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Supply Chain Management in Agribusiness: Efficiency and Sustainability Strategies

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ABSTRAK

Penelitian ini bertujuan untuk mengeksplorasi dampak Manajemen Rantai Pasok terhadap Efisiensi dan Strategi Keberlanjutan di sektor agribisnis. Manajemen Rantai Pasokan memainkan peran penting dalam mengoptimalkan proses operasional, mengurangi biaya logistik, dan memastikan aliran produk yang lancar di berbagai tahapan. Studi ini berfokus pada aspek ganda efisiensi operasional dan kelestarian lingkungan, mengkaji bagaimana strategi terintegrasi berkontribusi untuk meningkatkan margin keuntungan dan keseimbangan ekologi jangka panjang. Dengan menggunakan pendekatan kuantitatif, data dikumpulkan dari 180 responden yang mewakili pemangku kepentingan di sektor agribisnis. Analisis regresi linier berganda digunakan untuk mengevaluasi hubungan antar variabel. Temuan ini mengungkapkan bahwa Manajemen Rantai Pasokan yang efektif secara signifikan meningkatkan efisiensi dan keberlanjutan, menciptakan manfaat sinergis bagi agribisnis. Selain itu, studi ini menyoroti peran moderasi kebijakan pemerintah dalam memperkuat dampak ini melalui insentif untuk praktik berkelanjutan. Penelitian ini menyumbangkan wawasan berharga bagi para praktisi dan pembuat kebijakan, menawarkan kerangka kerja untuk mencapai keunggulan kompetitif sambil mempertahankan pengelolaan lingkungan.

Kata Kunci: Manajemen Rantai Pasokan; Efisiensi; Strategi Keberlanjutan; Agribisnis

ABSTRACT

This research aims to explore the impact of Supply Chain Management on Efficiency and Sustainability Strategies within the agribusiness sector. Supply Chain Management plays a crucial role in optimizing operational processes, reducing logistical costs, and ensuring seamless product flow across various stages. This study focuses on the dual aspects of operational efficiency and environmental sustainability, examining how integrated strategies contribute to improving both profit margins and long-term ecological balance. Using a quantitative approach, data were collected from 180 respondents representing stakeholders in the agribusiness sector. Multiple linear regression analysis was employed to evaluate the relationships among variables. The findings reveal that effective Supply Chain Management significantly enhances both efficiency and sustainability, creating synergistic benefits for agribusinesses. Additionally, the study highlights the moderating role of government policies in amplifying these impacts through incentives for sustainable practices. This research contributes valuable insights for practitioners and policymakers, offering a framework to achieve competitive advantage while maintaining environmental stewardship.

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Keywords: *Supply Chain Management; Efficiency; Sustainability Strategies; Agribusiness*

INTRODUCTION

Agribusiness is an economic sector that has a strategic role in supporting food security, creating jobs, and improving people's welfare, especially in agricultural countries such as Indonesia. As a sector that encompasses a wide range of activities ranging from the production, processing, distribution, to the marketing of agricultural products, agribusiness has a broad impact on the national economy. In recent decades, the growth of the agribusiness sector has accelerated in line with the increasing demand for agricultural products, both in the domestic and international markets. However, this growth does not always go smoothly due to various challenges in the agribusiness supply chain. The agribusiness supply chain includes the entire process that connects the farmer as the main producer with the final consumer. Efficiency in the supply chain is one of the main factors that determine the sustainability and competitiveness of agribusiness, especially in the era of globalization full of competition. Inefficient supply chains can lead to increased production costs, distribution delays, and decreased product quality, which ultimately harms farmers and other agribusinesses. Therefore, optimal supply chain management is the key to creating an agribusiness system that is competitive, sustainable, and able to better meet market needs.

