

Sustainable supply chain management on firm performance: Evidence from manufacturing companies in developing countries

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Abstract: This study examines the effect of Sustainable Supply Chain Management (SSCM) practices on firm performance in manufacturing companies in developing countries, focusing on manufacturing firms in Makassar City, Indonesia. A quantitative research design was employed, using purposive sampling to select 100 employees involved in production, procurement, distribution, and operational management from three manufacturing companies. Primary data were collected through a five-point Likert-scale questionnaire and analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 3.0. The findings demonstrate that all examined SSCM practices have a positive and significant effect on firm performance. Energy efficiency in production processes has the strongest effect ($\beta = 0.739$; $p < 0.001$), followed by supplier environmental performance evaluation ($\beta = 0.341$; $p = 0.044$), waste management and product recycling ($\beta = 0.239$; $p = 0.047$), and the use of environmentally friendly production technologies ($\beta = 0.165$; $p = 0.026$). These findings indicate that integrating sustainability into supply chain activities can strengthen operational efficiency and overall firm performance. The study implies that manufacturing firms should prioritize energy efficiency, strengthen environmental supplier assessment, adopt green technologies, and improve waste management and recycling practices to achieve sustainable competitiveness.

Keywords: Company performance, Developing countries, Manufacturing industry, Sustainability, Sustainable supply chain management.

1. Introduction

The changes in global economic dynamics over the past few decades have driven companies to focus not only on operational efficiency and financial performance but also on social responsibility and environmental sustainability [1]. In this context, the concept of Sustainable Supply Chain Management (SSCM) has emerged as a strategic approach that is increasingly gaining attention in modern business practices [2]. SSCM emphasizes integrating economic, social, and environmental principles across all supply chain activities, from raw material procurement and production processes to distribution and post-consumption product management [3]. This approach is believed to enhance a company's competitiveness while ensuring the long-term sustainability of resources [4].

The manufacturing sector is one of the industrial sectors that makes a significant contribution to economic growth in many developing countries [5]. On the other hand, manufacturing activities are often associated with various environmental issues, including carbon emissions, industrial waste, high energy consumption, and the exploitation of natural resources [6]. This condition requires manufacturing companies to implement more responsible and sustainable supply chain management practices [7]. The implementation of Sustainable Supply Chain Management (SSCM) is important not

only for minimizing negative environmental impacts but also for improving operational efficiency, corporate reputation, and overall business performance [8].

In recent years, attention to the relationship between SSCM practices and firm performance has increased in the operations management and strategic management literature [9]. Various studies indicate that implementing sustainability practices in the supply chain can positively impact multiple aspects of firm performance, including financial, operational, and environmental performance [10]. Practices such as green procurement, energy efficiency in production processes, improved waste management, and sustainable collaboration with suppliers and distributors are believed to create added value for companies [11]. By integrating sustainability practices into the supply chain, companies can not only meet regulatory requirements and address stakeholder pressures but also enhance resource efficiency and strengthen their competitive position [12].

Implementing Sustainable Supply Chain Management (SSCM) in developing countries presents challenges distinct from those in developed countries [13]. Infrastructure limitations, a lack of awareness of sustainability issues, weak regulatory systems, and constraints on financial and technological resources often impede the adoption of sustainable supply chain practices [14]. In addition, companies in developing countries are frequently under pressure to minimize production costs, making sustainability a secondary priority [15]. This situation raises an important question about the extent to which SSCM practices can truly improve firm performance in developing countries [16].

On the other hand, increasing global pressure for responsible business practices has encouraged manufacturing companies in developing countries to adopt a range of sustainability initiatives throughout their supply chains [17]. Demands from international markets, investors, and consumers, who are increasingly concerned about environmental and social issues, have become key drivers for companies to improve their operational practices [18]. Therefore, it is important to understand how SSCM practices are implemented in developing countries and how they influence firm performance.

Research on the relationship between Sustainable Supply Chain Management (SSCM) and firm performance has been widely conducted in developed countries; however, empirical evidence from developing countries remains relatively limited. Differences in economic characteristics, regulatory environments, and industrial structures between developed and developing countries may yield varying research outcomes. Therefore, empirical studies are needed to provide a more comprehensive understanding of the relationship between sustainable supply chain management practices and firm performance in developing countries, particularly in the manufacturing sector.

