

## Transport optimization practices in the supply chain of Agro-firm companies: Evidence in Ghana

Clement Nangpiire<sup>a</sup>, Zaruk Narsam Salifu<sup>b\*</sup> and Elizabeth Beduwa<sup>a</sup>

<sup>a</sup>Simon Diedong University of Business and Integrated Development Studies, Ghana

<sup>b</sup>University for Development Studies, Ghana

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### ABSTRACT

Transportation is one of the most important functions of logistics management because of its impact on both the level of customer service provision and the organization's cost structure. The study explores the transportation cost optimization strategies and how they affect the supply chain performance of Shea nuts in the Agro-processing industries in Ghana. The quantitative study design was adopted and utilized to solicit data. With a sample size of 204 respondents. Data was analyzed using multiple linear regression in Statistical Package for Social Sciences (SPSS v20). The results revealed interesting findings in the supply chain within the institution as it seeks to assert that transportation is seen to be effective and contribute highly to firms output when Agro companies use outsourcing and pooling as means of transport. From the results, the supply chain correlated positively and significantly with outsourcing and pooling as transport optimization practices in Agro firms supply chain. This paper adds to the existing literature on the supply chain systems of Agro processing firms but departs from previous studies which seek to concentrate not on the transport optimization of the Agro processing firms but rather on the challenges, production, and profit maximization of these firms. Our study is unique unlike any other research previously authored as it seeks to reveal the option of transport optimization that is cost effective and efficiently productive for Agro processing firms to adopt.

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## 1. Introduction

Achieving profit is key to the success of a firm in a competitive environment industry. According to Gao, Erokhim and Ariskiy (2019), transportation costs make up a significant amount of the total costs incurred by enterprises operating in the manufacturing sector. However, these costs can be decreased by improving the efficiency of the transportation system. Several studies have indicated that transportation costs make up approximately fifty percent of total logistic costs (Gao et al., 2019; Nguyen et al., 2013; Sodhro et al., 2019). According to Faulin et al. (2019), transportation is identified as an indispensable aspect of the supply chain. In addition, Sodhro et al. (2018), highlighted transport costs as one of the main factors for a firm's competitiveness. Transport optimization describes all actions a firm takes to improve the movement of its goods and services within and across all its other subsidiaries or partners (Wan et al., 2018). Malladi and Sowlati (2017) added that worldwide transport expenditures can increase by as much as 25% over the next few years if firms do not find strategies to reduce the impact of freight costs increases. Therefore, it is critical for firms to develop an effective distribution network that reduces costs. This includes the location and requirements of customers and the optimal placement of distribution centers, terminals, and warehouses. The selection of a suitable fleet is also vital because an improperly adjusted fleet can significantly lower the potential of a transport company (Nakandala, Lau & Zhang, 2016).

The management of transport expenses is particularly critical within the shea products manufacturing sector. This is because shea nuts, the raw material for the industry, are typically harvested from rural areas to feed the organizations for the manufacture of its products. This issue is made worse by the poor local roads, inadequate networks, and in available transport

\* Corresponding author.

E-mail address: [zaruksalifu@gmail.com](mailto:zaruksalifu@gmail.com) (Z.N. Salifu)

