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Investigating the parameters which influence green supply chain management in agricultural industry

Abstract. The main objective of the current research is to identify and prioritize factors affecting the efficacy of green supply chain management (GSCM) in the agricultural sector in Indonesia. For this purpose, three factors of production, purchase and green transportation were considered in the green supply chain. This research is applied in terms of purpose and descriptive-quantitative in terms of data type. To collect information, both library and field methods were used, and in this way, the statistical population in this study is 415 employees of the green food manufacturing companies in Indonesia, such as: BOHAN Food, Asian Agri, Ardena Food and others, who were selected by Cochran sampling method, and to measure information from a standard 19-item questionnaire in the period of 2022-2023. A five-point Likert scale was used. To analyze the data, partial least squares method and Smart-PLS software were employed. In order to fit the reliability, Cronbach's alpha was used and its coefficient is more than 0.7 for all research constructs. The results indicated that the performance evaluation of GSCM in the agricultural industry is significantly related to green purchasing, production, and transportation, whilst the green production is the most affecting variable. Based on the results of this research, it can be suggested to the agricultural and food companies of the studied area that, if the green supply chain is employed instead of the traditional one, the environmental performance will be maintained and the financial performance of their businesses will be improved concurrently.

Keywords: GSCM; Green Purchasing; Green Transportation; Green Production; Agricultural Industry; Green Food Manufacturing; Performance

JEL Classifications: E24; E41; E64; I18; J28; J31

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1. Introduction and Brief Literature Review

During the economic growth and the huge advancement of technology, the waste of natural resources, excessive consumption of resources and also the blows to the environment have increased, especially in fast growing countries. The governments and industries of different nations have tried to improve this success by creating standards and rules and regulations, but the efforts have been insufficient and the great challenge still remains. Forecasts show that the world population will be around 9 billion by 2050 and 1.10 billion by 2100 (Pham & Pham, 2017). This huge population growth creates significant pressures on the environment and resources. Therefore, the need to extract raw materials will increase, and as a result, the production of waste will also increase (Gardas et al., 2019). For this reason, organizations are under various and increasing pressures from stakeholders to include environmental sustainability measures in their SCM practices (Souhli & En-nadi, 2023). Therefore, it is necessary to take appropriate action on a large scale of technological and social, financial and political changes, and one of the processes that can be effective in any organization to consider this important and apply it in all SCM (Wang & Zhang, 2022). According to Trivellas et al. (2020), the SCM association in today's globalized environment and with application of the networks companies have united to create a group of products or unified services, increased the reliability of the system, reduced the distribution time and removed extra costs for the end customer (Razmara et al., 2022). The combination of these steps is known as the supply chain (Puspitasari et al., 2022). The SCM is a network that includes all activities related to the flow and transformation of goods from the stage of raw material to the final product, as well as the flow of information related to it (Munawir et al., 2021). SCM is the management and coordination of a complicated networks of activities including in providing the final product to the users. Also, by adding the word green, GSCM is introduced, which refers to green procurement, green production, green distribution and reverse logistics. The idea of GSCM is to reduce waste (energy, greenhouse gas production, hazardous chemicals, and solid waste) along the supply chain (Fianko et al., 2021).

Since the supply chain presence in the 1990s, the framework of environmental conditions in businesses have been changed. Sustainability goals became the main source of many companies and businesses discovered that the combination of environmental issues in all section of the organization is necessary to achieve the best results and creating friendship with the environment not only in The case of transportation costs is for the purpose of creating value for business and improving financial performance (Fesharaki & Safarzadeh, 2022). For this reason, GSCM is an important strategy for companies that improves environmental and economic performance while reducing environmental risks and increasing economic productivity. However, GSCM is still a novel idea and has not been extendedly used, especially by small and medium-sized companies. For example, global manufacturers of products and most manufacturing companies in China are still in the early stages of learning environmental actions (Trivellas et al., 2020). Products that directly use natural resources as input need to be managed in a green way. The use of various chemicals in the cellulose industry creates effluents and wastes that are harmful to the environment. Therefore, GSCM is of double importance here. Establishing a proper relationship between the industry and the environment in such a way that the least amount of damage to the environment is caused requires actions that are given in various studies, some under the title of green management and some under the title of environmental protection.

Some of these measures are related to the product and its design. Designing products that can work with less material or energy consumption (Nasrabadi et al., 2024), designing products in such a way that they can be recycled or repaired after failure, designing products or processes that can instead of using toxic and harmful substances for the environment, use environmentally friendly materials and finally, designing products that produce less waste or require less input resources for work, are included in this category of measures.

Focusing on the production line and adapting it to the environment is another factor that researchers have addressed. Using the system or process to control harmful substances, using

efficient technology to reduce energy consumption, using the system/process to minimize waste during production, remanufacturing and lean production, clean production (Montazeri-Gh & Mahmoodi-K, 2016), better use of capacity, lower costs of raw materials, increasing production efficiency and improving the image of the company, are the solutions that are given to them. Green packaging including environmentally friendly packaging and recyclable and reusable packaging have also been proposed in this context. Also, concepts such as green warehousing (including reduction of inventory level, sale of inventories and excess materials, sale of additional capital equipment), green logistics (including environmentally friendly transportation, the use of green fuels such as low sulfur and alternative fuels such as liquefied natural gas and reverse logistics (including the sale or reuse of used parts or components and the replacement of obsolete or old items in the process use, have been considered for compatibility of industry and environment (Nursalim, 2021).

