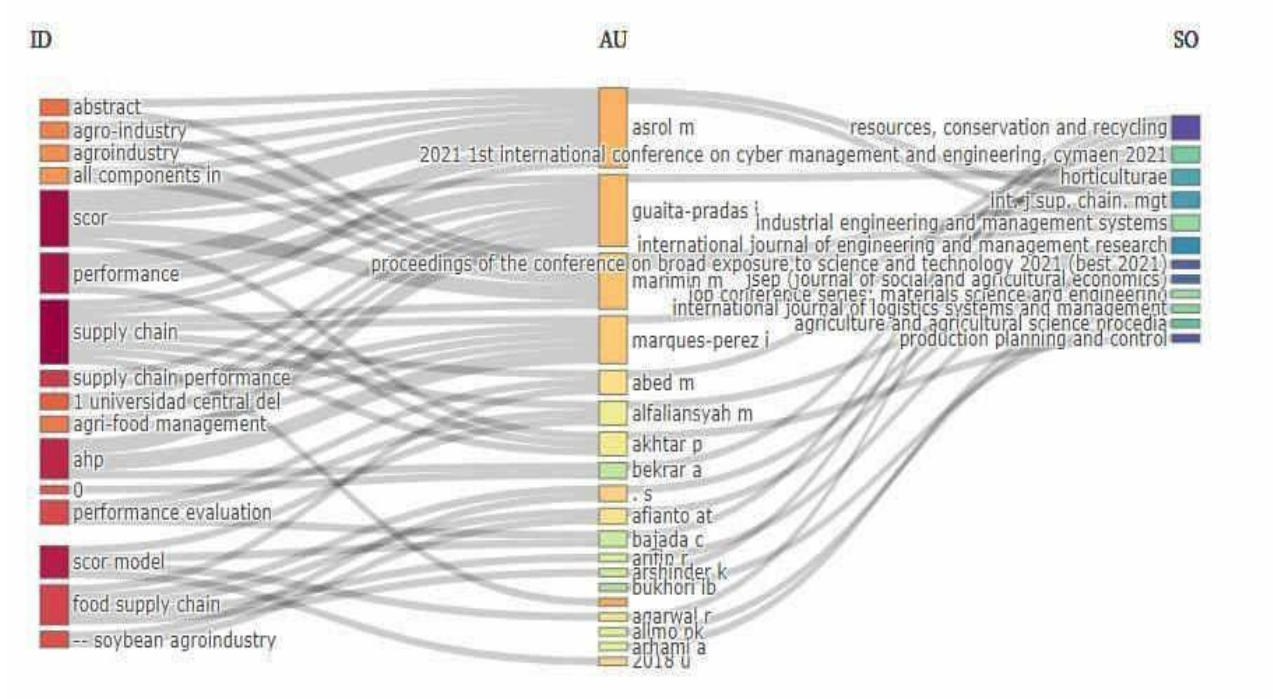

Figure 2. Three Field Plot

The purpose of Figure 2 is to illustrate the relationship between authors, keywords, and publications in the context of SCOR MODEL-related research. This visualization aims to show the relationship between key elements, such as authors, dominant keywords, and the journals or conferences in which the publications were published. This visualization is expected to provide a clear picture of who the main authors are on the topic and how the topics are spread across various scientific publications. Based on the findings in this image, Asrol M is the most prominent author, with significant links to various keywords such as supply chain, performance, and SCOR. These keywords indicate that the research focus is largely related to performance evaluation in agro-industrial supply chains. In addition, the leading publications connected to this author and these keywords are “Resources, Conservation, and Recycling” and “Proceedings of the 1st International Conference on Cyber Management and Engineering (CYMAEN 2021)”. This pattern shows that research in this field is largely related to supply chain optimization and the application of SCOR models to improve performance in the agro-industrial sector.

The interpretation of these findings shows that the emphasis on supply chain and performance evaluation focuses on the implementation of the SCOR model in optimizing supply chains in the agro-industry. Asrol M's dominance as the lead author in this visualization shows the important role of the author in this study. This pattern illustrates that topics related to agro-industrial supply chains and performance evaluation have made a significant contribution to scientific literature, with the implication that further research needs to explore the application of the SCOR model in greater depth to improve supply chain efficiency in the agricultural sector. The information presented in this image is highly relevant to the research objective of focusing on supply chain and performance evaluation in the agro-industrial sector. By mapping the relationships between authors, keywords, and publications, this visualization helps to explore in more depth the application of the SCOR model in improving supply chain performance, which is part of the broader research objective.

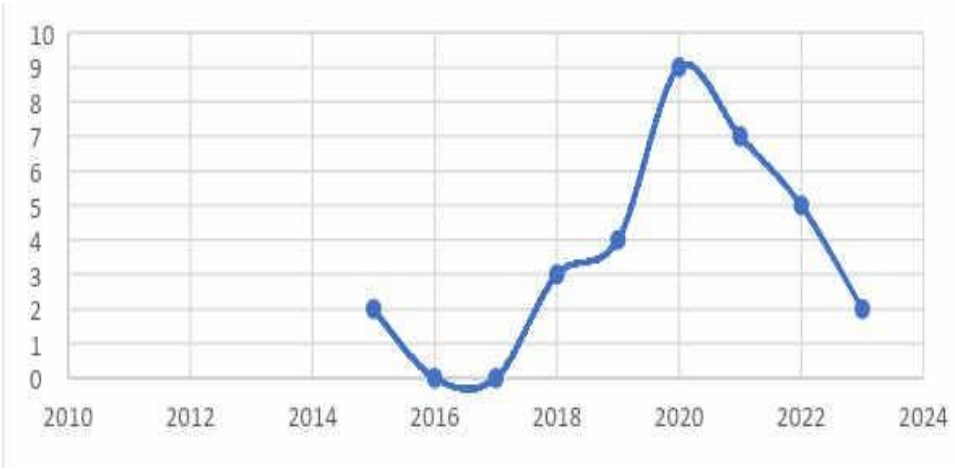

Figure 3. Number of Articles in 2014-2023

Figure 3 presents the trend of article publications related to the topic of the SCOR model over the past ten years. The purpose of this figure is to show the year-on-year development of the number of publications related to this topic, as well as to identify periods with significant spikes that can provide insight into relevant research trends. Based on Figure 3, the main finding that can be summarized is that there is a fluctuation in the number of publications, with the highest peak occurring in 2020. This shows a significant increase in interest in the SCOR model that year, followed by a decrease in the number of publications in the following years. This peak could be triggered by factors such as advances in the theory or practical application of the SCOR model in industry, which increased the relevance of research in that period. Interpretation of this pattern shows that interest in SCOR topics spiked in 2020, most likely due to the increasingly urgent need for industries to optimize their supply chains, especially in the face of the challenges brought by the COVID-19 pandemic. The subsequent decline may indicate that this topic is beginning to stabilize or reaching a phase where research is more focused on specific aspects or advanced applications of the SCOR model. The information presented in Figure 3 is relevant to the research objective which focuses on the analysis of the SCOR model in the context of supply chain optimization. Figure 3 helps illustrate how this topic has evolved and provides an overview of when the focus on this topic was highest, which can be used to plan further research or evaluate the need for publications in this field.