To obtain a more objective and measurable understanding of this relationship, this study adopts a quantitative approach. The quantitative approach enables researchers to systematically examine relationships among variables through standardized measurements and statistical analysis. Through this approach, SSCM practices can be operationalized as measurable indicators, including environmentally friendly procurement, resource efficiency, waste management, and collaboration with supply chain partners. Meanwhile, firm performance can be assessed using indicators of operational, environmental, and financial performance.

The use of quantitative methods also enables more empirical and generalizable hypothesis testing of the effects of SSCM practices on firm performance. Research data can be collected through surveys of manufacturing companies, the objects of the study, and then analyzed using statistical techniques such as regression analysis, Structural Equation Modeling (SEM), and other relevant methods to identify relationships among variables. Thus, the quantitative approach provides a stronger analytical foundation for explaining the causal relationship between sustainable supply chain management practices and firm performance.

Based on the above explanation, this study aims to analyze the effect of sustainable supply chain management on firm performance in the manufacturing sector in developing countries. This research is expected to contribute theoretically by enriching the literature on SSCM in developing countries, as well as providing practical implications for companies seeking to design supply chain strategies that are not only economically efficient but also socially and environmentally sustainable. In addition, the

findings of this study are expected to serve as a reference for policymakers in formulating policies that promote sustainable business practices in the manufacturing industry.

2. Literature Review

2.1. *The Concept of Sustainable Supply Chain Management (SSCM)*

Sustainable Supply Chain Management (SSCM) extends the traditional supply chain management concept by integrating economic, social, and environmental aspects into every operational activity of a company [19]. SSCM not only focuses on the efficiency of the flow of goods, information, and finances within the supply chain, but also emphasizes corporate responsibility for the social and environmental impacts of these activities [20]. This concept has emerged in response to growing global attention to sustainable development and responsible business practices [21]. Theoretically, SSCM can be explained through the Triple Bottom Line Theory introduced by Khovrak [22]. This theory states that a company's success is measured not only by economic profit (profit) but also by its contribution to social well-being (people) and environmental sustainability (planet) [23]. In the context of supply chains, companies are expected to integrate these three dimensions into activities such as raw material procurement, production, distribution, and waste management [24].

In addition, SSCM practices can also be explained through the Resource-Based View (RBV) developed by Adhi, et al. [25]. This theory explains that a company's competitive advantage can be achieved through the utilization of internal resources that are unique, valuable, difficult to imitate, and not easily substitutable [26]. The implementation of sustainable supply chain practices can become a strategic resource that enhances operational efficiency, corporate reputation, and stakeholder trust [27]. Thus, companies that can manage their supply chains sustainably have a greater opportunity to improve overall firm performance [28].

In practice, SSCM encompasses activities such as environmentally friendly sourcing of raw materials, energy-efficient production processes, industrial waste management, and collaboration with suppliers and distributors committed to sustainability [29]. The integration of these practices is believed to create economic value while minimizing negative environmental impacts [30].

2.2. *Firm Performance*

Firm performance is an important indicator of an organization's success in achieving its business objectives. It is generally measured along various dimensions, including financial, operational, and environmental performance [31]. In the context of sustainable supply chain management, firm performance is evaluated not only by financial gains but also by operational efficiency and the company's ability to reduce the environmental impact of its production activities.

According to Freeman [32], companies must consider the interests of various stakeholders, including customers, suppliers, government, society, and the environment. Implementing sustainability practices within the supply chain is a key strategy for meeting stakeholder expectations [33]. Companies that can meet these demands tend to gain greater social legitimacy, enhance their corporate reputation, and strengthen their competitive position in the market.

Several empirical studies indicate that implementing Sustainable Supply Chain Management (SSCM) practices is positively associated with firm performance. Environmentally friendly procurement practices can reduce the costs of raw materials and energy. Improving production efficiency can increase productivity while lowering operational costs. Strong collaboration with suppliers can also enhance product quality and ensure supply stability. Therefore, implementing SSCM not only provides environmental benefits but also positively impacts overall business performance.

