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A Systematic Literature Review of Smart Logistics and Supply Chain Management Implementation

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Abstract - *The development of information and technology today has many positive impacts on the development of science and its practice in supply chain management. Industrial needs are getting easier and easier to achieve, and easily achieve the goals of every party in the industry. This research aims to examine the previous literature on the implementation and role of IT in the context of supply chain management. This research used the systematic literature review method. The result of this study shows an overview of the use of IT in supply chain management, as well as offers the next research opportunity point.*

Key Words: Smart Logistics, Smart SCM, SLR, Logistics and SCM Implementation, Information Technology

1. INTRODUCTION

One of the forms of the progress of human civilization is the development of technology in every human activity. In the industrial sector today, the term industry 4.0 is known which is relatively new. It is said to be new because some other parts of the world are new to the term and have not found widespread application. In the folds of history, we understand at the beginning of the 18th century how the role of mechanical technology was able to create a climate of mass production to meet human needs [1]. This historical fact reflects that the role of technology during human life can be said to be the driving force of human civilization. Its appearance is a matter of pride because it can ease the burden of human work physically, and on the one hand, it can increase productivity. Although it is not as sophisticated when compared to the current 21st-century technology, the presence of this technology is an accelerator in the fulfillment of human needs. So, technology in its development in the industrial world cannot be separated. In the current era, the term industry 4.0 is known which reflects the strong role of information technology in manufacturing processes and business supply chains broadly in supporting performance and productivity [1].

In the context of supply chain management (SCM), technology also has a fairly important role in achieving SCM goals. In Janat Shah [2], described how technology plays a role in revolutionizing the supply chain in several stages until it reaches the point of a product or service that can be customized according to human needs. The SCM revolution described by Janat Shah shows that information technology is a supporter of supply chain management. This can be seen from the stage of revolution which he called Virtually Integrated Global Supply Networks, namely a virtually integrated global supply chain network in meeting consumer needs. Information technology can be used to manage all information related to consumers to provide services to the needs of the consumers themselves.

Today's business trends are increasingly leading to the use of information technology (IT). This is shown by the rise of business operations that have been integrated with information systems and technology. The benefits of IT have an impact on business processes both at the strategic, tactical, and operational levels that can improve business performance, namely reducing costs, increasing competitiveness profits, resource and process efficiency, service speed, and meeting consumer needs. This also finally attracted the attention of many academics to study the direction or trend of the "marriage" of IT and SCM fields [3].

This research seeks to explore the term "SMART" as a nomenclature for the development and advancement of information technology in the era of disruption in the context of supply chain management. This research is a systematic literature review to find answers to research questions that will be described in one part of this paper. Briefly, this paper consists of several parts, namely the introduction, methodology, findings and discussions, and conclusions and suggestions.

2. RESEARCH METHODS

This reserch will discuss information technology in the context of SCM conducted through a literature study approach. The literature study approach in this paper will refer to the writing that has been carried out by Angreani et al, which includes six stages [4], in this paper, the stages are summarized into five main stages. These stages are categorized into two main stages, namely, the first stage consists of determining research questions (RQ) and criteria, finding articles, and selecting and selecting articles. The second stage consists of an assessment of the quality of selected articles, content extraction, and synthesis. The stages are shown in Figure 1.

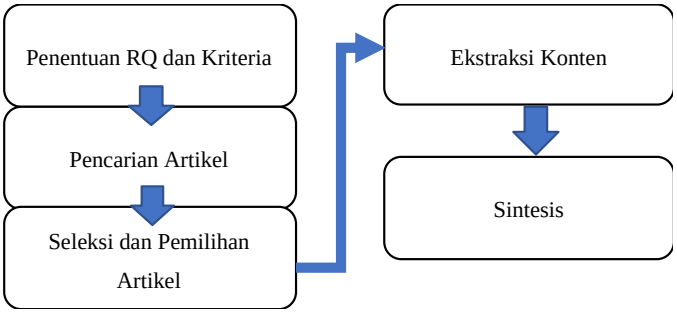

Fig - 1 Research Methodology Flow Chart

A literature review methodology is an approach that describes the stages used in reviewing several previous research articles to analyze previous research and find a new research opportunity [4], in this case, the six stages in Figure 1 are explained as follows:

