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INTERNET OF THINGS IMPLEMENTATION ANALYSIS OF GREEN SUPPLY CHAIN MANAGEMENT IN COMPANIES

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ABSTRACT

Supply chain management is an important part of achieving company efficiency. The existence of globalization makes the transformation of technology in supply chains. The use of IoT in enterprise operations makes the company grow quickly and more effectively and efficiently. But this kind of performance makes there is more energy consumption. Environmental problems such as global warming and increasing air pollution arise, so many studies have suggested improving Supply Chain Management (SCM) with Green Supply Chain Management. In this study, we wanted to discuss "How ten companies in the world to do sustainability energy efficiency by using the GSCM (Green Supply Management) model so that it can reduce the risk of rising air pollution and global warming." This study uses the review literature method with a descriptive literature study model. Organized techniques were used to observe 100 (eventually trimmed to 10) research studies from January 1, 2017, to April 2022, collected through various references. The results show that companies have widely applied the Green Supply Chain Management model. However, some companies have not implemented it because they do not understand the concept of GSCM. Even so, they have understood the concept of green, accompanied by caring for the environment and applying it in the company's operations.

Keywords: Green Supply Chain Management, Internet of Things, Environmental Issues

INTRODUCTION

A company's supply chain management decisions can impact its effectiveness and efficiency. Coordinating information and material flow across an organization's supply chain to meet customer demand is the goal of Supply Chain Management. SCM aids in the optimization of existing supply chain processes in response to current and future consumer demands (Hanifah and Suryani 2017). Supply chain management has a significant impact on a company's performance. Management of supply chains has been shown to have effective and positive effects on the performance of businesses. As a result, the better the financial and operational performance of the company, the higher the level of supply chain management will be (Ilmiyati and Munawaroh 2016). In addition, supply chain management is critical for ensuring customer satisfaction. A supply chain, logistics network, or supply network, as defined by Arif (Hedin et al. 2022), is a coordinated system of organizations, human resources, information, activities, and

other resources that Products are co-participation or services in physical and virtual form from supplier to customer. Through this supply chain management, the company can find out what goods consumers are asking for and when is the right time to deliver the goods.

The use of supply chain management can also lower storage costs, including the cost of storing raw material supplies. When it is known what materials are not so necessary soon, the company can delay the purchase of these materials until the specified time, so that finally the other impact is that the storage warehouse of raw materials becomes more efficient and can be used for other purposes (Hedin et al. 2022). However, a lack of knowledge about supply chain management can result in issues like higher transportation, inventory, and resource costs. Furthermore, a lack of understanding of the importance of supply chain management for businesses has resulted in a long time for goods to be produced for consumers. The following are some of the most important supply chain issues: (1) deciding how much outsourcing is necessary, (2) management of the acquisition or acquisition of goods, and (3) managing issues through rapid risk management (Myles and Church 2022).

Humans are increasingly developing technology to make their work easier, for example, creating a system that allows multiple devices to connect via the Internet, also known as the Internet of Things. Thanks to the ease of IoT, it has now begun the application of this technology in industrial sectors (Octaviani 2021). IoT is defined by Casagras (Coordination and support action for global RFID-related activities and standardization) as a global network infrastructure capable of connecting hardware and virtual via data collection, usage, and communication capabilities. Existing networks, the Internet, and network extensions are all part of the infrastructure. The Internet of Things (IoT) connects objects, sensors, and networks to provide self-contained collaborative services and applications (Binus 2020a).

The industrial sector is also among those who do not miss adopting this technology. Furthermore, there is such a thing as industrial IoT, which is the application of IoT technology to an industrial process, from those related to instrumentation to sensor control of industrial equipment (Octaviani 2021). The use of IoT in enterprise operations makes the company grow quickly and more effectively and efficiently. But this kind of performance makes there is more energy consumption. If not followed by the level of consumer demand, the product is not sold, and the manufacturer chooses to store the goods in the warehouse. The company produces goods according to the number of requests or interests the consumer wants to buy. High consumer

demand causes a company to produce more and more goods. The number of goods delivered will impact the environment due to the waste produced, such as global warming and air pollution that can interfere with human health. Therefore, many studies have suggested improving Supply Chain Management (SCM) with Green Supply Chain Management. This system prioritizes the company's effectiveness and operational efficiency and pays attention to environmental conditions.