3. Research Methods

This study employs a quantitative approach to examine the relationship between Sustainable Supply Chain Management practices and the performance of manufacturing companies. A quantitative approach is selected because it enables researchers to systematically measure research variables and test

hypotheses through measurable statistical analysis. This approach provides a strong empirical foundation for explaining causal relationships among research variables, allowing the findings to be analyzed objectively and scientifically justified.

This research was conducted in Makassar City, one of the centres of industrial and trade activity in Eastern Indonesia. The city hosts various manufacturing companies operating in sectors such as food processing, consumer goods, and raw material industries. In this study, the research objects comprise several manufacturing companies operating in Makassar City, namely PT Indofood CBP Sukses Makmur Tbk, which operates in the food processing industry; PT Wings Surya, which operates in the household and processed food products industry; and PT Mayora Indah Tbk, which operates in the processed food and beverage industry. These companies were selected because they have complex supply chains and have implemented various operational practices to improve production and distribution efficiency.

The sampling technique used in this study is purposive sampling, which selects samples based on specific criteria established by the researcher. The criteria for respondents in this study include employees or staff involved in production activities, raw material procurement, distribution, and company operational management. By using purposive sampling, the researcher can obtain respondents with knowledge and experience relevant to the research topic. The total number of respondents in this study is 100, drawn from three manufacturing companies.

The data used in this study consist of both primary and secondary data. Primary data were obtained directly by distributing questionnaires to respondents working in the manufacturing companies that served as the research sites. The questionnaire was developed based on indicators of the research variables related to sustainable supply chain management practices and company performance. It was distributed via Google Forms, enabling the researcher to reach respondents more efficiently and collect data more quickly and systematically.

Meanwhile, secondary data were obtained from various relevant sources, including company reports, official company websites, online media, scientific books, academic journals, and other publications on sustainable supply chain management and company performance. These secondary data were used to strengthen the study's theoretical foundation and provide a more comprehensive overview of the manufacturing industry context.

The research instrument used in this study is a Likert-scale questionnaire ranging from 1 to 5. The scale consists of five response categories: (1) Strongly Disagree, (2) Disagree, (3) Neutral, (4) Agree, and (5) Strongly Agree. The use of a Likert scale enables the researcher to measure respondents' perceptions and attitudes toward statements related to the research variables in a more structured and quantitative manner.

Data processing and analysis in this study were conducted using SmartPLS version 3.0. The Partial Least Squares (PLS) method of Structural Equation Modeling (SEM) was used to examine the relationships among the research variables and test the formulated hypotheses. SEM-PLS was chosen because it can analyze complex relationships among latent variables and applies to relatively small sample sizes. In addition, this method allows for testing construct validity and reliability through outer-model analysis, as well as examining structural relationships among variables through inner-model analysis. By using this approach, the study is expected to yield valid empirical findings and contribute to the scientific understanding of how sustainable supply chain management practices influence the performance of manufacturing companies in Makassar City.

4. Research Results and Discussion

4.1. Respondent Characteristics

Table 1.

Demographic Characteristics of the Respondents by Age Group.

Characteristics	N	(%)
Age		
21–30 years	61	61%
>30 years	39	39%
Entire	100	100%

Based on the respondents' ages, the majority of respondents in this study fall within the 21–30 age group. Of the 100 respondents, 61 (61%) are within this age range. This indicates that most respondents in the study belong to the productive-age group, which generally exhibits high work mobility and active involvement in the company's operations. This age group also tends to be more adaptive to technological developments and modern management systems, including the implementation of sustainable supply chain management practices within the company.

Meanwhile, respondents aged 30 or older account for 39 respondents (39%) of the total sample. This age group generally has more work experience and a deeper understanding of the company's managerial and operational processes. The presence of respondents in this age group makes an important contribution to the study, as their experience can provide a more comprehensive perspective on the implementation of supply chain management and its impact on company performance.

Table 2.

Demographic Characteristics of Respondents Based on Educational Level.