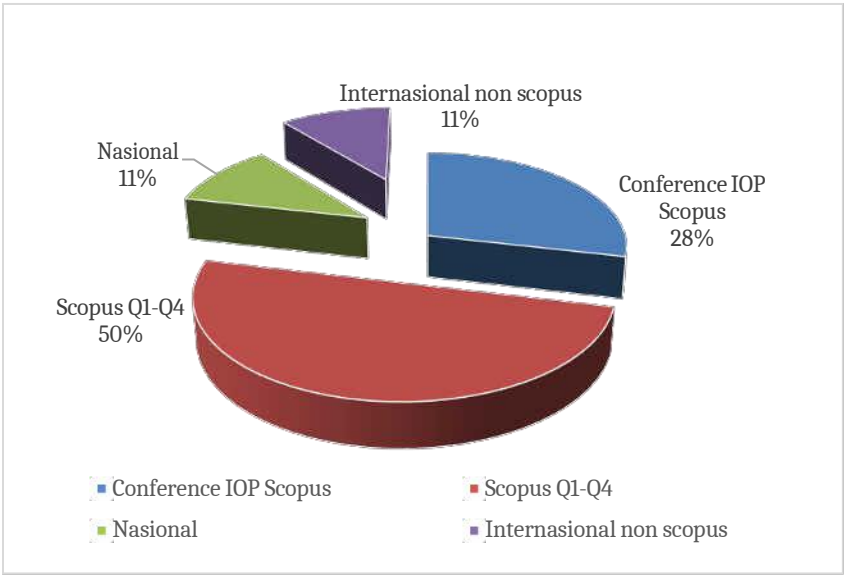

Figure 4. Types of articles from various sources

Bibliometric analysis can also illustrate the countries that produced the most articles related to the topic of the SCOR model from 2013-2024. This research also illustrates the dominance of words used in research. This is identified through the word treemap and word Cloud in describing words that often appear related to the topic of SCOR. The visible relevance of the three aspects is the word supply chain, SCOR, performance, and SCOR Model that appears in the visual image. Word Cloud displays the essence of the word with illustrations using words in various sizes according

to the number of words that appear. In terms of placement, Word Cloud tends to be random, but the dominating word is always placed in the center to be more visible with its large size (Figure 4). While TreeMap displays frequently occurring words in squares similar to regions on a map, the more words appear the larger the square area. Grouping displays Words in the form of colored groups by considering the relationship between one word and another (Figure 5). These three things are presented in the following image:

Figure 5. Word Cloud

Figure 6. TreeMap

Figures 5 and 6 are representations in the form of a word cloud and tree map that illustrate the main topics in research on supply chain management and supply chain performance evaluation. The purpose of this visualization is to show keywords or concepts that are often discussed in this context, by highlighting the terms that appear most frequently with a larger font size. This provides an overview of the main focus in the field of supply chain management. From this word cloud, it can be seen that words such as supply chain and performance stand out, which shows that

much of the research is focused on performance in supply chain management. In addition, the terms SCOR model SCM (Supply Chain Management) is also quite dominant, which indicates the importance of the SCOR (Supply Chain Operations Reference) model as a tool for performance evaluation. Various industrial sectors, such as agri-food management, coffee supply chain, fishery supply chain, and coconut, also frequently appear, indicating that supply chain-related research is not limited to a single sector but covers various industries. Furthermore, words related to green supply chain management, benchmarking, and circular economy indicate an increasing attention to the aspects of sustainability and efficiency in supply chain systems.