Product design, procurement, material selection, manufacturing processes, final product delivery to consumers, and product end-of-life management are all included in Srivastava's definition of Green Supply Chain Management (GSCM) (de Oliveira et al. 2018). Environmental management principles are applied to supply chain activities such as design, manufacturing, procurement, logistics, packaging, assembly, and distribution in GSCM practices (Brilliana, Baihaqi, and Persada 2020). By implementing Green Supply Chain Management (GSCM), companies can reduce their environmental impact while increasing operational efficiency, according to Vanalle et al. (de Oliveira et al. 2018).

METHODS

This study uses the literature review method with a descriptive literature study model. There are many ways to conduct an academic research project, but the most common is a well-organized and managed literature review. An in-depth analysis of supply chain integration and its relationship to performance through the emergency prism is the goal of this review rather than simply synthesizing existing literature. It was done using the Tranfeld et al. method for a systematic review. To report results orderly and systematically, researchers should conduct thorough and well-planned article searches that combine synthesis and analysis. According to him, practitioners can benefit from a systematic review of this literature in any field or discipline. For many years, this has been at the forefront of scientists' and practitioners' research agendas. To make logical decisions and conduct other types of research, it is critical to conduct a literature review.

Review design

GSCM research issues were reviewed by a panel of experts and experts in specific research areas prior to the assessment process. It is possible, according to Tranfeld et al., that the early stages of a systematic review are an iterative process of definition, clarification, and refinement.

As a result, systematic reviews are published based on existing methods for identifying, categorizing, and monitoring GSCM implementation.

GSCM's size and scope and its relationship to various performance aspects were noted throughout the study. Several moderating variables and their relationship to the types of services available are discussed concerning the strength of multiple domains and GSCMs in this study. Furthermore, different dimensions of the GSCM reflect different outcomes related to many performance variables.

Implementation of the review

Following the formulation of a research query, the appropriate keyword program is created to search data from various databases, including Google Scholar, Cochrane, Elsevier's Science Direct, Garuda, and the American College of Cardiology.

We searched using specific keywords, including "supply chain integration," in all fields to find the most relevant articles (i.e., keywords, abstracts, and titles). The selected studies will run from January 1, 2017, to April 20, 2022. Following established protocols, initial articles were found in over 100 journals and peer-reviewed proceedings. The collected data is then refined through a focused review of the abstract.

Descriptive and thematically organized studies were found after a critical review of the first-obtained studies. It is clear from these studies that green supply chain management has a significant impact on various performance indicators. They can also assist in the search for appropriate answers to research questions.

Details about reviews

A descriptive and thematic analysis of the subject matter is discussed in this section of the review:

Descriptive analysis

During the review period, this study ensures a critical analysis of referenced GSCM studies published in selected journals. We included government and sectoral oversight in this study. In addition, the descriptive analysis incorporates several research techniques that have previously been used in other studies. Explanatory lenses used to support research in the GSCM field are also used to categorize articles.

Thematic exploration

The ranking is a fundamental approach to fully comprehending variables and their utility, and it is one of the primary objectives of reviewing existing literature. As a result, this paper assesses the research synthesis and divides it into two major categories: The concept of GSCM and the implementation of GSCM in enterprises (Hassan and Abbasi 2021).

RESULTS

Green Supply Chain Management (GSCM)

The concept of Green Supply Chain Management (GSCM) begins with concerns in line with the sustainability of the environment due to economic and industrial activities. People are becoming more aware of the importance of environmentally friendly products as environmental issues become more prevalent. This consumer demand certainly encourages business actors to pay more attention to their production activities. In addition, financial pressures, government regulation, growing competition, and complex environmental regulations have simultaneously increased awareness of sustainable supply chains and reverse logistics (Pramesti, Baihaqi, and Bramanti 2020).