2.1 Determination of Research Questions (RQ) and Criteria

The criteria determination stage is the author's stage in describing the thing or objects to be discussed. The stage of determining the criteria can be in the form of the formulation of research questions (research questions). To formulate research questions, the approach used in the literature review is PICOC (population, intervention, comparison, outcome, and context). So, the formulation of the questions in this paper includes first Population: digital, information technology, smart, and industry 4.0. Second, Intervention: model, framework. Third, Comparison: a case study. Third, Outcome: The concept and application of information technology. Fourth, Context: Logistics and Supply Chain Management. Based on the PICOC approach, the research questions (RQ) in this paper can be developed as presented in Table 1.

Table - 1: Research Questions

Code	Research Questions (RQ)	Purpose
RQ 1	What are the IT topics studied in the previous study?	Identifying IT topics in previous research
RQ 2	What are the CHARACTERISTICS of IT in the context of SCM?	understanding IT characteristics in the context of SCM
RQ 3	What are the research methods used in previous research?	Identifying the use of research methods in previous studies
RQ 4	What are the SCM topics discussed in previous studies?	Identifying SCM topics in previous studies
RQ 5	What are the current TRENDS in IT research against the SC stage?	Identify current IT research trends or applied to SC stages
RQ 6	In what sectors of industry can the role of IT be found today?	Identifying what sectors have currently been studied by previous research

2.2 Article Search

At this stage, data tracing is carried out, namely the previous articles to be reviewed. Database searches are carried out through a search on the Scopus data source using the help of Publish or Perish software. The search strategy includes the stage of determining keywords, determining the year of publication, and the language. The keywords used in searching for the article in this paper are ("Information Technology" OR "Smart" OR "Virtual" OR "Industry 4.0") AND ("Model" OR "Framework") AND ("Logistics" OR "Supply Chain Management") AND ("Case Study") AND NOT ("Literature Review"). Meanwhile, the determination of the year of publication and the language used is from 2019 to 2021 English.

2.3 Article Selection

Based on a search using the help of the Publish or Perish software on the Scopus data source, 163 papers have been found. The data selection process involves several criteria, namely papers in the form of proceedings articles, and journal articles, and includes criteria for discussing the topic in this paper. The selection stage in this paper is the same thing as was done in [4] who assessed the quality of the article. However, the difference in this paper is that the selection process is used as a process in assessing the suitability of the article to be studied for the topic of discussion. The stages of selection and selection of articles can be shown in table 2 below.

Table - 2: Article Selection and Selection Process

Selection Process	Number of *Selected Papers*	Information
0	163	Not selected
1	154	There is 1 *paper* in the form of a *review*, and 8 *papers* in the form of *a chapter book*, and 2 *papers* in the form of a *book*
2	82	Elimination of titles based on the criteria of the topic of discussion
3	25	Elimination based on keywords done using *Mendeley software*
4	16	Selected articles based on *a review* of the research objectives of this article

2.4 Content Extraction and Synthesis

At this stage, the selected paper will be extracted from the content contained in the paper. The goal is to be able to understand and find answers to the research questions that have been formulated. Angreani, et al provide guidelines for conducting data extraction in the form of a data extraction card form as shown in Table 3 below [4]. The synthesis points will be outlined in the fourth part of this paper.