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infrastructure services, all of which contribute to the high transport costs in the shea nut supply chain. It is believed that approximately 900,000 women in Northern Ghana are involved in various shea operations and that over two million people depend directly or indirectly on the shea sector for their means of sustenance (Tulashie, Appiah, Akpari & Saabome, 2020). The implication is that any improvement in the shea nut industry is very relevant not only to the industry but to the economy of Ghana in general. Li, Jia, Cheng and Hu (2017), state that transportation is one of the most important functions of logistics management because of its impact on both the level of customer service provided and the organization's cost structure. Both inbound and outbound costs can account for an increase in the price of products. Ansah, Obiri-Yeboah and Akipelu (2020), further added that transportation in Ghana is a serious challenge especially from the rural areas, which are the starting point of most supply chains to the urban centers. A report from the Ghana National Development Commission (2019) indicated that the poor transportation and communication networks in Ghana are said to be a major impediment to the distribution of inputs needed to manufacture products for both domestic markets and exports. The situation is worsened by the choice of transportation, which is only land, unlike other countries where management has a choice. The implication is that whatever mode of transport is available to businesses, they must be able to optimize its utilization. Failure to plan and make transportation decisions can lead to excessive costs, missing delivery dates and damaged goods. That is why optimizing operating efficiency and reducing transport costs are crucial. The optimization of transport costs should be one of the top priorities for Agro firms which wants to remain viable in the business environment. However, it appears there is limited literature to this effect. As such, this study therefore explores the transport costs optimization practices on the supply chain in the agro industry in Ghana in order determine the viable and appropriate transport strategy to adopt.

The relevance of the study is to investigate the transport optimization method that is appropriate to be adopted by firms in the Agro-processing industries in Ghana to save cost and improve in efficiency of deliveries of goods. The findings of this study will further contribute knowledge on transport optimization and accelerate governments, organizational heads and key policy makers on the approach strategies. Researchers in this research area can rely on this study gap to further probe on transport optimization methods. The remaining sections of this study include: literature, methods, results and analysis, discussions of the main findings, study implication and conclusion and limitation of the study.

## **2. Literature**

### *2.1 Theoretical Review*

The theory of resource mobilization underpins this study. The theory highlights the need for accessible materials or resources to individuals or entities. It is used to analyze social movements and argues that the success of social movements depends on both the availability of resources and the ability to put those resources to use (time, money, skills, etc.) (Holgate, Simms & Tapia, 2018). It is concerned with the timely and cost-effective acquisition of the necessary resources. Resource mobilization promotes the right sort of resources at the right time at the right price by correctly using the obtained resources so that the same is used optimally. Mobilization of resources theorists conclude that a person's choice results from rationally made decisions after evaluating the costs and benefits of numerous alternatives (Pichardo, 1988). In contrast to a traditional theory of collective conduct, which considers social movements as deviant and illogical, resource movement views them as rational social institutions produced and filled by social actors with the goal of political activity (Jenkins, 1983). The theory assumes that individuals are rational and act only if the benefits outweigh the costs.

The Agro-processing industry is a sector with rational employee within it, therefore institutions within this sector are very sound in decision-making and will thus optimize transportation by analyzing the costs and benefits of its decisions before making a choice. It is explained that the institutions have rational employees within it. However, this theory implies that a person or institution's readiness to determine the raw material area or location is based on the expected profit. The company will tend to examine the advantages of choosing a specific route of transportation and or positioning of raw material source by looking at the difference between the farms and their factories, the state of transport routes when it is in good standing or the quality of raw materials at a particular point in a given location by analyzing the costs and benefits of its decisions. However, the choice made after analysis is shown to be the result of a sensible decision after assessing the costs and advantages of making a profit rather than loss on transportation costs.

### *2.2 Conceptual Review*

#### *Supply Chain Management (SCM) Practices*

There are several distinct points of view on the practices of supply chain management that are presented in the available literature (Bahha, Hdidou & El Kartit, 2015; Chen & Paulraj, 2004; Kopczak & Johnson, 2003). Several facets contribute, in their own unique ways, to the SCM process; it comprises a diverse range of processes and activities that are carried out within the organization on a day-to-day basis. This study makes use of some SCM practices that were generated from prior studies.

#### *2.2.1 Supplier and Customer Relationship*

To improve customer satisfaction by utilizing suppliers' ability to provide high-quality goods and services, the concept of supplier and customer relationship defines the activities of businesses as a way to ensure the effective management of the

relationship between the supplier and the customer as well as others like the product and service supplier. This is done by making sure that the relationship between the supplier and the client, as well as those with other parties like the provider of goods and services, is handled successfully (Keane, 2004).