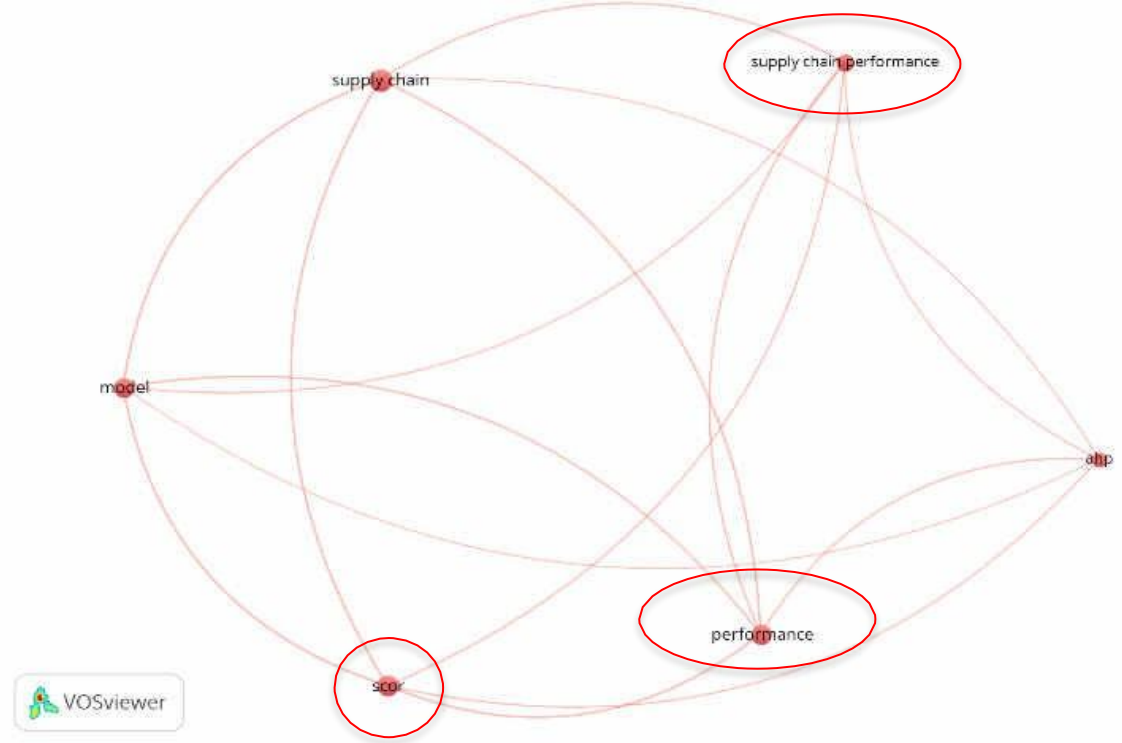

Figure 7. VOSviewer Visualization

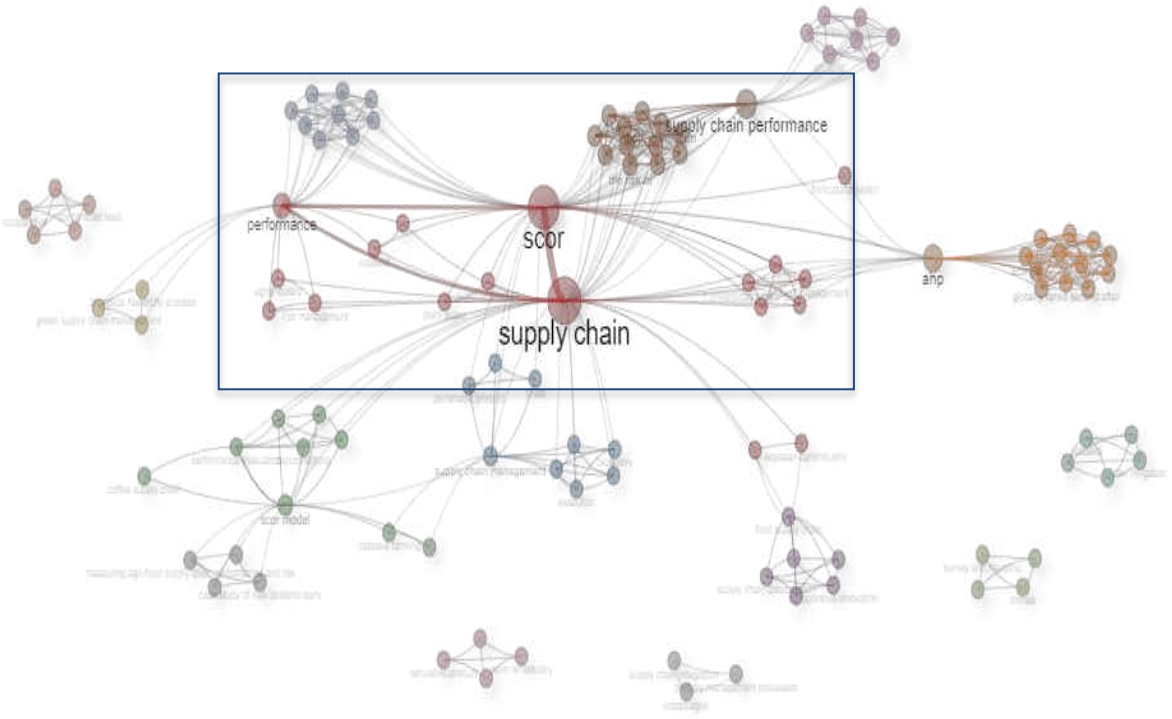

Figure 8. Visualization of co-occurrence

The bibliometric analysis also examines how structures and concepts are related to the existing SCOR model topics. This indicates that the themes and subfields of research are mapped in a two-dimensional matrix. There will be a visual systematic relationship within the scope of the research including author, source, title, abstract, and affiliation. The second part of the bibliometric analysis is network analysis. Network analysis is used in data visualization to assess the number of emerging groups, the number of occurrences and associations between different units of analysis, the overall strength of the network, and the number of citations (Pendse *et al.*, 2022). In this study, network analysis was conducted to look at conceptual structure, intellectual structure, and social structure based on the output generated by the VOSviewer application. The size of the circles indicates the frequency of citations, different colors and proximity of groups of circles indicate different themes. Figure 7 shows the co-occurrence: network visualization which is divided into two dominant clusters with different colors, namely red, green, and blue. Each cluster contains keywords that are frequently used in SCOR research and are related to each other. Based on the output, it can be seen that the keywords that appear most together with other keywords are supply chain, supply chain performance, etc. The co-occurrence output: overlay visualization in Figure 6 shows that the occurrence of the keyword supply chain operation reference dominates large and usually coincides with the words supply chain and SCOR, among others.

Figure 8 is a visualization of a network or graph that illustrates the relationship between entities, with various groups identified using different colors. The purpose of this visualization is to show the structure of the relationship between elements in a system, such as in the context of research or social network analysis. This visualization allows us to identify patterns or relationships between groups or individuals in the network. In this image, we can see several groups represented in different colors, each of which represents a cluster or subgroup in the network. There is also a large node (node) that connects several groups, which indicates the existence of entities that have strong or important connections between the various groups. The relationships between nodes are indicated by lines (edges), with some relationships being strongly connected, while others are more isolated or slightly connected. The large red node connected to many groups is likely to indicate very important or central elements in this network. The largest nodes are the supply chain, SCOR, performance, and SCOR Model.

The pattern that appears in this image shows a clear division between several groups in the network. Groups that are closely connected with many relationships between nodes are likely to indicate subgroups that have more intensive interactions, while isolated groups are more indicative of less connected or more independent entities. Elements connected to many large groups can be seen as connectors or key players in this network, who have an important role in connecting various more isolated elements. The implications of this visualization in network research or analysis are important for understanding how relationships and network structures work, especially in identifying more influential entities or those that are central to intergroup relationships. This can be used to optimize collaboration strategies or information flows in a system, as well as to evaluate its strengths and vulnerabilities.