Table - 3: Data Extraction Card

Year of Publication	
Author Name	
Source	
Topics of Discussion on the Scope of IT	RQ 1
IT Usage Trends in the context of SCM	RQ 2
Research Methods used	RQ 3
Discussion Topics for the Scope of SCM	RQ 4
Research Trends in the Use of IT in SCM	RQ 5
Research Industry Sector	RQ 6

3. Result

In previous research, it was known that the most published articles at this time were in 2021. Meanwhile, from 2017 to 2021, it shows an increasing trend in the number of articles published. This is as presented in Chart 1. Meanwhile, based on publication sources, it is known that there are 16 publication sources that have published articles on the topic of IT and SCM. As shown in Table 4, most articles based on published sources recorded as many as 2 articles published in the journal Sustainability (Switzerland). Meanwhile, in terms of authors, [5] wrote more than one article related to IT and SCM. The distribution of previous research in other article sources shows 1 publication each.

Table - 4: Number of Articles by Publication Source

Publication Sources	Number of Publications	Author
International Journal of Production Research	1	Zhong, et al [6]
Journal of Cleaner Production	1	Sichao Liu, et al [7]
IFIP Advances in Information and Communication Technology	1	Sabbagh, et al [8]
Renewable Energy	1	Lee, et al [9]
Advances in Intelligent Systems and Computing	1	Casado-Vara, et al [10]
Transportation	1	Halvorsen, et al [11]
LOGI - Scientific Journal on Transport and Logistics	1	Sulyova, et al [12]
Transactions on Emerging Telecommunications Technologies	1	Kumar, et al [13]
Sustainability (Switzerland)	2	Gorecki, et al [14], and Mazzarino, et al [15]
2020 3rd International Conference on Computer and Informatics Engineering, IC2IE 2020	1	Komala, et al [16]
Production Planning and Control	1	Helo, et al [17]
Journal of Open Innovation: Technology, Market, and Complexity	1	Tripathi, et al [18]
International Journal of Logistics Research and Applications	1	Weihua Liu, et al [5]
Industrial Management and Data Systems	1	Weihua Liu, et al [19]
Automation in Construction	1	Weisheng Lu, et al [20]

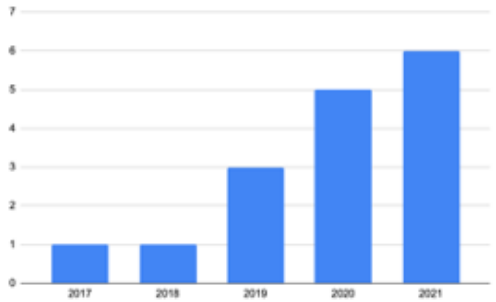

Chart - 1: Number of Articles by Year

3.1 Information Technology Discussion Topics (RQ 1)

Based on the literature study conducted, the articles that are the subject of the study are then grouped based on the topic of discussion of information technology contained in the article. The grouping in this paper develops the topic grouping techniques that have been carried out by [3]. The

selected articles are known to cover several topics related to information technology as shown in Table 5 and Chart 2 below.

Collectively, Chart 2 shows that previous research examines more in the technology regions of IT itself (43.8%) such as IoT, GIS, Google Trend, Blockchain, and System Modelling and Simulation. There are several rationalizations that encourage some researchers to discuss this, for example, to support the improvement of operational management efficiency, specifically it can be seen in the context of service efficiency in logistics networks [7], [9], production floor [6], [14], and contracting activities [10], [13]. Meanwhile, in Table 5, it is shown that there is 1 article that examines the issue of smart manufacturing using the perspective of the framework or industrial model 4.0 [1].

Table - 5: CLUSTER IT Topics

Cluster	IT Topics [Reference]
Decision Support	Big Data[6], Artificial Intelligence[17]
IT Technologies	Internet of Things[7], Google Trend Data[8], Geographical Information System[9], Blockchain[10], [13], [20], System Modelling and Simulation[14]
Information System (IS) Development and Application	Automatic Data Collection System[11], Smart City Concept[12], ERP [16]
Information System (IS)-Enabled Business	E-Commerce[5], Smart Lean-Green[18], Smart logistics ecological chain [19]
Decision Support and IT Technology	Smart Manufacturing [1]

