

Supply Chain Integration and Performance of Agricultural Firms in Cross River State, Nigeria

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Abstract

The study examined supply chain integration and performance of Agricultural firms in Cross River State. The study investigated the influence of supply chain integration, proxied by process integration, information integration, supplier integration, and customer integration, on Agricultural firms' performance, proxied by customer service, product quality, on-time delivery, and market share. The study adopted a cross-sectional survey research design. The stratified sampling method was used for the selection of elements for the study. Four hypotheses were formulated, and a multiple regression statistical tool was used in the test of hypothesis. The population of the study consists of 513 employees. The Taro Yamane sample size formular was adopted to determine the sample size. The sample size was 217. The findings of the study established that supply chain integration dimensions such as process integration, information integration, supplier integration, and customer integration have a significant and positive effect on the performance of Agricultural firms in Cross River State. The study recommended that supply chain managers should always integrate their upstream and downstream processes and flow of activities to eliminate waste of resources, strategically build a strong suppliers and customers relationship through information interchange and feedback to achieve effective flow of products that will meet their requirements and enhance their organisational performance.

Keywords: Supply Chain Integration, Process Integration, Supplier Integration, Agricultural Firms Performance, Cross River State.

Introduction

The agricultural sector comprises diverse stakeholders, input suppliers, farmers, traders, commission agents, processors, and distributors, whose effective coordination through supply chain management (SCM) is essential for improving product development, quality, customer service, demand forecasting, inventory balance, delivery timeliness, and market competitiveness. SCM has been conceptualised as the efficient flow of materials, finances, and information by linking processes, customers, and suppliers through manufacturing and service activities (Alfarajat, 2023). Over time, SCM has evolved into a strategic tool for enhancing productivity across industries beyond firm boundaries (Jamaludin, 2021). Supply chain integration has become central to these discussions, as firms increasingly develop partnerships and information-sharing mechanisms that transcend traditional organisational boundaries (Zhang et al., 2022). Israel (2022) defined it as the extent to

which activities of firms, suppliers, customers, and partners are unified, while Lee (2021) emphasised coordination and information exchange through communication, partnerships, and alliances.

The prevailing assumption in SCM literature is that greater integration improves performance. Poi and Okwandu (2021) similarly noted that when supply chain members operate as a unified system, efficiency in product flow, demand forecasting, profitability, market share, and customer satisfaction increases. Scholars have outlined multiple dimensions of integration. Uwamahoro (2018) identified internal, external, supplier, and customer integration, while Mpuon et al. (2023b) highlighted process, knowledge, and information integration. Sukati et al. (2020) described four practical levels: internal, cross-functional, backward, and forward integration. Ugoani and Ugoani (2018) classified them as internal, dynamic, chain, and network levels. Building on these perspectives, this study adopts process, information, supplier, and customer integration as the key dimensions relevant to agricultural performance indicators such as customer service, quality, delivery, and market share. Agricultural supply chains uniquely combine agro-food management with broader SCM frameworks, linking upstream and downstream actors in farm-to-table processes of production, supply, marketing, and distribution (Zhang et al., 2021a, 2021b). Ufiobor (2017) emphasised the role of agricultural firms in bridging production and consumption, while Chong et al. (2021) argued that integrating processes, information, suppliers, and customers enhances responsiveness and competitiveness. Yet, agricultural supply chains face persistent constraints, including fragmented markets, inadequate infrastructure, financial bottlenecks, weak supplier–customer linkages, and ineffective policy environments (Mpuon, 2023). These challenges are particularly pronounced in Nigeria, where declining oil revenues have intensified reliance on agriculture as a pathway for economic diversification (Mpuon, 2023). In Cross River State, agriculture remains the backbone of the economy, accounting for nearly 70% of activity and driving growth through cash crops such as cocoa, groundnut, cotton, palm oil, kola nut, and rubber, alongside poultry, fisheries, timber, and hides (Nego & Ejionume, 2017). Beyond its contributions to food security and employment, agriculture also provides raw materials for local and foreign industries. Effective integration, however, is needed to allow actors to share timely and reliable information, align forecasts with orders, and strengthen inter-organisational processes (Xu & Sun, 2018; Mose, 2013). As Gu and Yu (2022) and Ray (2020) observed, supply chain integration enhances resilience, fosters learning across inbound and outbound logistics, and enables firms to mitigate disruptions through business intelligence. Accordingly, this study investigates how process, information, supplier, and customer integration influence the performance of agricultural firms in Cross River State.