Characteristics	N	(%)
Education		
Senior High School	18	18%
Diploma D3	17	17%
Bachelor	65	65%

Regarding respondents' educational levels, this study found diverse educational backgrounds, ranging from senior high school/vocational school (SMA/SMK) to the undergraduate level (Bachelor's degree/S1). Of the 100 respondents, the majority hold a Bachelor's degree (S1), accounting for 65 respondents (65%). The dominance of respondents with bachelor's-level education indicates that most possess sufficient academic capacity to understand various managerial and operational concepts related to manufacturing company activities, including sustainable supply chain management practices.

Respondents with a senior high school or vocational school (SMA/SMK) education total 18 respondents (18%) of the overall sample. This group is generally involved in the company's operational activities, including production processes, packaging, and other technical tasks supporting manufacturing. The involvement of respondents at this educational level provides insight into practical fieldwork experience.

Respondents with a Diploma (D3) education account for 17 respondents (17%) of the total. Diploma-level education generally equips this group with strong technical and professional skills, enabling them to contribute to both operational and administrative activities within the company. The diversity of respondents' educational backgrounds offers a broader perspective on the implementation of sustainable supply chain management and its relationship to the performance of the manufacturing companies examined in this study.

Table 3.
Characteristics of Respondents Based on Length of Work.

Characteristics	N	(%)
Length of work		
1–5 years	33	33%
>5 years	67	67%

Based on respondents' employment tenure, the study's participants have diverse work experience. Of the 100 respondents, the majority have more than five years of work experience, accounting for 67 respondents (67%). The predominance of respondents with relatively long work histories indicates that most have gained substantial experience and a good understanding of the company's operations, including production processes, raw-material management, and distribution mechanisms within the manufacturing supply chain.

Respondents with 1–5 years of work experience account for 33 respondents (33%) of the total. This group is generally at the stage of developing work experience but has already been sufficiently involved in various operational activities within the company. Work experience within this range enables respondents to understand the company's work system and coordination processes in operational activities.

The composition of respondents by length of employment indicates that this study involves workers with sufficient work experience. The proportion of respondents with more than five years of experience makes an important contribution to the study, as their experience can offer more comprehensive insights into the implementation of sustainable supply chain management practices and their impact on the performance of manufacturing companies.

4.2. Research Variable Reliability

Table 4.
Reliability and Convergent Validity Results of the Research Constructs.

Construction	Cronbach's Alpha	Rho_A	Composite Reliability	Average Variance Extracted (AVE)	
Energy Efficiency in Production Processes	0.780	0.786	0.872	0.695	Reliable
Evaluation of Supplier Environmental Performance	0.780	0.785	0.872	0.696	Reliable
Use of Environmentally Friendly Production Technologies	0.852	0.858	0.895	0.632	Reliable
Waste Management and Product Recycling	0.951	1.445	0.966	0.904	Reliable
The Impact of Sustainable Supply Chain Management on Company Performance in the Manufacturing Sector in Developing Countries	0.878	0.922	0.924	0.804	Reliable

Based on the results of construct reliability testing using Structural Equation Modeling (SEM) via the Partial Least Squares approach, all variables in this study demonstrate high reliability. Reliability testing was conducted by examining Cronbach's Alpha, Rho_A, Composite Reliability, and Average Variance Extracted (AVE) for each construct. A construct is considered reliable if the values of Cronbach's Alpha and Composite Reliability are greater than 0.70 and the AVE value is greater than 0.50. The analysis results indicate that all constructs in this study meet these criteria and can therefore be considered reliable and suitable for further analysis.

The construct of Energy Efficiency in the Production Process has a Cronbach's Alpha of 0.780, a Rho_A of 0.786, Composite Reliability of 0.872, and an AVE of 0.695. These values indicate that the indicators used to measure energy efficiency have good internal consistency. This suggests that each indicator within the construct consistently represents the measured variable. The construct of Supplier Environmental Performance Evaluation also shows good reliability, with a Cronbach's Alpha of 0.780, a

Rho_A of 0.785, Composite Reliability of 0.872, and an AVE of 0.696. These values indicate that the indicators used to measure supplier environmental performance evaluation are sufficiently consistent in explaining the research variable.

The construct of Environmentally Friendly Production Technology Usage shows a fairly high level of reliability, with Cronbach's Alpha of 0.852, Rho_A of 0.858, Composite Reliability of 0.895, and AVE of 0.632. These values indicate that the indicators for this construct consistently measure the variable and exhibit good convergent validity.