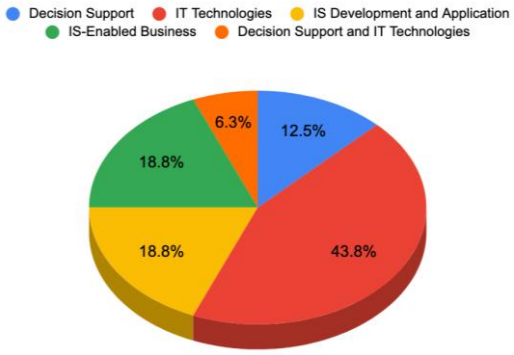

Chart - 2: Percentage of Number of Articles by IT

3.2 IT Characteristics in the Context of SCM (RQ 2)

Research related to IT in the context of SCM has an impact on companies in reducing costs and increasing competitiveness through the application of IT in determining decisions both at the strategic and tactical levels. Based on the literature studies that have been carried out, a grouping of research developments in previous research related to IT and SCM was obtained. The grouping was carried out referring to the grouping of studies that have been carried out by Kakhi and Gargeya [3]. As shown in Chart 3 below, there are four clusters in this paper. The most widely carried out research trend is related to Supply Chain Integration (SCI). Based on Chart 4 from 2017 to 2021, topics related to Business Intelligence and Analytics (BI&A) can be seen that every year there is one article and especially in 2017 and 2018 there are only BI&A topics that are published. Meanwhile, the topic of Supply Chain Integration is seen to have increased every year from 2018 to 2021.

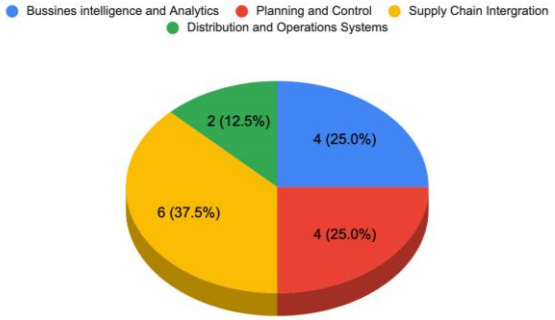

Chart - 3: Percentage of IT Articles in the Context of SCM

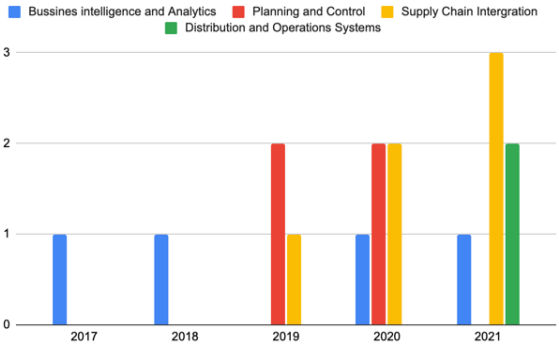

Chart - 4: Number of Articles Classified by SCM Topic

3.3 Research Methods (RQ 3)

Chart 5 below is presented related to the research methods used in the context of IT & SCM. There are 14 different types of methods used by researchers. The most widely used method is an exploratory study of 3 articles. Based on the exploratory study method, the research results obtained are in the form of theoretical models related to IT & SCM topics, as was done by Liu, et al related to factors that affect the collaboration of a logistics organization in the context of smart logistics ecological chain (SLEC) [5].