According to Corbett and Klassen, green supply chain management (GSCM) refers to efforts to reduce an organization's and its supply chain's environmental impacts related to climate change, pollution, and non-renewable resources. To reduce the environmental impact of the product's life cycle, GSCM integrates supply chain management and collaborates with supply chain partners to promote green business processes. As part of his duties, he must work with suppliers and customers, conduct internal analyses of processes and procedures, and consider environmental factors during product development (Heriyanto and Noviardy 2019).

According to Srivastava, GSCM adoption goes beyond environmental concerns because a positive corporate image leads to higher profits, lower costs, and business value creation. GSCM was initially motivated by environmental degradation, dwindling raw material resources, and rising pollution levels. Chen et al. claim that the implementation of green practices, such as procurement and supply chain management (GSCM), can significantly impact a business. To Vanelle et al.'s knowledge, organizations believe that GSCM can help them reduce their operations' environmental impact while simultaneously improving their operational efficiency (de Oliveira et al. 2018).

Companies must adhere to the basic principles outlined in ISO 14001's Environmental Management System Management Clause to achieve GSCM. Operational activities and functions in GSCM include the following.

1. Green procurement. "Green purchasing" refers to making purchases while keeping in mind the environment by reducing the number of raw materials used, recycling what can be reused, and repurposing what can still be recycled.
2. Green manufacturing. Manufacturing processes that use low-impact inputs are highly efficient and produce little or no waste or pollution is referred to as green manufacturing.
3. Green distribution. Green packaging and logistics are examples of green distribution activities (Jumady and Fajriah 2020).

Hervani defines GSCM as a combination of green design, material management, green procurement, environmental collaboration with suppliers, and reverse logistics to avoid waste loops. According to Srivastava, GSCM can reduce negative impacts (pollution of the air, water, and soil) and resource waste (energy, materials, and products). Using real case studies, many researchers and students describe the meticulous practice of GSCM implementation (Abdel-Basset, Chang, and Gamal 2019).

Implementation of Green Supply Chain Management (GSCM)

One of the important aspects that the company's management must consider is green supply chain management (GSCM). This article will be presented related to the implementation of GSCM in several companies. Of the 60 companies we collected, ten companies deserve to be considered research objects. These companies are taken from previous research related to the topic of discussion.

Employee perceptions of the application of Green Supply Chain Management (GSCM) in the hospitality and tourism industry in West Sumatra were investigated in a study by (Meuthia, Lita, and Faisal 2019). The findings show that hotels and tourism companies in West Sumatra instill a strong sense of environmental stewardship in their employees. To maintain environmental sustainability, almost all hospitality, and tourism sectors, such as cafes, restaurants, and hotels, manage waste well. They have established good working relationships with trusted suppliers to ensure the quality of their products and utilize resources. The cafe's main ingredients are non-toxic and free of harmful chemicals. Furthermore, the hotel is concerned about the water quality consumed by visitors. The company has a clear policy of

promoting environmental awareness by posting littering warnings all over the place. Internal and external parties influence the behavior of those who see it indirectly. The better each hotel and tourism sector's internal environment is managed, the better the GSCM concept will be implemented.

GSCM benefits greatly from a coordinated external and internal environment. This demonstrates their ability to support the hospitality and tourism industries' green supply chain management. GSCM development practices, on the other hand, necessitate corporate values and a commitment to ethical environmental protection standards. Managers must be aware of their responsibilities and have them clearly defined. Furthermore, in the hospitality and tourism industry, where managers' perceptions of environmental compliance must be aligned with stakeholder needs, the external environment supports green supply chain management. This implementation will assist businesses in conserving resources while also protecting the environment. Finally, it can help to establish a positive corporate image. West Sumatra's hospitality and tourism industries also form cross-functional partnerships to improve the environment (Meuthia et al. 2019).