Sun et al. (2024) associate focus on economic performance with environmental protection. In such a way that factors such as reducing the cost of energy consumption, trying to create innovation, reducing the cost of waste disposal, reducing environmental damage, increasing the company's income, reducing the costs related to services and increasing the market share have a positive relationship with preserving the environment. In this context, Gardas et al. (2019) have discussed the relationship between operational performance and the environment. Improving the use of capacity, reducing delivery time, improving quality and brand image, improving public relations and increasing brand loyalty can lead to GSCM in the organization. Fesharaki and Safarzadeh (2020) have discussed environmental performance and factors such as the ability of GSCM to reduce carbon emissions, the effectiveness of the system in reducing water and solid pollutants, and the reduction of harmful and toxic substances with the implementation of GSCM.

The present research seeks to identify and prioritize GSCM indicators in Indonesian agricultural industries. The purpose of the research is to determine the indicators of GSCM in agricultural production industries and also to determine the priority of each of these indicators in this industry. This issue can determine the factors that have the maximum impact on GSCM in this industry, and by improving them, this industry will cause less damage to the environment. The main hypothesis of this research is affecting the green product, purchasing and transport on GSCM, and the structure of the proposed research model is presented in Figure 1.

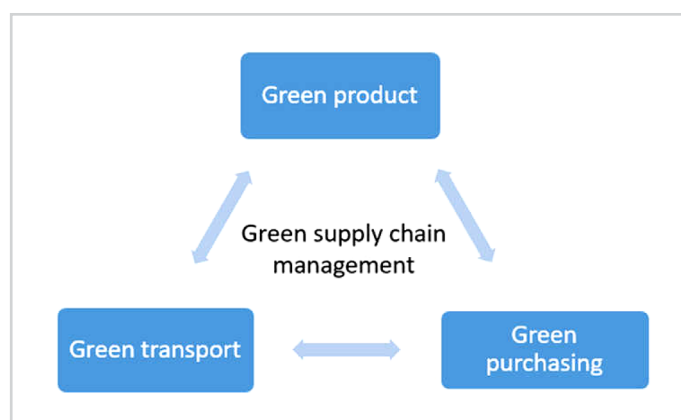


Figure 1:
Structure of proposed model for GSCM
 Source: Compiled by the authors

2. Method

In terms of purpose, this research is of the type of applied and developmental research and in terms of the implementation method, it is considered part of the descriptive-quantitative research of the survey type. Also, in terms of the time horizon, it is temporary because it was done only at a specific point in time in the period of 2022-2023. The statistical population in this research includes 415 employees of agricultural industry in Indonesia. Sampling was done randomly and to explain the sample size, simple random sampling was used assuming sampling from a limited population. Considering the accuracy level of 0.01 and the confidence level of 99%, the required sample was determined to be 88, and for more accurate calculations, 200 questionnaires were distributed and out of this number of questionnaires, it was usable.

To check the divergent validity, the relationship degree of a structure with its indicators in comparing the links of that structure with other one is shown by the Fornell-Larcker matrix. In this method, only the latent variables of the first order are entered in the matrix. In Table 1, the numbers 1-4 are related to Green Product, Green Purchasing, Green Transport and GSCM, respectively.

To calculate this matrix, the root value of the hidden variables in the current research, which are placed in the main diagonal of the matrix, should be greater than the correlation amount between them, which are placed in the lower and left houses of the main diagonal. As presented in Table 1, it can be seen that the variables in the model interact more with their indicators than with other constructs and the model's divergent validity is at a reasonable level.

Table 1:
Divergent validity of data

	1	2	3	4
Green Product	0.81	-	-	-
Green Purchasing	0.56	0.76	-	-
Green Transport	0.49	0.63	0.69	-
GSCM	0.76	0.55	0.66	0.84

Source: Authors' own research

3. Results

The method of data collection in this research is library and field, in this way, with library studies, strategic management literature, GSCM and its strategies, the background of the research and the theories that exist on the subject have been reviewed and collected. Then, based on the theoretical foundations of the research, the questionnaire of this research is prepared, which includes strategies as options and dimensions of green SCM as criteria. After filling and collecting the data of the questionnaires, the data are analyzed with the structural material technique and statistical method. The structural equation for the presented model is evaluated based on the impact of the effective factors on the performance of GSCM in the agricultural industry, including production, purchase and transportation (distribution), is given in Figure 2.