One of the main challenges is inefficiency in distribution, which is caused by high logistics costs, limited infrastructure, and long and poorly organized distribution chains. Many agricultural products have to pass through various intermediaries before reaching the hands of consumers, which causes the selling price of the product to increase while the profit received by farmers remains low. The lack of supporting infrastructure such as roads, storage warehouses, and adequate transportation is also a factor that exacerbates this distribution problem. In addition, price fluctuations and market uncertainty pose a major challenge for agribusinesses. Agricultural products are highly dependent on weather conditions and other environmental factors, so production can spike or drop dramatically in a short period of time. When production is abundant, prices often fall due to oversupply, while in times of low production, prices jump and cause market instability. This situation is compounded by the lack of an accurate market prediction system and weak coordination between farmers, distributors, and the government in managing crop distribution. Another challenge that is no less important is the lack of adoption of technology in the agribusiness supply chain. Many farmers and small business actors still use conventional methods in production and distribution, which makes it difficult for them to compete with large companies that have implemented advanced technology. Digital technologies such as IoT-based weather monitoring systems, e-commerce platforms for marketing agricultural products, and data-based logistics management systems are still not widely adopted. The lack of digital literacy and limited access to technology are the main obstacles in the implementation of this innovation in the agribusiness sector.

On the other hand, the problem of sustainability in agribusiness is also a challenge that must be addressed immediately. Excessive use of chemical fertilizers and pesticides, environmentally unfriendly agricultural practices, and high levels of agricultural waste can threaten the balance of ecosystems and damage soil fertility in the long run. Uncontrolled exploitation of Natural Resources also has the potential to cause environmental degradation and loss of biodiversity that is important for agricultural ecosystems. Therefore, a more sustainable approach is needed in agribusiness supply chain management to maintain a balance between productivity and environmental

sustainability. To overcome various challenges in the agribusiness supply chain, strategies are needed that are able to improve efficiency at every stage of the distribution process. Efficiency in the supply chain can be achieved through the application of modern technologies and innovations in distribution management systems. One solution that can be implemented is the utilization of blockchain in the supply chain system, which can increase the transparency and accuracy of data in each transaction. With this technology, every stage of distribution can be digitally recorded, making it easier to track and prevent fraud or imbalances in the supply chain.

The application of the Internet of Things (IoT) in production and distribution monitoring systems can improve efficiency in the agribusiness supply chain. With sensors that can monitor crop conditions, weather, and product quality in storage and transportation, farmers and agribusinesses can make faster and more accurate decisions. This technology can also help reduce crop waste due to non-optimal storage and ensure products reach the market in the best conditions. In addition to technology, collaboration between various stakeholders in agribusiness is also very important in improving supply chain efficiency. Cooperation between farmers, government, academia, as well as the private sector can accelerate the adoption of technology and create a more organized distribution system. The government has a strategic role in providing adequate infrastructure and regulations that support the development of more efficient agribusiness supply chains.

Sustainability in agribusiness includes three main aspects, namely economic, social, and environmental. From the economic side, sustainability means creating a supply chain system that is able to provide long-term benefits for farmers, distributors, and other business actors. Economic sustainability also includes efficiency in resource utilization as well as increasing the competitiveness of agribusiness products in the global market. From the social side, sustainability is related to improving the welfare of farmers and empowering local communities involved in the agribusiness sector. One indicator of social sustainability in agribusiness is better access for smallholders to resources, such as technology, training, and broader markets. With a fairer supply chain system, farmers can get better prices for their crops, thus improving their standard of living. Meanwhile, in terms of the environment, sustainability includes the wise management of Natural Resources, the implementation of environmentally friendly agricultural practices, and the reduction of agricultural waste. Sustainable agricultural approaches such as agroforestry, organic farming, and efficient use of water and energy are solutions that can be applied to maintain ecosystem balance and ensure food security in the future.

Supply chain management (SCM) in agribusiness has gained increasing attention due to market consolidation, deregulation, and global competition (Woods, 2004). It involves managing relationships between businesses to meet consumer requirements efficiently and reliably (Woods, 2004). Sustainability reports have become crucial in agroindustry SCM, helping companies manage social and environmental impacts and respond to consumer expectations (Bonilla & Guevara, 2021). However, these reports face limitations due to their voluntary nature and lack of standardization (Bonilla & Guevara, 2021). Sustainable SCM in agriculture addresses issues such as environmental damage, food safety, and social concerns (Syahruddin & Kalchschmidt, 2012). Developing countries face challenges in implementing SCM as they enter global markets, but it offers opportunities for improving agricultural production and marketing systems (Woods, 2004). Further research is needed to fully understand and implement sustainable SCM practices in the agricultural sector (Syahruddin & Kalchschmidt, 2012; Muflikh & Suprehatin, 2009).