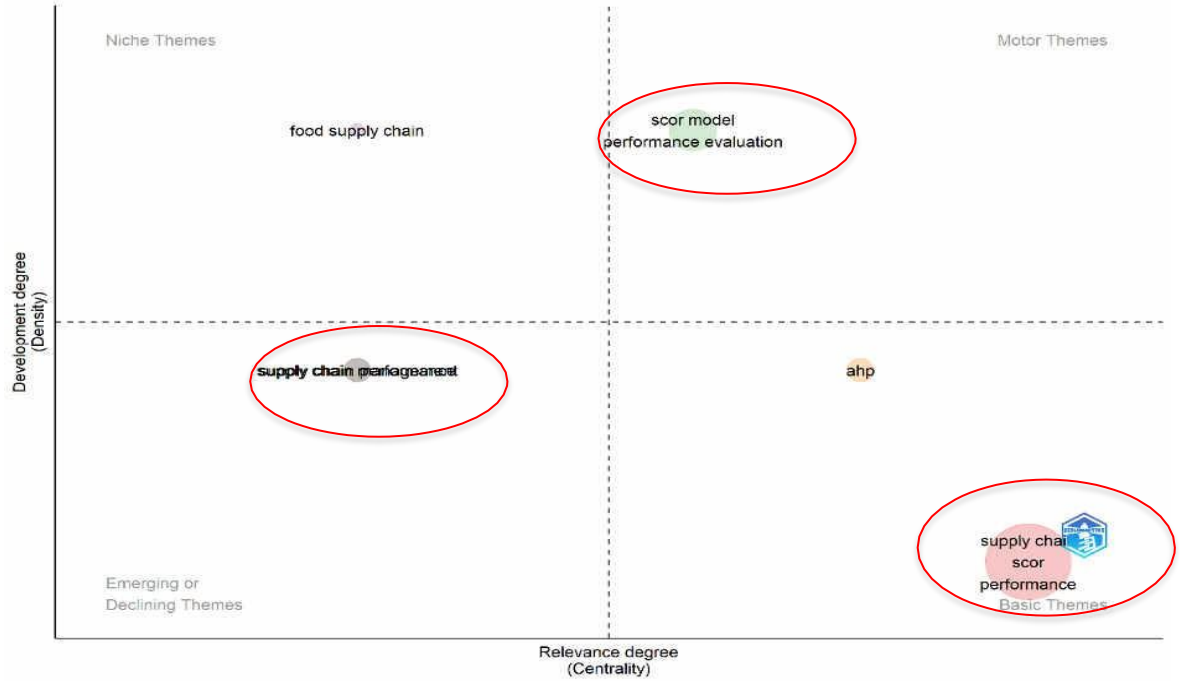

Figure 9. Thematic Map

Furthermore, bibliometric analysis produces thematic map output. Yu and Muñoz-Justicia (2020) define thematic maps as a form of centralization or topic focusing by considering various groups that are connected within a certain flow framework. Thematic maps are divided into four quadrants. The top left section (niche) has minimal connection

to the theme, but its external connections are ignored to identify the theme. The lower left part (emerging or declining) has a low connection. The upper right part is the main theme (motor) for the basis of theme development. The bottom right is the basic theme, which has a high level of connection but little development in the SCOR theme in the context of the supply chain. The results of the thematic map output in this study can be visualized in Figure 7 as follows:

Figure 9 is a Thematic Map that visualizes the relationships between various themes or concepts based on two main dimensions: Relevance degree (Centrality) and Development degree (Density). This map is divided into four quadrants, each representing a different category of themes:

a. Motor Themes: Located in the upper right quadrant, these themes have a high degree of relevance (centrality) and a high degree of development (density). This indicates that these themes are important core concepts that are currently being actively explored or discussed. In this figure, the themes "scor model" and "performance evaluation" are in this quadrant.

b. Niche Themes: Located in the upper left quadrant, these themes have a low degree of relevance (centrality) but a high degree of development (density). This suggests specific or specialized themes that are quite developed within their own scope, but may not be a central focus in broader discussions. The theme "food supply chain" is located in this quadrant.

c. Emerging or Declining Themes: Located in the lower left quadrant, these themes have a low degree of relevance (centrality) and a low degree of development (density). This indicates themes that may be newly emerging and not yet widely explored, or themes whose popularity is declining. The theme "supply chain management" is near this area, indicating relatively low relevance and development.

d. Basic Themes: Located in the lower right quadrant, these themes have a high degree of relevance (centrality) but a low degree of development (density). These are fundamental or basic themes that are important and frequently discussed, but may not be undergoing significant development or exploration currently. The interconnected themes of "supply chain", "scor", and "performance" are in this quadrant, as is the theme "ahp".

SCOR model business process variables

A supply chain is a system in which an organization distributes its production goods and services to the organization's customers. The supply chain is also a network of various organizations that are interconnected and have a common goal. The supply chain is a new concept in a broader and longer logistics problem, starting from basic materials to finished goods used by end consumers. Therefore, it can be said that supply chain management is a logistics network. The players have the same interests, from suppliers, manufacturers, distributors, retail outlets, and customers, connecting from upstream to downstream and generating material value of goods and services in the hands of the final customer. The Supply-Chain Operations reference (SCOR) model is a model developed by the Supply Chain Council (SCC) and is used to measure and improve a company's total supply chain performance (Henry & Nusraningrum, 2020; Ehie & Ferreira, 2019; Bidarti *et al.*, 2019; Maulana & Rochman, 2024). The model includes performance assessment of delivery and demand fulfillment, inventory and asset management, production flexibility, assurance, process cost, and other factors that affect the overall performance of the supply chain assessment (Hasibuan *et al.*, 2021). As a reference model, the SCOR model is based on three main pillars: process modeling—a reference to identify a model of a supply chain process for easier translation and analysis; performance measurement—a reference for measuring a company's supply chain performance as a standard; and implementing best practices—a reference to determine the best practices required by the company. The SCOR model contains five main management processes: Plan, Source, Make, Deliver, and Return. The model can be used to describe very simple or complex supply chains and has been able to provide the basis for supply chain improvement for global and site-specific projects.

The SCOR (Supply Chain Operation Reference) method is one way to measure supply chain performance. This method was introduced by SCC (Supply Chain Council) as a model for measuring supply chain performance across industries. The SCOR model is a process reference model for supply chain operations developed by SCC, Pittsburgh, PA (Bolstorff, P., & Rosenbaum, 2003). The SCOR model is a process-based model of supply chain operations that integrates three key elements of management, namely business process reengineering, benchmarking, and best practice analysis into a cross-functional supply chain framework. SCOR divides the supply chain processes into five (5) core processes, namely plan, source, make, deliver, and return. SCOR also has three levels of processes from general to specific: Level one is the highest level that provides a general definition of the five core processes. The second level is said to be the configuration level, where the company's supply chain can be configured based on 30 core processes, and the company can form a current (as-in) or desired (to-be) configuration. The third level is called the process element level which contains the definition of the process element, the input metrics of each process element, and the reference to the process element.

SCOR is a reference model used to measure the performance of supply chains. SCOR combines several elements namely Business Process Engineering, benchmarking, and applications that lead to a framework. Hierarchically, the SCOR supply chain management model consists of detailed processes that are integrated from the supplier's supplier to the customer's customer where all processes are in line with the company's operational strategy, material, labor, and information flow.