Research (Puryono, Mustafid, and Jie 2017) shows that GSCM can provide information and influence supply chain performance and financial performance indexes. The supply chain process in its performance value using the five criteria in Green SCOR and connected with financial performance then analyzed to find the weight of each standard using the AHP method. The results of the analysis are then compared with the real consequences of the SCOR system so that it can be evaluated, controlled, and monitored because the results of the research obtained show that the production, delivery, and return process is already running well and can be said to be environmentally friendly. The procurement process orders via email need attention and improvement because few still use this method. Two criteria must be evaluated: reliability that has not met the company's targets and Asset Management that is too large to be expressed from what has been determined. Even the company's profit exceeded the target of Rp.23,331,000,000, and the return on the company's assets exceeded the target of 3.7% of what had been determined. This means that the method used can analyze and evaluate the company's performance and finances more effectively.

Furthermore, research by (Ida Bagus Suryaningrat, Novita, and Kurniaputeri 2020) aims to analyze economic aspects and study environmental elements in the application of GSCM in CV

MUER. This company is a business unit that produces fresh and processed milk located in Kalibaru District, Banyuwangi Regency. This research is conducted with surveys, direct discussions, environmental indicators, and economic analysis. There 3600 liters were used to clean the cages, 2265.57 kilograms of feed were consumed, 550 kilograms were used for milking, and the water consumption for cleaning tools was 250 liters, according to the study. Based on the 13 environmental indicators used in the assessment, the milk supply chain at CV MUER was implementing most of the GSCM concepts. Other findings revealed that contamination levels in milk processing (COD and BOD levels) were higher than agency regulatory standards. According to economic analysis, the NPV value is IDR 2,723,162,185, the IRR is 36.99 percent, and the B/C ratio is 1.48. Net present value (NPV), internal rate of return (IRR), and B/C ratio (B/C ratio greater than 1) are all greater than zero. This indicates that GSCM implementation in CV MUER is highly feasible based on environmental and economic considerations.

Research by (Purnomo et al. 2019) aims to measure the performance of GSCM applied to the tanning industry at PT Asa Yogyakarta. AHP (Analytical Hierarchy Process) and Green SCOR (Green Supply Chain Operations Reference) were used in the study. A company's GSCM activities and performance indicators relevant to the Green SCOR approach can gather data for research purposes AHP is used to determine the relative importance of each performance metric. The study results showed that GSCM's performance value in the tannery industry of PT Asa Yogyakarta was included in the category quite well, where the total value of GSCM performance in January, February, and March was above 90. The company's on-time delivery performance, adherence to production plans, and the number of defective machines needed to improve. Meanwhile, the recommendations for improvements are improving the management of raw material supplies in warehouses, improving coordination and communication between engineering and production parts in terms of scheduling, and often following up or monitoring workers about the current conditions of product delivery.

Using the GreenSCOR method, as well as the results of an Importance Performance Analysis (IPA) method, (Susanty, Santosa, and Tania 2017) assessed the extent to which Pekalongan Batik Small and Medium Enterprises (SMEs) implemented green supply chain management practices (SMEs). The findings show that small tie-dye SMEs have a low level of GSCM implementation because they do not implement GSCM properly, such as not promoting liquid waste recycling. Most medium-sized batik SMEs have implemented GSCM practices in

nearly every indicator, but GSCM implementation in medium-sized batik SMEs is average. They have also recycled liquid waste through wastewater treatment plant facilities (IPAL). According to the mapping results, the indicator of tie-dye SMEs is located in the A quadrant. Develop strategies to help batik SMEs in Pekalongan improve their GSCM practices, focusing on improving performance on green resource usage indicators.