Research rationale

The agricultural sector has been acknowledged as a crucial catalyst and builder for economic growth and national development for both developed and developing countries

(Odunze, 2019). Despite these economic contributions such as job creation, food security enhancement, improved income and standard of living, most agricultural firms are often dead in their introduction face due to high rate of customers' changing demand for agricultural product that have triggered the fierce competition in the market place and uncertainty degree of external environment such as political, economic, social- cultural and technological changes that is getting higher and higher, making the management of agricultural firms more complex. Most agricultural firms in Cross River State are underperforming and suffer from inefficiency in team work, waste of resources, increased production cost, rise in wage turnover and income per working hour, low - profit margin, poor inventory control which may be due to the non - implementation of supply chain integration dimensions such as process integration, information integration, supplier integration and customer integration.

These firms are faced with numerous challenges in carrying out their performance such as supply shortages, poor supplier relationships and data quality issues, poor customer service, product quality, on-time delivery and market share. These problems have hampered their capacity to grow sales and profitability overtime, thus, the enormity of these predicaments above faced by most agricultural firms are perhaps best appreciated by a short survey of the death rate among them. The non-implementation of process integration will lead to lack of information visibility along the supply chain. Without information integration, firms may not have access to real-time data making it difficult to make informed decision. Not integrating suppliers in the firm might make the firm to lose visibility and control over its supply chain. Firms tends to lack understanding of customer's needs and requirements and how to satisfy them when they fail to incorporate customer integration into their operational activities. These aforementioned problems become the focus of this research study. Therefore, the intention of this study is to examine the influence of supply chain integration proxied by process integration, information integration, supplier integration and customer integration on performance proxied by customer service, product quality, on-time delivery and market share of agricultural firms in Cross River State.

Literature Review

Supply chain integration

In this study, supply chain integration can be defined as the quality of state of collaboration existing among linked functional departments which presents overlapping activities (Riyadi, et al.,2021). This definition is limited to the supply chain integration within the company, which considers only the midstream activities of supply chain integration. Amue and Ozuru (2014), gave more embracing definition of supply chain integration, same with other authors as shown below. According to Poi, et al. (2022), supply chain integration is the level or intensity of information sharing and collaboration among internal functions and between value chain partners including customers and suppliers. This definition collaborates with the definition of Amue and Ozuru (2014) meaning that the

comprehensive definition of supply chain integration includes the upstream suppliers, midstream (Company) and downstream (distributor, retailers). The purpose of supply chain integration is to create the best customer value at the lowest operating cost, hence supply chain integration emphasizes effective information sharing and physical item flow to meet customers' demands starting from raw materials supply sources to the delivery of the products to the customers (Shahabadkar, et al., 2020). Mpuon, et al. (2020) argued that proper implementation of supply chain integration in the organisations will meet individual customers' demand, reduce delivery time, decrease logistics and purchasing cost, reduce the level of inventories, increase workforce efficiency and market share by sharing the supply and demand information. Supply chain integration is divided into three level of integration: high, medium and low integration (Adekunle, et al., 2022). The low level of integration has to do with partial integration in the supply chain whereas high integration involves the present of direct links among the people of different decision-making levels across the interlinked organisation in the supply chain network. Many scholars have investigated different degree of integration, for example the work of Mpuon, et al. (2021), found that the degree of integration varies from company to company depending on their business nature and expectations. A high degree of integration means a high degree of trust, suppliers' integration, knowledge integration, process integration, information integration and long-term commitment to achieving common goals, thus ensure common benefits of integrated value networks (Msimangiri, 2014). Uwamahoro (2018) has argued that supply chain integration enables different functions to work together linking with other cross functional units of business through information technology.