Business process re-engineering or reorganizing business processes describes how the business processes carried out by the company currently (as-is) and then define the desired process (to-be). Then, benchmarking is an activity to compare the company's operational performance data with similar companies whose performance is classified as best-in-class. Meanwhile, process measurement serves to measure, control, and improve supply chain processes to be effective and efficient. There are 5 core processes in the SCOR model, namely Plan, Source, Make, Deliver, and Return. The plan is the process of balancing demand with available resources. Source is the process of procuring goods and services according to the plan. Make is the process of converting inputs into outputs according to customer needs. Deliver is the process of sending product requests to consumers. Return is the return of products from consumers to the company for various reasons agreed by both parties. The five core processes must be clearly defined so that supply chain performance can be measured properly.

Table 1 summarizes the results of research on supply chain performance in various industries. Each study uses different indicators and performance metrics to evaluate supply chain effectiveness. The results show that supply chain performance varies between companies, with several areas needing improvement. This research provides insights into the attributes that need attention to improve supply chain performance in various industrial sectors. Further explanation is outlined in Table 1.

Table 1. Article Identification

No.	Author, Year	Research Object	Research Results
1	Nguyen *et al.*, 2021	Coffee Industry	The indicator consists of 10 performance metrics. The Company's supply chain performance is at a score of 68.28 with most processes having low performance scores.
2	Effendi *et al.*, 2019	Sugar Agro-Industry	The indicators consist of 17 valid performance metrics. The Company's supply chain performance is in the medium category (56.12) with waste management attributes being a priority for improvement.
3	Kusrini *et al.*, 2019	Sugar Agro-Industry	The indicators consist of 45 valid performance metrics. The company's supply chain performance is in the good category (70.94). Asset management attributes are prioritized for improvement
4	Moazzam *et al.*, 2018	Dairy Agro-industry	Using 31 performance metrics. The metrics used are in line with industry practices adapted by the New Zealand dairy industry. Detailed information required to measure SCOR metrics is not easily available.
5	Kodrat *et al.*, 2020	Passion Fruit Agro-Industry	The indicators consist of 9 valid performance metrics. The company's supply chain performance is in the medium category (78.69). The reliability attribute is a priority for improvement because it has the highest weight value (0.38).
6	Afianto *et al.*, 2019	Soybean Agro-Industry	The indicators consist of 7 valid performance metrics. The Company's supply chain performance is in the good category (85.67). The cost attribute is a priority for improvement because it has the highest weight value (0.286).
7	Nuraina *et al.*, 2021	Dairy Farmers Cooperative	The indicators consist of 9 valid performance metrics. The Company's supply chain performance is in the excellent category (98.94). The responsiveness attribute is an attribute that is a priority for improvement because it has the lowest attribute performance value (11.73).
8	Asrol *et al.*, 2021	Cane Sugar Industry	The indicators consist of 14 valid performance metrics. The Company's supply chain performance is in the good category (79.01). The asset management attribute is a priority for improvement as it has the highest weight value (1.26).
9	Makkarennu *et al.*, 2020	Palm Sugar Industry	The indicators consist of 19 valid performance metrics. The company's supply chain performance is in the marginal category (46). Flexibility attribute is a priority for improvement because it

No.	Author, Year	Research Object	Research Results
			has the highest weight value (0.194).
10	Alfaliansyah & Maswadi, 2021	Coconut Industry	The indicators consist of 6 valid performance metrics. Corporate supply chain performance is in the medium category (64). The reliability attribute is a priority for improvement.
11	Maulidah *et al.*, 2018	Potato Agro-Industry	The indicators consist of 18 valid performance metrics. The company's supply chain performance is average (55.7). Asset management is a priority attribute for improvement.
12	Wahyuni *et al.*, 2021	Tempe Crackers	The indicators consist of 15 valid performance metrics. The company's supply chain performance is marginal (45.94). The reliability attribute is a priority for improvement because it has the lowest normalized value (0).
13	Wati et al, 2021	Frozen Food Catfish	The indicators consist of 19 valid performance metrics. The Company's supply chain performance is in the excellent category (91.24). The asset management attribute is a priority for improvement because it has the lowest attribute performance value (0.033).
14	Djatna *et al.*, 2020	Palm oil industry	The indicators consist of 18 valid performance metrics. The company's supply chain performance is categorized as poor (64). The agility attribute is a priority for improvement because it has the lowest weight value (4).
15	Bukhori *et al.*, 2015	Poultry Industry	The indicators consist of 9 performance metrics. Performance attributes are prioritized for improvement
16	(Krishnan *et al.*, 2021)	Food Industry	The indicators consist of 19 performance metrics. The findings suggest that innovative practices at each level of the SCOR Model have a clear and significant impact on one or more sectors.
17	(Munawir *et al.*, 2021)	Cane Sugar Industry	The indicators consist of 15 performance metrics. Farmer performance is at an average level while mill performance is below average. The overall mill supply chain performance was 77.47%.
18	(Alimo, 2021)	Fruit and Vegetable Cultivation	It consists of 15 performance metrics. The performance metrics of the SCOR model show that there must be a mix of good management practices, post-harvest handling equipment, planning, fast order processing, knowledge of changes in customer demand and collaboration among all actors in the supply chain to the end consumer.
19	(Nattassha *et al.*, 2020)	Cassava Cultivation	The stages of SCOR process modeling in cassava cultivation include plan, source, manufacture, delivery, and return. It consists of 10 performance metrics. The cost aspect is an important aspect to improve performance.
20	(He, 2022)	China's Agricultural Industry	The results of this study show that the dimensions of guanxi have a positive effect on knowledge sharing in agricultural supply chains. By building trust and relationships in the supply chain, knowledge sharing can be enhanced and ultimately improve supply chain performance.
21	(Suryani *et al.*, 2023)	Cassava Value Chain	The results revealed several priority risks in the cassava value chain, consisting of unpredictable weather changes, fertilizer scarcity, absence of farming standards, limited capital, technical delivery constraints, price fluctuations, labor negligence, credit default, and lack of customer or farmer knowledge.
22	(Rodríguez-Mañay *et al.*, 2022)	Flower and Ornamental Plant Industry	The indicators consist of 10 performance metrics. The attributes that need improvement are: reliability, supply chain asset management, responsiveness, and agility.
23	(Chairany *et al.*, 2023)	Fishing Industry	Risk analysis at the tuna processing company as a frozen tuna producer shows the highest risk for fishermen and is inadequate refrigeration. The highest risk value in the Tuna Processing Company is caused by unclean dirt.
24	(Boxy *et al.*, 2020)	Vanilla Industry	The processed data shows that business process planning with a