Research by (Heriyanto and Noviardy 2019) aims to evaluate the application of GSCM carried out on Culinary SMEs in Palembang City. The population used as many as 36 SMEs with data collection methods using the help of structured questionnaires. The majority of respondents were unaware of green supply chain practices, according to the survey results. General owners or managers, according to on-site observations, understand the concept of green but not the idea of GSCM in the manufacturing process. The RL application has not yet been fully implemented in Palembang culinary SMEs, according to the results of on-site interviews. This is demonstrated by the low average value of each indicator. Even though the owner uses high-quality raw materials in the field, the owner does not provide consumers with a true raw material guarantee. Furthermore, the average SME owner or manager lacks a system to track suppliers' environmental risks. Environmental management, packaging, and distribution are also less important to SME owners or managers. Styrofoam and environmentally damaging plastics, such as polystyrene, are still used in packaging despite their danger to human health and the environment. It is known from the analysis of five aspects of reverse logistics that culinary SMEs in Palembang has not implemented green-looking processes.

Thailand's electronics industry follows GSCM's practices as a business strategy to achieve its long-term goals of improving performance. Indicators are used in Green Purchases, Green Logistics, and Legislation for the green environment and sustainable performance as contained in (Jermsittiparsert, Namdej, and Somjai 2019) research. The findings reveal a positive and significant link between green procurement and long-term success. Furthermore, it was discovered that green logistics and legislation have a significant positive correlation with long-term performance. As a result, it can be concluded that Thai electronics companies use environmentally friendly supply chain practices to improve and maintain their performance. In contrast, companies may fail to recognize the importance of TQM (Total Quality Management) practices for improved procurement to enhance Thailand's electronics industry performance.

There are still developmental issues in Thai manufacturing companies in green supply chain management.

Following that, (Worasatepongsa, Chordkunpan, and Jermsittiparsert 2020) study the relationship between green supply chain management (internal environmental management, recycling logistics, green procurement, and customers' environmental protection companies) and private company environmental performance in Bangkok, Thailand. An additional focus of the research is on the environmental performance of Thai private companies and the role that green innovation mediation plays in green supply chain management practices. This study found a strong correlation between private company environmental performance in Bangkok and green supply chain management. It appears that green innovation has had a positive effect on supply chain management relationships and the environmental performance of private companies in Bangkok, according to the findings. As a result, the study concludes that private companies in Bangkok maintain high supply chain practices and effectively manage them, which explains why their environmental performance is so good. These findings offer advice to environmental regulatory development agencies, which should focus more on green supply chains to improve the environmental performance that businesses require to succeed.

Shamsuddin, Ahmad, & Peng's (2020) research aims to understand GSCM practices and the level of the corporate sustainability performance of manufacturing companies in Batu Pahat, Johor. Both companies have designed products that use less energy, water, and hazardous and hazardous materials like plastics because of the similarity in their GSCM approach. In addition, by implementing GSCM practices, both companies could reduce purchase costs, waste treatment costs, and disposal costs. Paperless policies, turning off lights and air conditioners during lunch breaks and when leaving the office, using LED light bulbs and recycling bins, pre-job briefings, and performing five working days are all examples of activities or actions taken by both companies to promote greener corporate behaviors and practices. As a result, an examination of data gathered through surveys and interviews reveals that companies' implementation of current GSCM practices has a lot of room for improvement. The current level of GSCM is average, and all techniques reviewed, particularly those related to internal environmental management and reverse logistics practices, require more attention.

Research by Sundram, Bahrin, Othman, & Munir (2017) under "Green Supply Chain Management Practices in Malaysia Manufacturing Industry." The study's goal was to see if green

supply chain management practices had any effect on the environmental and operational performance of Malaysian manufacturing companies. Green procurement, return on investment, green design and packaging, reverse logistics, customer collaboration, manufacturing environment, and operational performance were among the seven variables examined. Eco-friendly methods and eco-friendly packaging practices actively support environmental performance, making them the only green practices with a return on investment. Only three of the five GSCM practices identified in this paper have a significant relationship; ecological sourcing, return on investment, and customer collaboration will positively impact a manufacturing firm's business operations. Managers can better prioritize and allocate resources and communicate and collaborate with suppliers if they thoroughly understand GSCM practices and how they are linked through a logical structure. In conclusion, GSCM practices are primarily concerned with environmental issues in operational activities and manufacturing performance.