Performance of agricultural firms

Organisational performance refers to a company's performance compared to its goals and objectives. Organisational performance according to Achim, et al. (2013), includes results or organisational outcomes that are measured against planned outcomes. Daniel (2018) argued that organisational performance just-like other concepts in the field of management is very important due to its multifaceted nature. However, in his assertion, researchers have used objective and subjective measures to explain the concept of organisational performance while objective measures have to do with the use of accounting analysis to measure organisational performance, subjective measure has to do with the observation of managers on how effective and efficient the performance of an organisation is such as the attainment of set goals and objectives. According to Ganta (2014), performance measurement is an analysis of both efficiency and effectiveness in accomplishing a given task. Chen and Lin (2021) argue that performance is the process of quantifying the efficiency and effectiveness of organisational action in terms of customer service, product quality, one-time delivery, sales turnover, profitability, return on investment, market share, and increase profit margin. Muogbo (2013), noted that performance involves the process of assessing the progress made towards achieving

predetermined set goals, monitoring of progress towards the goals, and making necessary modifications to attaining those goals, and making those goals in an effective and efficient manner. Djumarno, et al. (2017), opined that there are various ways of measuring organisational performance which include customer service, profitability, speedy delivery of goods, higher quality products, costs effectiveness, customer satisfaction, accurate demand forecasting, return on investment, return on assets, sales, market share and shareholder return. According to Zhang, et al. (2022), most of the performance measures in agricultural firms has been based on effective and efficient customer services, product quality, on-time delivery, market share, return on investment, profitability, innovation, sales turnover, and product availability. However, performance measures in this study are limited to customer service, quality products, on-time delivery of goods and services and market share.

Process integration and performance of agricultural firms

Process integration is a dynamic process that senses organisational changes and respond quickly to organisational intelligence by eliminating waste of all types of resources, continually restructuring and measuring specific business outcome of activities for customers benefits. Anupam (2015) defined process integration as adaptive capability of firms to integrate business processes that facilitate continuous restructuring and analysis of fundamental business activities such as manufacturing, marketing, communication, and operations to meet customers requirement while preparing for unexpected event that can lead to disruption of operations. According to Kaniski and Vincek (2018), process integration entails the continuous and abrupt changeability of functioning effectively by creating new behavior and attitude that will represent their adequate and rapid response to the organisations undergoing reformation and transformation. Teixeira, et al. (2018) asserted that process integration is the act of integrating specified ordering of work activities over time and location with beginning and an end, quickly or rapidly using clearly defined input and a structure of action. In conceptualizing process integration as a dimension of supply chain integration, Alrabiah and drew (2018), argued that process integration will help performance in terms of customer service, product quality, on-time delivery and market share by incorporating supply chain partners, customers point of view, product value of customers and optimizing operations. Similarly, as theorized by Mansoar, et al. (2021), conceptualizing process integration will strengthen rapid response to customers' demands and requirement, elimination of waste of resources, coping with volatile market conditions, improve customer service, customer satisfaction, quality performance, product quality, on-time delivery, sales turnover, market share, cost performance and accurate demand forecasting by continuously integrating fundamental activities such as manufacturing marketing, communication. Nevertheless, Anupam (2015) noted that process integration will enhance performance of agricultural firms by addressing a number of decision-making processes such as choosing a path from multiple options,

deciding design criteria, job specification, quality innovation or resources allocation. Hence, this study proposed the following alternative hypothesis:

H₁: Process integration has a significant effect on performance of agricultural firms in Cross River State.