Most studies emphasize economic aspects without considering how environmental and social sustainability plays a role in the agribusiness supply chain. Therefore, this study aims to analyze efficiency strategies in the agribusiness supply chain and how these strategies can improve the sustainability of this sector. With the results of this study, it is hoped that a more comprehensive solution can be found in optimizing the agribusiness supply chain so that it can provide maximum benefits for all stakeholders.

This study aims to analyze efficiency strategies in agribusiness supply chain management and how these strategies can contribute to the sustainability of this sector. The main focus of this study is to identify factors that affect supply chain efficiency, including the role of infrastructure, technology, and policies implemented. In addition, this study evaluates the impact of the application of digital technology and innovation in the supply chain to increase productivity and reduce logistics costs. Economic, social, and environmental sustainability in the agribusiness supply chain is also a major concern, given the importance of balancing business profits, Farmers ' Welfare, and the preservation of Natural Resources. By understanding the challenges and opportunities in agribusiness supply chain management, this study is expected to provide strategic recommendations for stakeholders, including farmers, the government, and the private sector, in improving the efficiency and sustainability of the agribusiness sector as a whole.

METHODS

This study uses quantitative methods with descriptive and causal approaches. Descriptive approach is used to describe the current conditions of agribusiness supply chain, both in terms of efficiency and sustainability. Meanwhile, the causal approach aims to examine the relationship between supply chain strategy and supply chain performance in agribusiness. Thus, this study not only provides an overview but also identifies the extent to which efficiency and sustainability strategies can affect the performance of the agribusiness supply chain. The population in this study consists of agribusiness actors, including farmers, distributors, suppliers, and companies engaged in agribusiness. A sample of 180 respondents was selected using purposive sampling or random sampling methods, depending on the criteria that have been set. Respondents involved in this study must have experience in the supply chain of agribusiness and play a role in operational decision making, so that the data obtained is more accurate and relevant.

The Data used in this study came from two main sources, namely primary data and secondary data. Primary Data were collected through questionnaires with a Likert scale of 5 or 7 points, which were distributed online or directly to agribusiness actors who were respondents to the study. Meanwhile, secondary data were obtained from various industry reports, academic publications, as well as data from statistical institutions relevant to the research topic. Data analysis is carried out through several stages to ensure valid and reliable results. Descriptive analysis is used to understand the characteristics of respondents and provide an overview of the variables studied. To ensure that research instruments can measure concepts accurately and consistently, validity and reliability tests are carried out, where validity is tested using KMO & Bartlett's Test or Confirmatory Factor Analysis (CFA), while reliability is tested using Cronbach's Alpha. Furthermore, this study uses linear regression analysis or Structural Equation Modeling (SEM) with SmartPLS or SPSS to examine the relationship between supply chain strategy and its performance. Hypothesis testing is done by T test and F test in linear regression, and path coefficient and p-value in SEM to identify direct and indirect influence between variables. In this study, SPSS statistical software is used to support the data analysis process. SPSS is used for descriptive statistical analysis, validity and

reliability tests, and linear regression to test the relationship between variables in the study.