DISCUSSION

Changes in the new industrial age necessitated the emergence of green supply chain management to implement supply chain strategies that reduce waste and pollution. Contemporary issues such as energy conservation and pollution reduction are emerging due to green supply chain management, which necessitates industrial activities that balance marketing performance and environmental concerns. To reduce waste and improve operational efficiency, including product and service delivery, the company sees a need to enhance its work network or supply chain. All goods and processes, from raw materials to finished goods and their disposal, should be considered as part of a green supply chain to minimize their impact on the environment.

According to Dheeraj, GSCM is an innovation that incorporates supply chain strategies such as reduction, recycling, reuse, and material substitution into an environmental context. GSCM aims to integrate environmental factors into all aspects of supply chain management, from product design to raw material source selection to manufacturing processes to final product delivery to customers and product management after use, according to Toke. We can therefore deduce that the GSCM concept is built around reducing waste and the environmental impact of industrial supply chain activities. For supply chain activities to continue to be sustainable,

companies must keep an eye on this long-term non-financial aspect of the environment (Binus 2020b).

Companies must effectively manage their supply chain and logistics operations to remain competitive in today's dynamic business environment. Improved planning, implementation, and control of goods, services, and information flow and storage from source to consumption have all been made possible thanks to IT. Technology plays an important role in coordinating stakeholders by improving communication, data collection, and transmission, enabling effective decision-making, and improving supply chain performance. Problems in the supply chain can be reduced in this way. One of SCM's most recent IT developments is the Internet of Things (IoT), which allows for more accurate data and more effective decision-making (Rejeb et al. 2020).

The Internet of Things is defined by Bahroun et al. as a digitally interconnected network of physical objects to gather and analyze data and interact with each other within and between the company and the rest of its supply chain. This allows the company to operate with greater agility, visibility, tracking, and information sharing, which helps with supply chain planning, control, and coordination. IoT plays an important role in multiple aspects of SCM as a path to operational excellence. Companies can simplify the flow of information, gain significant efficiencies at every stage of the supply chain, and improve communication and integration between and within organizations by implementing IoT. Zara, for example, uses IoT to ensure a high level of planning flexibility, reliable replenishment solutions, shorter wait times, and a smaller product assortment. The Internet of Things (IoT) can help companies better understand their customers' needs and improve demand planning and customer service. IoT helps modern supply chains close information gaps by capturing granular data in real-time between organizational units, processes, and people (Rejeb et al. 2020).

Connecting devices carry out the application of IoT in the industrial sector with sensors with controller tools. Analyze the information gathered by these devices to improve products, services, and operations. IoT enables device-to-device communication (M2M - Machine to Machine) to reduce the need for human intervention. The information obtained can increase productivity and provide valuable feedback for continuous improvement for design engineering and manufacturing operations teams. IoT helps modern supply chains close information gaps by capturing granular data between organizational units, processes, and people. Ultimately, with IoT,

companies can produce "smart" products and provide customers with more information and feedback needed by the company (Binus 2020a).

CONCLUSION

Green Supply Chain Management (GSCM) reduces an organization's and its supply chain's negative environmental impacts related to climate change, pollution, and non-renewable resources. GSCM is one of the important aspects that the company's management must consider. According to the literature studies that have been conducted, most companies have implemented Green Supply Chain Management (GSCM) in their operations. In Indonesia itself, in terms of the implementation of GSCM, some companies have implemented, and some have not. Companies that have not implemented GSCM face some recommendations and enhancements to reduce waste and increase operational efficiency, including the delivery of products and services. Meanwhile, in industries in other countries such as Malaysia and Thailand, GSCM significantly impacts manufacturing performance. To improve and maintain their performance, they use green supply chain practices. Because the company carries high supply chain practices and manages them effectively, one of SCM's most recent IT developments is high environmental performance. The Internet of Things (IoT) has the potential to provide more accurate data for better decision-making. IoT helps modern supply chains close information gaps by capturing granular data between organizational units, processes, and people.

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