Information integration and performance of agricultural firms

Information integration refers to a company's ability to swiftly adapt its communication technological infrastructural to assist in accessing, collecting and managing information among supply chain partners to enhance customer value. Information integration according to Abdulamear and Yaacob (2020) describes the integration of information as systems that respond promptly to changing market conditions and currently give information to all parties involved in the exchanged of products and services based on their requirements and desire. Ominde, et al. (2020) asserted that information integration enables organisations to be responsible and flexible in sharing strategic supply chain information alongside transactional data that result in waste elimination, increased productivity, customer satisfaction, quality performance, cost performance, customer relation, product quality, on-time delivery, sales turnover, market share, accurate demand forecasting, increased consultant service efficiency, trust and cooperation with all stakeholders. Heron, et al. (2019) argued that information integration strengthens performance of agricultural firms by integrating organisation processes, expertise and information that improves agricultural intermediaries, producers, supplier and customers relationship to bring about uniqueness in product design, work conditions, elimination of waste of resources, energy and time, using various supply chain management information systems platforms such as enterprise resources planning, electronic data interchange, warehouse management systems, transportation management system and radio frequency identification. Xue, et al. (2022) believed that the agricultural supply chain will improve performance with regards to customers services, sharing information on design quality, thus enabling the customers to make informed decisions based on the shared information. Correiado, et al. (2021) suggested that supply chain information network may ensure better customer services more precised demand forecasting, and that organisations can acquire market information in real time and more correctly. In conceptualizing Ho as a dimension of supply chain integration, White, et al. (2021), retained that information integration eliminates waste in all phase of the agricultural supply chain and provides quick access to vital data from centralized data resources that connect internal and external data to access inventory status, use a computerized mechanism between customers, intermediaries, producers. Likewise, Vaska, et al. (2021) argued that information integration accelerates and simplify all organisation processes, promoting quality services and products, enhancing organisational effectiveness of products and efficient operations based on the vision, mission and strategies of the agricultural industry. Hence, this study proposed the following alternative hypothesis:

H₂: Information integration has a significant effect on performance of agricultural firms in Cross River State.

Supplier integration and performance of agricultural firms

Supplier integration refers to the inter-organisation systematic and forward-looking coordination between organisation and its suppliers which results in synchronous practice of information sharing, strategic sales alliances, consumer demand forecasting, and establishing strategic partnerships with suppliers, customers, logistics and other relevant external partners to achieve collaborative work and generate typical value (Zhang, et al., 2022). Supplier integration is long-term relationship between the organisation and its suppliers designed to leverage the strategic and operational capabilities of individual participating organisation to help them achieve customer value and significant benefits (Uwamahoro, 2018). Supplier integration is the degree to which a manufacturer collaborates strategically with its suppliers to achieve effective flows of products and services (Garengo & Paniszzolo 2013). Hartmann, et al. (2012), opined that supplier integration enhances performance of agricultural firms by facilitating effective customer services, on-time delivery of products, product quality, market share, sales turnover, product development, improved decision making, enhanced knowledge sharing, aligned capabilities, built learning routines and increased performance of supply chain. Israel (2022), affirmed that supplier integration improves on performance of agricultural firms by strengthening trust and commitment between the two parties, reduces transactional costs, improves cooperation, enhance the satisfaction of the two parties, decreases formal contracts and reduces conflicts. Similarly, Lee (2021), argued that supplier integration facilitates performance of agricultural firms by integrating strategic activities with suppliers, involving suppliers' capabilities to generate new products during the design stages, production planning and inventory management, having a rapid response order processing system with suppliers, installing a supplier network that ensures reliable delivery and exchanging information with suppliers. Also, Von and Bergtisson (2015), noted that supplier integration improves performance by facilitating data flow between two or more companies and constituting a way towards achieving process and information integration under which a supplier takes control of the inventory and purchasing functions of the buyer. Moreover, Winpple, et al. (2015) suggested that supplier integration contributes to firm performance in the form of market shares, increase growth in sales, on-time delivery, product quality, customer service, market share, profitability among others. Hence, this study proposed the following alternative hypothesis:

H₃: Supplier integration has a significant effect on performance of agricultural firms in Cross River State.