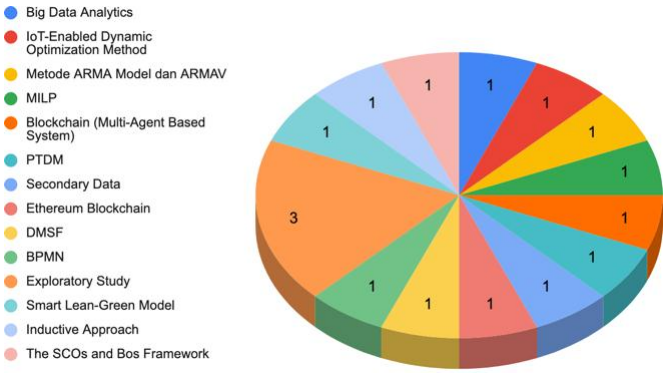

Chart - 5: Articles Classified by Research Methods

3.4 SCM Discussion Topics (RQ 4)

In previous studies, a grouping has been carried out based on the topic of discussion of SCM as presented in Chart 6. Based on the results of the review, four classifications were obtained related to the topic of discussion of SCM in the previous study which included operational management (OM), logistics management (LM), supply chain management (SCM), and supplier relationship management (SRM). According to Chart 6, it can be seen that the dominating SCM topics are related to LM topics by 43.8% related to logistics networks [5], [7], [9], transportation [11], [12], distribution [16], and logistics organization collaboration [19].

On the other hand, the attention of academics has not been fully directed to the topic of SRM because it can be seen from the current number of articles that as many as 12.5% of previous studies have addressed the topic and the scope discussed is still limited to contracting activities as Kumar, et al have done [13], and Casado-Vara, et al [10].

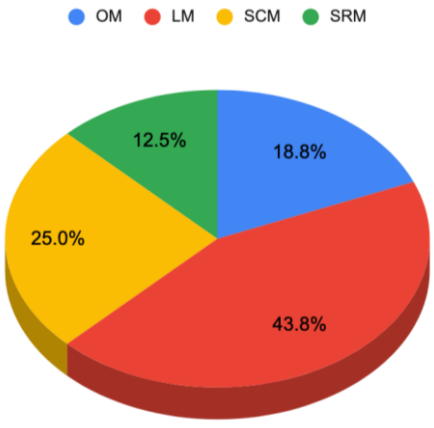

Chart - 6: Percentage of Articles by SCM Topics

3.5 IT Research Trends in SCM (RQ 5)

Information technology has a very important role in an organization including in the context of the supply chain [2]. Some of the important roles of information technology for organizations include improving the efficiency of an operation, facilitating the transaction process, being able to collect and provide various relevant and useful information in decision making, being able to monitor and supervise the performance of employees and an organizational unit, and playing a role in recording the status and changes that occur in business functions. Briefly, the role of IT from a functional perspective in supply chain management is divided into four, namely as a function of transactions, collaborative, decision consideration (DSS), and reporting [2].

Table 6 below shows a map of previous research based on the it role matrix and supply chain stage adopted from [2]. Based on Table 6, the position of the previous research was dominant in the decision support systems (DSS) study and at the supply chain stage, namely make.

Table - 6: Previous Research Matrix Based on Supply Chain Stage

Role of IT	Buy	Make	Sell
Reporting		[11], [14], [21]	[7]
DSS	[9]	[6], [8], [11], [12], [14], [15], [17], [21], [22]	[7], [19]
Collaborative	[19]	[14], [16], [19]	[7], [10], [19]
Transactions	[7], [13]	[12], [14], [15], [17]	[10], [17]

Supply Chain Stage

3.6 Research Industry Sector (RQ 6)

Chart 7 below shows the number of articles based on the industry sector used as the object of the research case study. There are 7 industry categories were identified in previous research, namely, the manufacturing, logistics, public service, e-commerce, pharmaceutical, biogas energy, and construction industries. From the data, it can be understood that most of it and SCM-related articles make the manufacturing industry sector a case study. In addition, it can also be seen that there is a researcher's interest in the e-commerce sector [5], [19] and public services (smart cities)

[12] as a case of IT and SCM-related research. Meanwhile, other industries such as construction, logistics, biogas energy, and pharmaceuticals are still relatively few. On the other hand, previous research has not touched the small-scale industrial sector.