The construct of Waste Management and Product Recycling demonstrates a very high level of reliability, with a Cronbach's Alpha of 0.951, Rho_A of 1.445, Composite Reliability of 0.966, and AVE of 0.904. These results indicate that the indicators used in this construct have very strong internal consistency in measuring the waste management and product recycling variable. The construct of "The Influence of Sustainable Supply Chain Management on Company Performance in the Manufacturing Sector in Developing Countries" also shows strong reliability, with a Cronbach's Alpha of 0.878, Rho_A of 0.922, Composite Reliability of 0.924, and an AVE of 0.804. These values indicate that the indicators used in this construct exhibit high consistency in measuring the relationship between sustainable supply chain management practices and company performance.

4.3. Regression Results

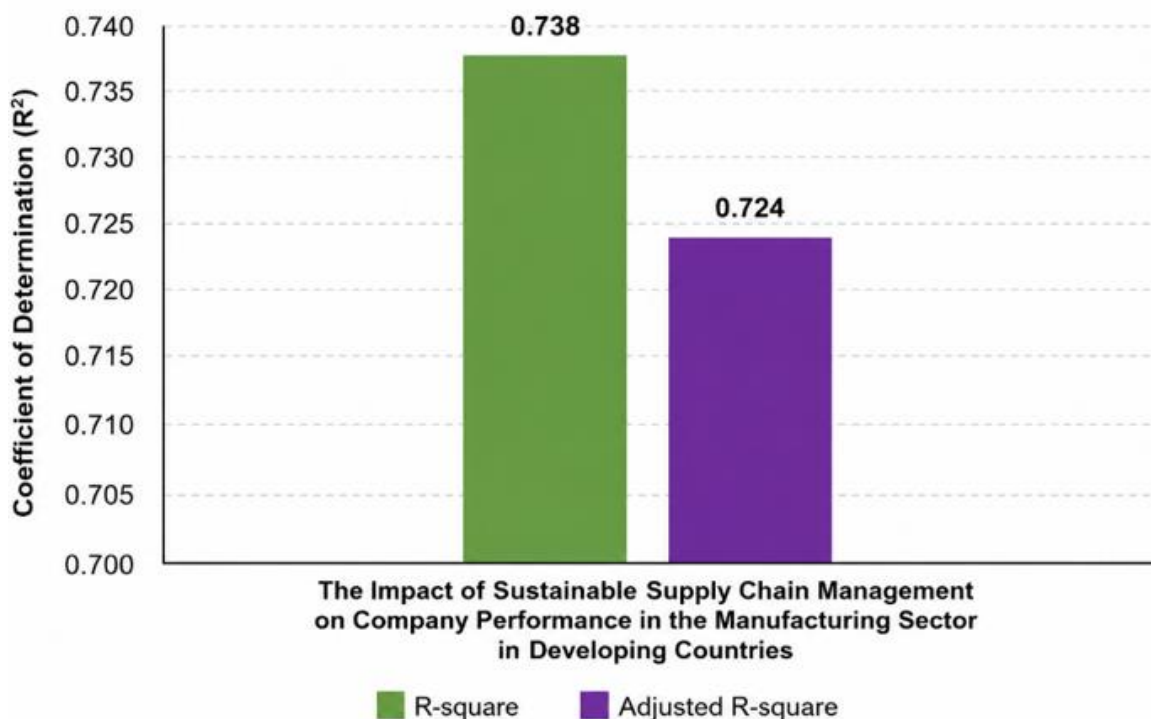


Figure 1.

Coefficient of determination (R^2) for the impact of sustainable supply chain management on company performance in the manufacturing sector in developing countries.

The test results for the construct "*The Impact of Sustainable Supply Chain Management on Company Performance in the Manufacturing Sector in Developing Countries*" indicate that the variable has a Cronbach's alpha of 0.738 and a Rho_A of 0.724. A Cronbach's alpha value above the minimum threshold of 0.70 suggests that the indicators used in this construct have good internal consistency in

measuring the variable under study. This indicates that each questionnaire item consistently represents the concept of the impact of sustainable supply chain management on company performance.