Customer integration and performance of agricultural firms

Uwamahoro (2018) defined customer integration as demand management practices through long-term customer relationship, satisfaction improvement, and compliant

management. Garengo and Paniszzolo (2013) asserted that the fundamental aspect of customer relationships is the focus on key customers to understand their needs and requirements and to satisfy them. According to Chang, et al. (2012), customer integration refers to acquiring technology, marketing, production and inventory information from the customers-manufacturers to facilitate the production of products that meets users' preferences, on-time delivery, sales turnover, market share, innovative products, product quality and enhanced customer services. Customer integration can be seen as a method of collecting and understanding customer needs and wants and division of mutual knowledge (Guang et al., 2019). According to Garengo and Paniszzolo (2013), customer integration enhances performance of agricultural firms by integrating process, suppliers, sharing demand information that help producers in understanding customer needs better and forecasts better customer demand as well as the collaborative involvement of customers with respect to product design, provision of better-quality products at a lower cost and more flexible in responding to customer demands. Kot, et al. (2018), stated that the integration of customer is one central aspect of open innovation that help to build competence that is derived from better coordination with customers in a supply chain to achieve improved service capabilities at lower total supply chain costs. Moreover, Zhang et al. (2018), further noted that customer integration emphasizes and strengthens performance by building collaborative relationships and strategic alliances, strategic partnerships, information sharing, coordinating and controlling materials, parts and finished goods at the strategic, tactical and operational levels. Shah, et al. (2018) and Mora-Monge, et al. (2019), supported that customer integration improves on performance with respect to customer service, on-time delivery, product quality and market share by helping producers' corporates with customers to structure their inter-organisational strategies, practices, procedures and behaviors into collaborative, synchronized and manageable resources to fulfil customer requirements. Hence, this study proposed the following alternative hypothesis:

H₄: Customer integration has a significant effect on performance of agricultural firms in Cross River State.

Theoretical Framework

This study is grounded in network theory, which explains how firms, suppliers, customers, and other actors are embedded in webs of interdependent relationships that shape performance outcomes (Chicksand et al., 2012). Originally developed in the 1970s and 1980s, the theory has expanded from a focus on dyadic relationships or alliances to a broader perspective of interconnected systems where multiple organisations collaborate across supply chains (Arni et al., 2007). In this view, a network is not merely a collection of actors but a structure in which interactions, trust, and commitments determine value creation and competitive advantage (Zaheer et al., 2000; Tuija-Lisa, 2014).

In the context of supply chain management, network theory highlights the importance of long-term cooperation, information sharing, and joint problem-solving among partners. Firms that operate within networks benefit from broader access to suppliers and customers, improved resource flows, and greater flexibility in meeting market demands (Ho et al., 2010; Kim et al., 2011). These collaborative ties reduce transaction costs, enable coordinated demand and production planning, and foster innovation in production and logistics processes (Li et al., 2009). As a result, performance improvements are not achieved solely through internal efficiencies but through the capacity to leverage the resources and capabilities of connected partners (Chicksand et al., 2012). The relevance of network theory to this study lies in its direct application to agricultural supply chains. In Cross River State, agricultural firms depend on the smooth integration of suppliers, farmers, processors, distributors, and customers to remain competitive. Network theory explains how such firms can strengthen performance through collaboration and trust-building across the value chain, enabling accurate demand forecasting, timely delivery, and enhanced product quality. It further underscores that agricultural firms are more resilient to environmental uncertainties when they embed themselves in cooperative networks that share resources, information, and risks. Thus, the theory provides a robust conceptual foundation for analysing how supply chain integration, through process, information, supplier, and customer linkages, translates into improved performance outcomes for agricultural enterprises.