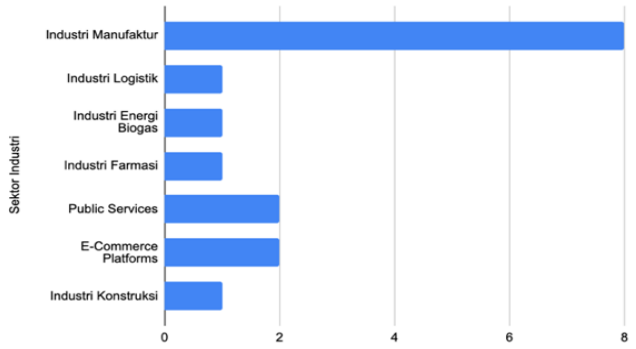

Chart - 7: Previous Research Based on Industrial Sector

4. DISCUSSION

This research found that based on the topic of discussion in previous research on the issue of information technology in the context of supply chain management, it is known that it is mostly dominated by IT technology topics such as IoT, Google Trend, GIS, Simulation systems and modeling, and Blockchain. Then, the next finding, namely the IT characteristics in supply chain integration in previous research showed a trend of publications that continued to increase from 2019 to 2021. Meanwhile, the characteristics of planning and control have decreased, which was shown in 2019 to 2020 there was 1 publication each, while in 2021 there were no publications about IT characteristics in planning and control in supply chain management.

Another criterion studied in this study is to identify previous research based on the research method used. The findings obtained are that the most widely used method is an exploratory study. This suggests an opportunity to use another approach in producing a study on IT in the context of supply chain management. Then, this study also highlighted that previous research did not pay much attention to the stages of the supply chain in the upstream and downstream areas. This can be seen from the many studies on SCM in the logistics management area. In fact, the study of SRM is also considered very important in the future.

This research also formulated several findings from selected articles into the form of mapping IT research in SCM. Based on Table 6 above, it can be seen how the previous research position is more in the position of utilizing the role of IT in supply chain management as a support for decision systems at the made level, and very few IT roles are involved at the upstream level such as procurement activities, and relationships with suppliers. However, on the other hand, it can also be understood that the research map shows the attention of researchers to the use of the role of IT in integrating supply chains. As presented on the research map, there is research at all levels of the supply chain, namely from the buy, make, and sell stages.

Based on the findings and discussions above, the author understands that there is still a view on the current competitive climate that has reached competition at the supply chain level. So that strengthening integration and collaboration between actors in the supply chain is believed to be a supplement that can encourage productivity and increase business competitiveness through IT support as decision support and collaboration between actors and stages in the supply chain. On the other hand, there is a shift in awareness at the consumer level on sustainability issues. So, to respond to this, corporations must be able to reconfigure business strategies so that they always consider environmental, social, and economic aspects. In addition, previous research has been limited to the study of the product. Previous research was seen seeking the use of IT in SCM to increase the efficiency of information flow, product flow, money flow, and business processes through IT Technology users. Thus, in terms of the topic of SCM, further research can pay attention to sustainability issues and their impact on SC's external environment and reach small-scale industries that are not only limited to integration issues but can encourage companies to make appropriate decisions (DSS) on the products and services produced. If more specific, the next research can be directed to research on sustainable product and service innovations.

As for related to research methods, it is a side that depends on the goals and problems of a study itself. However, in the future qualitative and quantitative research is a suitable option to be applied in the context of IT and SCM. Some previous studies used methods independently; none used the method qualitatively and quantitatively. However, it is possible that the trends of IT and SCM in the perspective of the methods specifically used in research are still very limited. In addition, subsequent research can fill research opportunities at the upstream level, because Table 6 shows that previous research focused more on internal issues (make). On the one hand, the relationship with suppliers is very important in supporting the sustainability of operations to the downstream area. As for the next stage of the IT research role, it can fill the gaps at the transaction, collaborative, and reporting levels.

5. CONCLUSIONS

This research concludes that the role of IT in supply chain management is needed. This is evident from several previous studies that present a positive contribution of IT to the achievement of supply chain management goals. Nevertheless, this article is still very far from perfection so there needs to be attention from various parties to be able to perfect this article in terms of content, methods, and results obtained.

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BIOGRAPHIES

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