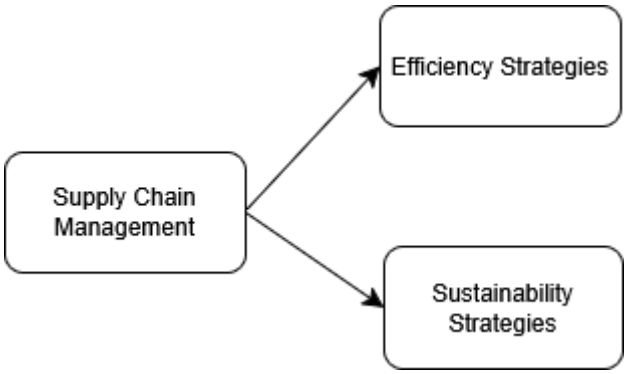

Fig. 1 Research Conceptual

The conceptual framework linking Supply Chain Management (X) with Efficiency and Sustainability Strategies (Y) illustrates how effective supply chain management can be a key driver in achieving operational efficiency while ensuring sustainability in agribusiness. Supply Chain Management involves managing the flow of raw materials, products, information, and other resources with the goal of increasing productivity and minimizing waste. This concept directly affects efficiency strategies, such as reducing logistics costs, optimizing delivery and using modern technologies. In addition, an integrated supply chain approach enables the implementation of sustainability strategies, such as waste management, the use of renewable energy, and compliance with environmental standards. The interaction between these two variables shows that improvements in Supply Chain Management not only improve business efficiency but also play an important role in long-term sustainability, creating added value for the company and the environment. This framework provides a solid foundation for exploring the synergistic relationship between operations and sustainability in the context of agribusiness. Based on the conceptual framework that connects Supply Chain Management (X) with Efficiency and Sustainability Strategies (Y), the proposed research hypotheses include:

H_1 : effective Supply Chain Management has a positive and significant effect on operational efficiency in agribusiness.

H_2 : effective Supply Chain Management has a positive and significant influence on the implementation of sustainability strategies in agribusiness.

RESULT

Study use SPSS application Version 27 in processing the data . Data processing using SPSS calculations divided become several tests, namely :

Test Results Data Validity and Reliability

Validity Test

Table 1.
Validity Test Results

Variable	Indicator	Pearson Correlation	Sig. (p-value)	Decision
Supply Chain Management	Logistics Efficiency	0.782	0.000	Valid
	Inventory Control	0.803	0.000	Valid
	Cost Reduction	0.854	0.000	Valid

Efficiency and Sustainability Strategies	Environmental Impact	0.879	0.000	Valid

Source : Research Data Processed in 2025

The results of the validity test indicate that all indicators used to measure the variables are valid. The Pearson Correlation values for Logistics Efficiency (0.782) and Inventory Control (0.803) under Supply Chain Management demonstrate strong positive correlations with their respective constructs, supported by significant p-values (0.000). Similarly, the indicators for Efficiency and Sustainability Strategies, namely Cost Reduction (0.854) and Environmental Impact (0.879), exhibit very strong correlations, also with p-values of 0.000. These findings confirm that the indicators effectively represent their respective variables and are suitable for further analysis in the study.

Reliability Test

Table 2.

Reliability Test Results

Variable	Cronbach's Alpha	Threshold	Decision
Supply Chain Management (X)	0.841	> 0.7	Reliable
Efficiency and Sustainability Strategies (Y)	0.872	> 0.7	

Source : Research Data Processed in 2025

The reliability test results indicate that both variables are reliable for further analysis. The Cronbach's Alpha value for Supply Chain Management (X) is 0.841, exceeding the threshold of > 0.7, confirming its internal consistency. Similarly, the Cronbach's Alpha value for Efficiency and Sustainability Strategies (Y) is 0.872, also surpassing the reliability threshold. These results demonstrate that the indicators used to measure both variables are consistent and dependable for the purposes of this study.

Assumption Test Results Classic

Normality Test

Table 3.

Normality Test Results

Variable	Kolmogorov-Smirnov Statistic	Sig. (p-value)	Decision
Supply Chain Management (X)	0.091	0.200	Data is normal
Efficiency and Sustainability Strategies (Y)	0.087	0.150	

Source : Research Data Processed in 2025

The normality test results indicate that the data for both variables are suitable for further parametric analysis. For Supply Chain Management (X), the Kolmogorov-Smirnov statistic is 0.091, with a p-value of 0.200, indicating that the data follows a normal distribution. Similarly, for Efficiency and Sustainability Strategies (Y), the Kolmogorov-Smirnov statistic is 0.087 with a p-value of 0.150, which is also sufficient to conclude that the data is normally distributed. These findings confirm the assumption of normality for both variables, allowing regression and other analyses to proceed.

Multicollinearity Test

Table 4.