Methodology

This study adopted a cross-sectional survey research design. Using this design, primary data were obtained on a one-time basis from employees of agricultural firms in Cross River State within a short period of time through a structured questionnaire. The population of the study comprised all 513 employees from thirty-five (35) agricultural firms registered with the Cross River State Chamber of Commerce and Industry as at 2024. These firms are spread across the three senatorial districts of the State, Southern, Central, and Northern districts, and were considered appropriate because of their substantial economic contributions, market presence, and representative characteristics of agricultural industries in the State. Using the Taro Yamane (1967) sample size determination procedure at a 5 percent error margin, a sample size of 225 employees was determined for the study. To select respondents into the survey, stratified random sampling was applied, with the three senatorial districts serving as strata. Thereafter, Bowley's (1926) proportional allocation formula was employed to distribute the 225 respondents across firms in line with their staff strengths to ensure fair representation and to reduce sampling bias. A structured questionnaire titled "Supply Chain Integration Questionnaire (SCIQ)" was used to collect data. The instrument consisted of two sections: Section A contained six items on respondents' demographic characteristics, while Section B contained forty items measuring the independent and dependent variables on a five-point Likert scale ranging from Strongly Disagree (1) to Strongly Agree (5). Prior to field administration, the

questionnaire was subjected to validity checks by two academic experts in management sciences and necessary modifications were incorporated. To confirm reliability, the instrument was pilot-tested on 30 respondents who were part of the population but not included in the study sample. The Cronbach's alpha coefficients obtained exceeded the 0.70 threshold, indicating that the instrument was reliable and suitable for field administration. The summary reliability results are presented in Table 1.

Table 1
Questionnaire reliability results

SN	Variables	No. of Items	Alpha Coefficients
1	Process integration	5	.95
2	Information integration	5	.98
3	Supplier integration	5	.96
4	Customer integration	5	.96
5	Customer service	5	.96
6	Product quality	5	.78
7	On-time delivery	5	.96
8	Market share	5	.96
	Performance of firms	20	.97
	Total	60	

Source: Researcher's analysis (2025)

After the administration of questionnaire copies, data obtained were analysed using descriptive statistics such as frequencies, percentages, and means, while the hypotheses of the study were tested using multiple regression analysis. The model was specified as follows:

$$PERF = a_0 + \beta_1PI + \beta_2II + \beta_3SI + \beta_4CI + e$$

Where:

PERF = Performance of agricultural firms
PI = Process integration
II = Information integration
SI = Supplier integration
CI = Customer integration
 a_0 = Intercept
 $\beta_1 - \beta_4$ = Coefficients of predictors
 e = Error term (5 percent)

Analysis and Discussion

Out of the total of 225 copies of the questionnaire administered, 220 were retrieved, 3 were wrongly filled and were not included in the final analysis, 217 copies representing 96.4 percent were used for the analysis.

Hypothesis 1

Ho₁: There is no significant relationship between process integration and performance of agricultural firms in Cross River State.

Hypothesis 2

Ho₂: There is no significant effect of information integration on performance of agricultural firms in Cross River State.

Hypothesis 3

Ho₃: Supplier integration does not have an effect on performance of agricultural firms in Cross River State.

Hypothesis 4

Ho₄: Customer integration does not affect the performance of agricultural firms in Cross River State.

Table 2

Model summary showing the influence of supply chain integration on performance of agricultural firms

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
	.825	.681	.675	3.20169

Source: Researchers' SPSS analysis (2025)

Table 2 presents summary result of the influence of supply chain integration on performance of agricultural firms. The multiple correlation of 0.675 was obtained which implies that 67.5% of the variation in performance of agricultural firms was accounted for by supply chain integration variables as measured by customer integration, process integration, supplier integration and information integration. Result of Analysis of Variance (ANOVA) is presented in Table 3.