No.	Author, Year	Research Object	Research Results
			weight of 0.32 is an important process compared to other business processes. The most important performance attribute is reliability which is worth 0.51.
25	(Syahputra *et al.*, 2022)	Fishing Industry	There are 19 potential risks recognized in the supply chain activities. Based on the results of the risk assessment, it was found that risk A12 (weakness in system control; quality of materials and products) had the highest CR value (417). An immediate mitigation plan should be the primary objective to improve the overall performance of the industry.
26	(Husna *et al.*, 2020)	Fishing Industry	The indicators consist of 13 performance metrics. The total performance value of PT Aceh Lampulo Jaya Bahari is in the average category with a total index value of 64.2. The attribute that needs to be improved is Reliability.
27	(Fauziyah *et al.*, 2020)	Halal Food Industry	Based on the measurement results there are a total of 15 performance metrics. The overall performance score of 72.73 is classified as Good, the responsiveness attribute is a priority for improvement.
28	(Ramos *et al.*, 2018)	Blueberry Cultivation	The results of the analysis show that the performance value of the blueberry cultivation supply chain in Peru has a score of 0.70.
29	(Mañay *et al.*, 2022)	Flower and Ornamental Plant Industry	The Supply Chain performance of the Ecuadorian flower sector is 85%. The results show that all processes need to be improved, especially the planning and manufacturing processes.
30	(Maizi *et al.*, 2020)	Patchouli Oil Industry	The results show that in the supply chain only 5% of the processes are carried out with a systematic and measurable standardization process. While about 55% of the processes are not entirely carried out by following standards and 40% of the processes are not at all carried out according to industry standards. From the mapping of the supply chain using the SCOR Model, it is concluded that the average of the processes that are not carried out in the existing supply chain system is 41%
31	(Pratiwi *et al.*, 2019)	Onion industry	The research findings revealed that production, quality, and order fulfillment are important aspects of the shallot supply chain. Cost and order fulfillment proved to be the attributes and indicators with the highest weight scores for improvement priorities.
32	(Sutopo *et al.*, 2015)	Palm Oil Industry	The results show that of the five SCOR performance attributes, only reliability, responsiveness and asset attributes have a gap with the benchmarking target performance value while agility and cost attributes produce the same value as the benchmarking target. This means that palm oil mill companies in Indonesia need to improve their supply chains related to these three performance attributes.

Source: Author (2024)

Various problems that exist in the agribusiness supply chain, especially related to the SCOR model for agribusiness products that are perishable, bulky, seasonal, interesting locations and also of varying quality, including the management of activities that are still included in the conventional category and not yet modern. It can be seen from the table below that the dominant articles reviewed have problems with product quality, traditional business activities and also low product competitiveness. It is usually closely related to outdated technology and transportation, inadequate infrastructure, and conventional investment, facilities, and managerial knowledge. The facts found from the various articles analyzed show that supply chain actors carry out production based on capacity. They do not care about demand prediction nor do they use any methods or techniques to accurately forecast demand. For example, in the case of Vietnamese coffee. For example, production is largely a 'family' operation carried out by smallholders. As a result, coffee farmers use traditional intensive farming practices to increase coffee yields but with negative impacts on the environment and low quality coffee beans. In addition, most companies work more with traders than with individual farmers because coffee farmers are smallholder households. So, they need to pay more for middlemen.

Other problems include 1) errors in the quantity and time of delivery of goods, 2) delivery errors, and 3) declining customer demand due to the performance of both the company and the supplier. The soybean agro-industry supply chain mechanism in Cianjur Regency is still traditional because farmers as producers do not have agreements or contracts regarding the sale of their products to other supply chain actors. Farmers do not have a good bargaining position. Farmers' welfare is not fully guaranteed because they have not obtained certainty of purchasing their crops and information on product quality specifications and product selling prices received by farmers is still limited. The system of buying and selling products between farmers and collectors and collectors and tempeh producers only relies on trust. Seen from the supplier aspect, the quality of agribusiness products supplied is quite a lot, then another problem is from the consumer aspect where there are still products returned by consumers due to damage or products returned that are not in accordance with production process standards. Usually sugarcane is damaged such as withered, too young, and dirty conditions. The following is the dominance of supply chain article problems using the SCOR model.

Table 2 presents a comprehensive overview of the various issues related to the Supply Chain Operations Reference (SCOR) model, which identifies the challenges often faced by organizations in various aspects of their supply chains. Table 2 categorizes these issues under several main headings, such as conventional activities, product quality, raw material efficiency, business risk, and customer demand, among others. Each issue is then linked to relevant scientific articles, which show the depth of research that has been conducted on these topics. The issues listed in this table reflect the dynamic nature of supply chain management and the various factors that can affect overall business performance and competitiveness. By examining the challenges listed, organizations can gain valuable insights into areas that require attention and improvement to increase efficiency and resilience in their supply chains. More details are outlined in Table 2.

Table 2. SCOR Issues

Supply Chain Issues	Related articles
Conventional activities	Nguyen *et al.*, (2021), Afianto *et al.*, (2019**) ,** Nuraina *et al.*, (2021**)**, Mañay *et al.*, (2022), Ramos *et al.*, (2018)
Product quality	Nguyen *et al.*, (2021), Wati et al, (2021**)**, Moazzam *et al.*, (2018**)**, Afianto *et al.*, (2019**)**, Bukhori *et al.*, (2015**)**, Fauziyah *et al.*, (2020), Syahputra *et al.*, (2022)**,** Maizi *et al.*, (2020)**,** (Munawir *et al.*, 2021)
Low recycling process	Effendi *et al.*, (2019**)**
Raw material efficiency	Effendi *et al.*, (2019**),** Djatna *et al.*, (2020**)**
Business risk	Moazzam *et al.*, (2018**)**, Syahputra *et al.*, (2022)**,** Nattassha *et al.*, (2020), Mañay *et al.*, (2022), Chairany *et al.*, (2023)
Declining customer demand	Kodrat *et al.*, (2020**),** Krishnan *et al.*, (2021)**,** Nguyen *et al.*, (2021)**,** Alimo, (2021)
Delivery error	Kodrat *et al.*, (2020**)**, Mañay *et al.*, (2022)
Business deal	Afianto *et al.*, (2019**),** Alfaliansyah & Maswadi, (2021**),** (Boxy *et al.*, 2020)
Professional Worker	Nuraina *et al.*, (2021**),** Nattassha *et al.*, (2020)
Competitive Advantage	Asrol *et al.*, (2021**),** Ramos *et al.*, (2018), Wahyuni *et al.*, (2021**),** Sutopo *et al.*, (2015)**,** Mañay *et al.*, (2022)
Halal Assurance System	Wahyuni *et al.*, (2021**)**
Price fluctuations	Suryani *et al.*, (2023)

In analyzing and calculating the SCOR model, there are 4 stages in the framework to facilitate researchers in carrying out the SCOR model. Business process design is an activity of analyzing business activities, namely business processes that are usually carried out in the form of mapping. As well as analyzing the to-be design, namely the business processes that will be addressed by researchers to improve the previous business design which will also be outlined in the form of mapping. The following are business processes from relevant articles.