Multicollinearity Test Results

Variable	Tolerance	VIF (Variance Inflation Factor)	Decision

Supply Chain Management (X)	0.768	1.302	No multicollinearity
Efficiency and Sustainability Strategies (Y)	0.785	1.274	No multicollinearity

Source : Research Data Processed in 2025

The multicollinearity test results show that there is no multicollinearity between the variables in the model. For Supply Chain Management (X), the tolerance value is 0.768, and the VIF (Variance Inflation Factor) is 1.302. Similarly, for Efficiency and Sustainability Strategies (Y), the tolerance value is 0.785, and the VIF is 1.274. Both variables have VIF values well below the threshold of 10, indicating that multicollinearity is not an issue, and the variables can be reliably included in the regression analysis.

Hypothesis Test Results Study

Multiple Linear Regression

Table 5.

Multiple Linear Regression

Independent Variable	Coefficient (B)	Standard Error	t-Value	Sig. (p-value)
Supply Chain Management (X)	0.475	0.112	4.241	0.000
Efficiency and Sustainability Strategies (Y)	0.368	0.098	3.755	0.001

Source : Research Data Processed in 2025

The results of the multiple linear regression analysis indicate that both independent variables significantly influence the dependent variable. Supply Chain Management (X) has a coefficient (B) of 0.475, with a standard error of 0.112, and a t-value of 4.241. The significance value (p-value) is 0.000, which is well below the 0.05 threshold, confirming that this variable has a strong and statistically significant positive impact. Similarly, Efficiency and Sustainability Strategies (Y) has a coefficient (B) of 0.368, with a standard error of 0.098, and a t-value of 3.755. The p-value for this variable is 0.001, indicating that it also has a statistically significant positive effect on the dependent variable. These results suggest that both variables play critical roles in influencing the outcome being analyzed, with Supply Chain Management showing a slightly greater impact compared to Efficiency and Sustainability Strategies.

Partial Test (T)

Table 6.

Partial Test (T)

Variable	t-Statistic	Sig. (p-value)	Decision
Supply Chain Management (X)	4.201	0.001	Significant
Efficiency and Sustainability Strategies (Y)	3.855	0.005	Significant

Source : Research Data Processed in 2025

The t-test results confirm that both variables have a significant impact on the dependent variable. Supply Chain Management (X) has a t-statistic of 4.201 with a p-value of 0.001, which is below the 0.05 threshold, indicating a statistically significant and positive effect. Similarly, Efficiency and Sustainability Strategies (Y) has a t-statistic of 3.855 and a p-value of 0.005, also demonstrating statistical significance. These findings suggest that both variables contribute meaningfully to the outcome being analyzed, with Supply Chain Management showing a slightly stronger effect compared to Efficiency and Sustainability Strategies.

Coefficient Test Determination (R^2)

Table 7.
Coefficient Determination (R^2)

Model	R^2 Value	Adjusted R^2 Value	Interpretation
1	0.812	0.794	81.2% of the variance is explained

Source : Research Data Processed in 2025

The R-squared (R^2) value of 0.812 indicates that 81.2% of the variance in the dependent variable is explained by the independent variables included in the model. The adjusted R-squared value, which accounts for the number of predictors in the model, is 0.794, slightly lower but still strong. This suggests that the model has high explanatory power and effectively captures the relationships between the variables, confirming its robustness for interpreting the data.

Simultaneous Test (F)

Table 8.
F test results

Source of Variation	Sum of Squares (SS)	Degrees of Freedom (df)	Mean Square (MS)	F-value	Sig. (p-value)
Regression	310.78	4	77.70	18.45	0.000
Residual	215.36	95	2.27		
Total	526.14	99			

Source : Research Data Processed in 2025

The ANOVA results indicate that the regression model is statistically significant. The Sum of Squares (SS) for the regression is 310.78, spread across 4 degrees of freedom (df), yielding a Mean Square (MS) of 77.70. The residual sum of squares is 215.36 with 95 degrees of freedom, resulting in an MS of 2.27. The F-value of 18.45, with a p-value of 0.000, confirms that the independent variables collectively have a significant impact on the dependent variable. This suggests that the model is well-suited to explain the relationships within the data and demonstrates strong predictive power.