Table 3

ANOVA result summary showing the influence of supply chain integration on performance of agricultural firms

Model		Sum of Squares	Df	Mean Square	F-calc.	F-crit.	Sig.
1	Regression	4635.062	4	1158.766	113.041	2.41	.000
	Residual	2173.177	212	10.251			
	Total	6808.240	216				

Source: Researchers' SPSS analysis (2025)

Table 3 presents ANOVA result summary showing the influence of supply chain integration on performance of agricultural firms. Result Table 23 reveals that the F-calculated of 113.041 was obtained with P-value of 0.000 as against the F-critical of 2.41 at 0.05 level of

significance. Result reveals that the F-calculated (113.041) is greater than F- critical (2.41) which means that there is a significant regression relationship between performance of agricultural firms and supply chain integration. Also, the parameter estimates of the multiple regression model as well as the significance is as presented in Table 4.

Table 4

Parameters estimate of the multiple linear regression showing the influence of supply chain integration on performance of agricultural firms

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
1 (Constant)	-6.763	3.013		-2.244	.026		
Process Integration	.733	.127	.249	5.776	.000**	.811	1.233
Information Integration	2.222	.139	.772	15.981	.000**	.645	1.550
Supplier Integration	.592	.143	.183	4.132	.000**	.769	1.300
Customer Integration	.256	.129	.079	1.982	.049*	.952	1.051

**Significant at 1% ($p < .01$). *Significant at 5% ($p < .05$).

Source: Researchers' SPSS analysis (2025)

Result in Table 24 presents summary of the parameter estimate of the multiple linear regression for the influence of supply chain integration on performance of agricultural firms in Cross River State. Result reveals that process integration ($\beta = .733$, S.E = .127, $p = 0.000$, $p < .05$), information integration ($\beta = 2.222$, S.E = .139, $p = 0.000$, $p < .05$), supplier integration ($\beta = 0.592$, S.E = .143, $p = 0.000$, $p < .05$) and customer integration ($\beta = 2.256$, S.E = .129, $p = 0.049$, $p < .05$) on performance of agricultural firms in Cross River state, Nigeria.

Discussion of Findings

Process integration and performance of agricultural firms

In hypothesis one, it was revealed that process integration enhances performance of agricultural firms in Cross River State. The result also revealed t - calculated (5.776) is greater than the t- critical (1.97) at the 0.05 level of significance. The findings is in line with the works of Kaniski and Vincek (2018) who posited that process integration will assist supply chain partners in the agricultural Industry to improve their performance by integrating upstream and downstream agricultural firm's processes and the flows of activities. The result of this study is supported by Khalfan and Raja (2012) who posited that process integration will improve agricultural firms' performance by providing end users with

effective and efficient customer services, a more responsive product delivery facilities and product quality that will help to meet customers need.

Information integration and performance of agricultural firms

In hypothesis two, the result revealed that the null hypothesis is rejected which means that there is a significant effect of information integration on performance of agricultural firms in Cross River State. This is evidence in the t - calculated value of (15.981) which is greater than the t - critical value of (1.97) at the 0.05 level of significance. Information integration accelerate and simplify all organisation processes, promoting quality services and products, enhancing organisational effectiveness of products and efficient operations based on the vision, mission and strategies of the agricultural industry (Vaska, et al. 2021). The result of this study is supported by Orlando, et al. (2020) who asserted that information integration will enhance performance of agricultural firms by examining and analyzing prototype concepts and systems to ensure that they are effective, efficient and secured in terms of organisation operation as well as having a high return on customer satisfaction, cost performance, quality performance, product quality, on - time delivery, accurate demand forecasting, market share, and return on investment.