As shown in Figure 2, green production has the greatest effect on SCM with a factor coefficient of 0.77, and green purchasing and transportation variables (and their subset factors in the supply

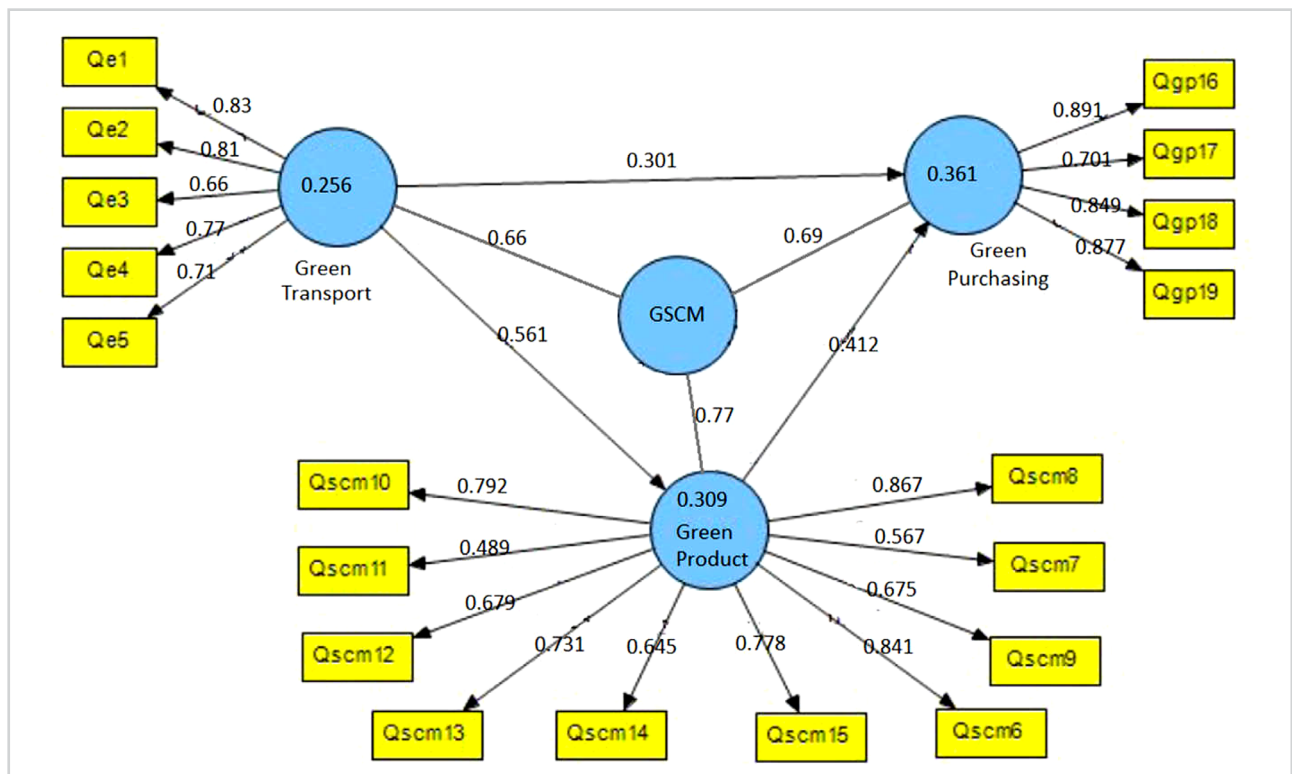


Figure 2:
Structural model of the variables and path coefficients

Source: Authors' own research

chain) are placed in the next positions. Also, the impact and interaction of each of these variables on each other's performance is presented in this structured middle school, which shows the positive and direct impact of these variables on each other.

In the next step, research hypotheses have been evaluated using t-test, the results of which are presented in Table 2. The criterion for confirming the research hypotheses is that the path coefficients are positive and the t-statistic is greater than 1.96. As it is clear from Table 2, all hypotheses have been confirmed with a t value higher than 1.96, although the first hypothesis regarding the impact of green purchasing on SCM has been set at a minimum value.

Table 2:
Hypothesis results

Path	Coefficient	T-Value	Results
Green Transport → GSCM	0.66	1.98	Confirmed
Green Purchasing → GSCM	0.69	2.68	Confirmed
Green Product → GSCM	0.77	9.56	Confirmed

Source: Authors' own research

4. Conclusion

In this research, the prioritization of green supply chain strategies in the agricultural industry has been considered. At the beginning of this research, based on the review of thematic literature and the theoretical foundations of the research, the selection criteria of the green supply chain strategy including three factors of green production, purchase and distribution were identified. In the next step, the research questionnaire was designed using strategies and criteria, and after its completion, the data was analyzed by statistical method and structural equation.

As the results of data analysis show, the most important criterion among the main criteria is green production. In a way, it can be said that as the results show, production should be considered before purchasing, distribution and marketing. This issue shows how important green production can be in realizing the goals of green SCM, because the output of this stage is considered as the input of the stages of purchase, distribution and marketing. Green production is a kind of basis, basis and foundation for the realization of GSCM. The purpose of this research was to determine the optimal strategy of GSCM. The obtained results indicate that purchasing, transportation and green production have a positive and significant effect on GSCM.

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