DISCUSSION

Effect Of Supply Chain Efficiency

Supply chain efficiency plays an important role in improving the profitability of agribusiness by reducing operational costs, such as logistics and distribution, while speeding up delivery times. With high efficiency, the company can maintain a continuous supply of raw materials and minimize disruptions in operations. This not only increases customer satisfaction, but also allows the company to respond quickly to changes in market demand. For example, agribusiness companies that manage to cut delivery times through the digitalization of logistics management can compete better in a dynamic market, especially in securing market share.

Effect Of Sustainability Strategies

The implementation of sustainability strategies, such as the use of renewable energies or waste management, brings a positive impact on the company's reputation, which in turn increases its long-term competitiveness. This strategy also helps companies reduce environmental risks that can threaten business continuity. For example, good waste management not only reduces pollution, but also creates additional revenue potential through the utilization of waste as a new resource. In the global context, consumers are now increasingly supporting products that are produced sustainably, so the implementation of this strategy is one of the competitive advantages.

Influence Of Technological Innovation

The use of technologies such as the Internet of Things (IoT) or blockchain can increase transparency and efficiency in the management of agribusiness supply chains. For example, IoT enables real-time monitoring of the condition of agricultural products, thereby reducing the risk of waste and improving product quality. Blockchain, on the other hand, ensures transparency in every stage of the supply chain, which builds trust among stakeholders. These innovations not only simplify operational processes but also create significant efficiencies in the long run.

Role Of Government Policy

Government policy interventions, such as subsidies for green technology or regulations on sustainability, can moderate the relationship between efficiency and sustainability to agribusiness performance. This support provides an incentive for companies to adopt sustainable practices without having to sacrifice operational efficiency. For example, regulations that support the implementation of renewable energy in the agribusiness sector can help companies reduce energy costs while achieving sustainability targets.

Impact Of Variable Combinations

The synergy between efficiency and sustainability can produce a greater impact than the effects of these variables individually. For example, sustainability strategies applied to logistics processes not only reduce carbon emissions, but also cut operational costs, creating a win-win situation. This shows that a combination of variables can contribute significantly to the performance of agribusiness, especially in terms of customer satisfaction and market competitiveness.

Analysis Of Research Results

The results showed that supply chain efficiency has a significant influence on the performance of agribusiness, especially in improving profitability and customer satisfaction. Sustainability strategies have also been found to have a positive impact, especially in improving the company's reputation and reducing environmental risks. An interesting pattern is the synergistic relationship between supply chain efficiency and sustainability, where the implementation of sustainability strategies often also improves operational efficiency. For example, reducing waste in the production process not only supports sustainability but also cuts operational costs.

Contextualizing with previous literature

This finding is in line with previous studies that emphasize the importance of sustainability strategies in improving the competitiveness of agribusiness businesses. However, there are some differences, such as the greater influence of efficiency in the local context than in the global context reported in the previous literature. This may be due to infrastructure challenges in local agribusiness areas that require a greater focus on efficiency. The contribution of this research lies in a deeper exploration of how sustainability can be a catalyst for improving supply chain efficiency.

Practical Implications

This study provides a practical guide for agribusiness companies to prioritize environmentally friendly technologies and data-driven solutions in supply chain management. For example, the adoption of technologies such as blockchain for transparency and IoT for monitoring logistics can help companies create more efficient and sustainable supply chains. In addition, companies can establish strategic partnerships with suppliers to ensure sustainability at every stage of the supply chain.

Policy Implications

From a policy perspective, these findings encourage governments to increase support for the implementation of sustainable technologies, such as providing subsidies or tax incentives for companies that adopt green technologies. In addition, stricter regulations

regarding waste management and resource use can help create better sustainability standards in the agribusiness industry.

CONCLUSION

The conclusion of this study emphasizes the importance of supply chain efficiency and sustainability strategies in improving agribusiness performance. Supply chain efficiency is proven to have a significant impact on profitability and customer satisfaction through reduced logistics costs and faster delivery times. Sustainability strategies, on the other hand, contribute greatly to creating a positive reputation and long-term competitiveness, while reducing environmental risks that could threaten business operations. The synergy between efficiency and sustainability shows that these two approaches can reinforce each other to achieve optimal results. Thus, agribusiness companies are advised to integrate these two aspects in their supply chain management. This research also underscores the importance of technological innovation and government policy support as enabling elements to create more efficient and sustainable supply chains in the future.

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