Supplier integration and performance of agricultural firms

In hypothesis three, the findings shows that supplier integration has a positive effect on the performance of agricultural firms in Cross River State. The result also reveals that t - calculated (4.132) is greater than the t - critical (1.97) at the 0.05 level of significance. Supplier integration enhances performance of agricultural firms by facilitating effective customer services, on - time delivery of products, product quality, market share, sales turnover, product development, improved decision making, enhanced knowledge sharing, aligned capabilities, built learning routines and increased performance of agricultural firms (Hartmann, et al.2012). The findings is in line with the works of Israel (2022) who opined that supplier integration improve on performance of agricultural firms by strengthening trust and commitment between the two parties, reduce transactional cost, improves cooperation, enhance the satisfaction of the two parties, decrease formal contracts and reduce conflicts.

Customer integration and performance of agricultural firms

Lastly the test of hypothesis four reveals that customer integration enhances performance of agricultural firms in Cross River State. This is evidence in the t - calculated value of (1.97) at the 0.05 level of significance. The finding is in agreement with the findings of Zhang and Huo (2018) who confirmed that customer integration emphasizes and strengthens performance by building collaborative relationships and strategic alliances, strategic partnership, information sharing, coordination and controlling material parts and finished goods at the strategic, tactical and operational levels.

Conclusion and Recommendations

This study examined the influence of supply chain integration (measured through process, information, supplier, and customer integration) on the performance of agricultural firms in Cross River State. The findings established that all four dimensions of integration play significant roles in enhancing performance outcomes. Process integration enables firms to sense organisational changes and respond swiftly by eliminating resource waste, while information integration supports responsiveness and flexibility through the strategic exchange of supply chain intelligence and transactional data. Supplier integration facilitates effective collaboration for the smooth flow of products, and customer integration allows firms to focus on understanding and satisfying key customer needs. Collectively, these dimensions underscore the centrality of integrated supply chain strategies to achieving operational efficiency and competitive advantage in agricultural enterprises.

Theoretically, the study extends the application of network theory to the context of agricultural supply chains in sub-Saharan Africa. By demonstrating how collaborative ties among farmers, suppliers, processors, distributors, and customers enhance performance, the study highlights the explanatory power of network theory beyond manufacturing and service sectors where it has been predominantly applied. Methodologically, the use of multiple integration dimensions provides a more comprehensive analytical model that captures the complexity of supply chain relationships in emerging economies. This represents a novel contribution to the growing literature on supply chain integration in resource-constrained environments.

Despite its contributions, the study is limited by its single-state focus and cross-sectional design, which restrict the generalisability and causal inference of the findings. Future research should consider multi-state or cross-regional analyses to capture variations across different agricultural contexts, as well as longitudinal designs to better understand the dynamic evolution of network relationships and their long-term performance implications. Expanding the scope in these ways would further strengthen the evidence base and provide deeper theoretical insights into supply chain integration within agricultural systems. In line with the findings, the following recommendations were proffered:

1. Supply chain partners in the agricultural firms should integrate their upstream and downstream organisational processes and flows of activities to eliminate waste of resources.
2. Firms should work together with suppliers to exchange information and develop a coordinated information flow and system.
3. Agricultural firms should collaborate strategically with its suppliers to achieve effective flow of products that will meet customer requirement.
4. Supply chain partners should maintain long -term customer relationship that will enable them focus on key customer requirement and customer conditions.

Contribution to knowledge

The study has provided the platform for managers of agricultural firms to take advantage of the various proposed dimensions of supply chain integration that will enhance performance. The research also contributed to the existing supply chain integration literature by proposing four dimensions of supply chain integration that will enhance performance contrary to other studies that failed to emphasize on the relevance of these dimensions on the performance of agricultural firms.

Suggestions for further studies

The study suggested that future researchers should consider other dimensions of supply chain integration such as internal and external integration that were not studied. The research was conducted within Cross River State, other geographical factors in other states were not taken into consideration. Therefore, this study should be replicated in other States of the federation to generalize the result.

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