The Rho_A value of 0.724 also shows that the construct has an adequate level of reliability. Rho_A is one of the reliability indicators used in Structural Equation Modelling based on Partial Least Squares (SEM-PLS) to measure the stability and consistency of indicators within a latent construct. A value above the recommended threshold indicates that the indicators can explain the research variable with sufficient stability.

Based on these results, it can be concluded that the construct “*The Impact of Sustainable Supply Chain Management on Company Performance in the Manufacturing Sector in Developing Countries*” meets the reliability criteria required for SEM-PLS analysis. Therefore, the indicators used in this construct are considered reliable and appropriate for use in the next stage of analysis, particularly for structural analysis and hypothesis testing.

4.4. Hypothesis Testing

Table 5.

Hypothesis Testing Results for the Dimensions of Sustainable Supply Chain Management.

Variable	Original Sample (O)	Sample Mean (M)	STDEV	T-Statistics (O/STDEV)	P value	Hypothesis
Energy Efficiency in Production Processes	0.739	0.709	0.185	4.001	0.000	Accepted
Evaluation of Supplier Environmental Performance	0.341	0.194	0.101	2.871	0.044	Accepted
Use of Environmentally Friendly Production Technologies	0.165	0.165	0.074	2.233	0.026	Accepted
Waste Management and Product Recycling	0.239	0.247	0.174	2.865	0.047	Accepted

Based on the hypothesis test results presented in Table 5, all variables in this study significantly influence company performance in the manufacturing sector of developing countries. The testing was conducted using Structural Equation Modeling Partial Least Squares (SEM-PLS), with the Original Sample (O), T-statistics, and P-values used to determine whether the research hypotheses were accepted or rejected. A hypothesis is considered accepted if the T-statistic value is greater than 1.96 and the P-value is less than 0.05.

The analysis results show that the Energy Efficiency in the Production Process variable has an Original Sample (O) value of 0.739, a T-statistic of 4.001, and a P-value of 0.000. These values indicate that energy efficiency in the production process has a positive and significant effect on company performance. This suggests that the more efficiently a company uses energy in its production process, the better its performance. Energy efficiency not only reduces the company's operational costs but also supports more sustainable production practices.

The variable Supplier Environmental Performance Evaluation shows an Original Sample (O) value of 0.341, a T-statistic value of 2.871, and a P-value of 0.044. These values indicate that evaluating suppliers' environmental performance has a positive and significant effect on company performance. This suggests that companies that actively assess their suppliers' environmental practices have more responsible supply chains and can improve the quality and sustainability of their operations.

The variable "Use of Environmentally Friendly Production Technology" has an Original Sample (O) value of 0.165, a T-statistic of 2.233, and a P-value of 0.026. These results indicate that environmentally friendly production technology also has a positive and significant effect on company performance. Adopting greener technologies enables companies to improve production efficiency, reduce environmental impact, and enhance their corporate image among stakeholders.

The variable Waste Management and Product Recycling shows an Original Sample (O) value of 0.239, a T-statistic value of 2.865, and a P-value of 0.047. These results indicate that waste management and the implementation of product-recycling systems have a positive, significant effect on company performance. Effective waste management practices help companies reduce their environmental impact while also improving resource efficiency in the production process.

5. Conclusion

This study shows that sustainable supply chain management practices have a positive and significant effect on the performance of manufacturing companies. Implementing various sustainability practices throughout the supply chain has been proven to improve operational efficiency and support overall business performance. The analytical results indicate that all variables tested in this study contribute significantly to enhancing company performance.

Energy efficiency in the production process has been shown to have a positive and significant impact on company performance. Companies that optimize energy use in their production activities have lower operational costs and can improve productivity and operational sustainability. In addition, evaluating supplier environmental performance also significantly influences company performance. This indicates that companies that monitor and assess their suppliers' environmental practices will have a more responsible and sustainable supply chain.

The use of environmentally friendly production technology also contributes positively to improving company performance. Applying such technology enables companies to enhance production process efficiency, reduce environmental impact, and improve their image among stakeholders. Furthermore, waste management and the implementation of product recycling systems have been shown to significantly affect company performance by reducing negative environmental impacts and increasing resource utilization efficiency.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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