1. Plan

   This principle is involved in every SCM implementation process (source, make, deliver, and return). Each implementation process has an element of planning. For example, a sourcing plan will determine the raw materials required and the amount of inventory produced. Delivery plans provide the necessary information to commit to customer orders. Meanwhile, the return plan offers the information needed to schedule returns and replacement orders.

2. Source

   Sourcing is defined as all sources of raw materials and services to be provided in the supply chain process. These activities include purchasing, scheduling, receiving, checking, and payment supplier authorization.

3. Make

   The principle is about transforming acquired resources into goods and services with agreed terms and conditions specifications. Activities include testing, certification, and packaging.

4. Delivery

   Deliver is any activity from taking customer orders, providing quotes to collecting payments from customers. Deliverers are associated with sourcing, so they must also make the order visible to the sourcing, execute, and ensure the customer communicates. Delivery also includes all warehousing, transportation, and distribution activities.

5. Return

   Return covers how previously sold products are stored, collected, and disposed of as appropriate with business policies and customer agreements. This process includes all activities from return authorization to financial settlement. This principle typically includes defective, faulty, or unsatisfactory returns; maintenance, repair, and overhaul (MRO) under service agreements; return of excess inventory; and recycling/repair/reuse.

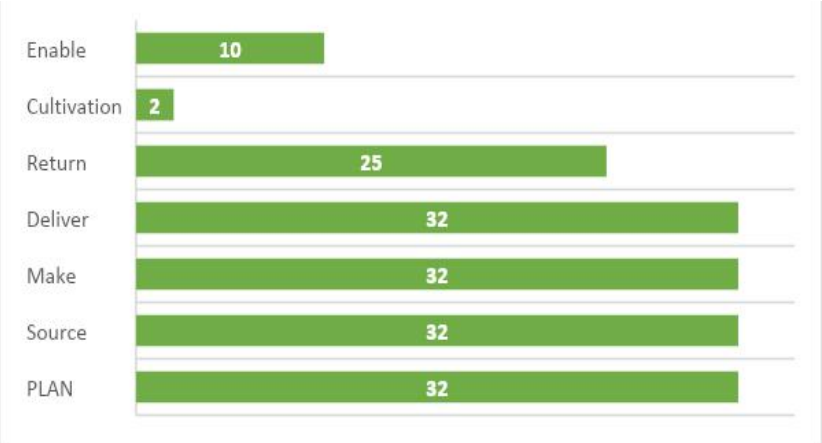

Figure 10. SCOR business process

Based on Figure 10 above, it can be seen that all articles have complete business processes for the four aspects of plan, source, make, and deliver with a total of 32 articles. Meanwhile, some articles have other business processes, namely cultivation and enable. To achieve supply chain goals, the Plan involves identifying needs and taking corrective actions. Source is the activity of requesting, delivering, receiving, and moving raw material goods. So, it is related to suppliers. Which is concerned with determining needs/needs and preventive actions to achieve supply chain objectives Make represents added value through the manufacture or creation of a product. This process is also the process of adding value to the product, while the delivery process is the process that deals with managing customer needs/orders Delivery refers to the distribution of products to customers. Return moves products from customers back through the supply chain to address errors in demand or production. Return is the process of returning damaged/defective products from customers along the supply chain. Finally, Enable is the process that deals with establishing, maintaining, and monitoring information, relationships, resources, and business rules across the supply chain.

SCOR model performance indicators

Figure 11 discuss about Attributes that are prioritized for improvement in supply chain operations may vary depending on the specific needs and challenges of a business or industry. Based on the figure 11 above, it can be seen that from the 32 articles analyzed, there are 7 categories of attributes found, namely reliability, responsiveness, flexibility, cost, assets, and agility. Of all the attributes, the dominant priority for improvement is reliability with 14 articles followed by responsiveness with 7 articles analyzed. Some attributes that are the focus of improvement in an effort to increase efficiency, responsiveness, and competitive advantage in the supply chain in the articles analyzed are: (1) Reliability, to improve reliability in supply chain performance, it is necessary to monitor and predict demand, efficient inventory management, optimization of production processes, close collaboration with suppliers, diversification of supplier sources, use of technology and information systems, and development of plans based on predictions of a possibility that will occur. (2) Responsiveness, improving responsiveness in supply chain performance, needs real-time monitoring of demand and inventory, selection of responsive suppliers, use of technology for coordination, rapid decision-making, adjustment of production and distribution capacity, fast delivery strategies, and employee training. (3) Cost, cost efficiency in supply chain performance can be improved through end-to-end cost analysis, price negotiation, delivery route optimization, lean manufacturing practices, technology automation,

efficient inventory management, infrastructure evaluation, and employee training.

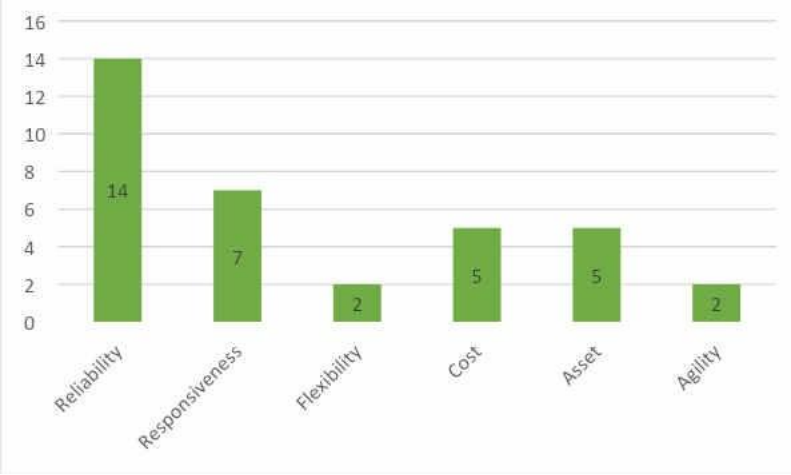

Figure 11. Prioritized attributes for improvement

Figure 11 discusses Attributes that are prioritized for improvement in supply chain operations may vary depending on the specific needs and challenges of a business or industry. Based on Figure 11 above, it can be seen that from the 32 articles analyzed, there are 7 categories of attributes found, namely reliability, responsiveness, flexibility, cost, assets, and agility. Of all the attributes, the dominant priority for improvement is reliability with 14 articles followed by responsiveness with 7 articles analyzed. Some attributes that are the focus of improvement to increase efficiency, responsiveness, and competitive advantage in the supply chain in the articles analyzed are: (1) Reliability, to improve reliability in supply chain performance, it is necessary to monitor and predict demand, efficient inventory management, optimization of production processes, close collaboration with suppliers, diversification of supplier sources, use of technology and information systems, and development of plans based on predictions of a possibility that will occur. (2) Responsiveness, improving responsiveness in supply chain performance, real-time monitoring of demand and inventory, selection of responsive suppliers, use of technology for coordination, rapid decision-making, adjustment of production and distribution capacity, fast delivery strategies, and employee training. (3) Cost and cost efficiency in supply chain performance can be improved through end-to-end cost analysis, price negotiation, delivery route optimization, lean manufacturing practices, technology automation, efficient inventory management, infrastructure evaluation, and employee training.

Effectiveness of the SCOR model in measuring supply chain management performance

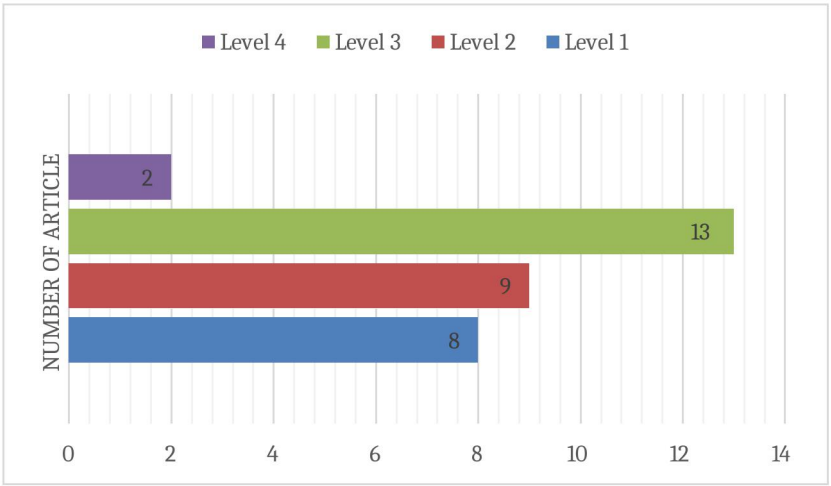

Figure 12. SCOR Levels

The SCOR model has a hierarchical structure with four different degrees of decomposition. However, these are concentrated on the first three levels (Figure 12). Level 1 presents the process types that identify the scope and content of the supply chain. Level 1 also creates the SCOR processes of plan, source, make, deliver, and return and measures their performance metrics. Then, Level 2 presents the process categories that define operations also known as each core process in SCOR will be shown in more detail from the company's supply chain processes. While Level 3 describes the process elements that define the configuration of individual processes. The 3 levels Consist of Level 1 can map the existence of each business process. Level 2 can provide make-to-stock and make-to-order but is constrained by finance, tools, and equipment machinery. Level 3 can identify all production activities attached. This

stage decomposes the processes in the supply chain into elements that define the company's ability to compete. Of the 32 articles analyzed, the dominant level used was at level 3 with 13 articles used. However, two articles have level 4 which indicates that they can overcome the company's managerial problems. Simply put, SCOR has a structured approach to process mapping as seen in the mapping starting at level 1 defining the scope and management of the core processes of plan, source, make, deliver, and return. Level 2 shows the characteristics associated with the process categories: planning, execution, and enabling. For example, the supply chain requires process pairs for overall supply chain planning such as source, make, deliver, and return decisions. Level 3 shows detailed information on the process elements of some of the Level 2 process categories, and Level 4 as the implementation of effective SCM as Figure 13.

Figure 13. SCOR Performance and number of relevant articles

Figure 13 discusses performance measurement as the process of comparing the actual results obtained with those planned. In other words, the goals must be examined one by one, which ones have been fully achieved, which ones are above the standard (target), and which ones are below the target or not fully achieved. The Supply Chain Operation Reference (SCOR) model, is one of the standard indicators that helps companies build supply chain performance by evaluating and comparing with other similar companies. Where performance evaluation is carried out by assessing performance parameters such as asset management, profitability, service level, and delivery time. Based on the results of the analysis related to the articles analyzed, it was found that the average supply chain performance was mostly in the good category with a total of 12 articles (performance score 70-90). Followed by the average category (performance value 50-70) with a total of 8 articles and the categories of poor (<40), marginal (40-50), and excellent with a total of 4 articles (performance value greater than 90). The performance of the supply chain itself is defined as the degree to which a supply chain can meet the needs of consumers and stakeholders regarding key performance indicators at each point. The purpose of performance measurement is to support the achievement of objectives, evaluate performance, and determine future strategic, tactical, and operational actions. To achieve objectives, process outputs must be measured and compared to standardized measures.

Performance or performance refers to the output and something resulting from the process of products and customers that can be evaluated and compared relatively to goals, standards, past results, and other organizations. Performance can be expressed in non-financial and financial terms. It can be concluded that performance measurement is a measurement action carried out on various activities in the value chain of the company. The results of these measurements are then used as feedback that will provide information about the performance of the implementation of a plan and the point at which the company needs adjustments to planning and control activities. In other words, these goals must be examined one by one, which ones have been fully achieved (100%), which ones are above the standard (target), and which ones are below the target or not achieved. According to Lynch and Cross (1993), the benefits of a good performance measurement system are as follows: 1) Tracing performance against customer expectations so that it will bring the company closer to its customers and make everyone in the organization involved in efforts to provide satisfaction to customers 2) Motivate employees to perform services as part of the internal customer and supplier chain. 3) Identifying various wastes as well as encouraging efforts to reduce these wastes. 4) Make a strategic goal that is usually still vague and becomes more concrete to accelerate the learning process of the organization. 5) Build consensus to make a change by giving "rewards" for the expected behavior.

CONCLUSION

Performance measurement in the supply chain is very important, this is because it has an impact on efforts to support the achievement of goals, evaluate performance, and determine future strategic, tactical, and operational actions. To achieve goals, the output process must be measured and compared with existing standard measures. Based The results of the analysis of 32 articles found, show that the trend in the number of SCOR model research fluctuates, which is dominated by articles sourced from Scopus with the main keywords that appear being Supply

Chain Management and SCOR Model. Various problems in supply chain performance are conventional activities, inadequate product quality, and low product competitive advantage. All articles conducted four main business processes namely Plan, Source, Make, and deliver with reliability attributes as the main improvement priority. The ability of each company to measure performance is seen from the level of the dominant level at the third level which shows the company's ability to compete, and the effectiveness of performance is worth an average of 70-90.

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