According to Sukati, Abu, Abdul, Prof and Baharun (2011), industry leaders are required to increase and build their competencies in order to integrate consumers and suppliers to achieve excellence in the supply chain process. When a supplier is involved in the design and production of a company's products, the firm can draw on the expertise of the supplier during the production process, which helps to ensure that the finished goods are up to the standards set by the client.

The primary goal of the process of managing the supply chain is to ensure that the client receives high-quality versions of the products and services they purchase.

### *2.2.2 Internal Operations*

The SCM approach places an emphasis, among other things, on the significance of the degree to which the efficiency of an organization's internal processes contributes to that organization's overall success (Singh & Zack, 2006). Before engaging in any integration from external parties, a company must first create a competitive advantage through its domestic business operations. This is the cornerstone for developing a competitive advantage. Poor internal operations could result in the failure of the organization to collaborate with external partners (Razzaque & Sheng, 1998). This failure could result in the company losing business. According to the findings of their research, an organization's internal business operations are concerned with all of the activities that are related to what takes place within the organization. Such are production methods and the progression of logic. The result is that SCM needs to have standards that are adaptable in order to account for changes in the market. Because of this, the production system ought to be ready to make a swift transition from the conventional methods of business to the individualized approach (Lambert & Cooper, 2000).

### *2.2.3 The Sharing of Information*

According to Lee, So and Tang (2000), one of the most important factors in successfully integrating the supply chain process is the free flow of information among participants. The availability of information both across and inside the activities of the supply chain is the focus of both cross-functional integration and inter-organizational integration, both of which are integral components of the supply chain. On the other hand, according to Lee (2002), when information is shared between two or more departments that are part of the supply chain, there is a risk of inadequate coordination, and this may result in circumstances where a variety of problems are faced. This may also result in circumstances where a number of different problems are faced. Despite this, the idea that participants in the supply chain should share information helps to reduce the number of unpredictability that are associated with demand.

According to the findings of a study that was carried out by Omar, Lo, Tan and Siron (2010), the sharing of information may be able to boost the operational synergy among partners in the supply chain. The type of information sharing, however, depends on consumer and market data as well as logistical data, and the impact of this information depends on the information shared, the caliber of the information received, and the ability of businesses to use the data and turn it into a supply chain strategy.

### *2.2.4 Information Technology*

When information technology (IT) resources are utilized effectively, enterprises have the ability to gain a competitive advantage over other types of businesses. Beginning with the upstream phase, which is concerned with the provision of goods and services, and continuing with the downstream phase, which is concerned with the distribution of goods and services in order to guarantee that there is an increase in the value of the products, information technology plays an important role within the framework of the SCM process in the delivery of a wide range of products to end users. This begins with the upstream phase, which is concerned with the provision of goods and services and continues with the downstream phase (Simchi-Levi, Kaminsky, Simchi-Levi & Ji, 2000).

A company that makes efficient use of the resources provided by the internet has a fantastic potential to reduce its operating costs, boost its rate of customer response, and enhance the quality of the services it provides to those consumers, which, in turn, boosts the organization's flexibility (Lee & Whang, 2001). For instance, exposing a company's products and services to an international market could be accomplished through the utilization of information technology resources, which would result in the achievement of a competitive advantage in the realms of manufacturing and distribution of goods and services. The company's products may be shown to people all around the world thanks to the internet, which will ultimately lead to an expanded customer base.

### *2.2.5 Training*

The key goal that serves as the foundation for the collaboration that is SCM is to achieve effective integration amongst the various units in the supply chain process that are responsible for enforcing value-added additions. This might take place either internally within the corporation or outside among the many different companies that are involved in the supply chain. Because of this reality, in order to achieve the goals that have been set for the business, there will need to be some

adjustments made to both the organization's culture and its human resources. This is due to the fact that human resources are accountable for the successful integration of all the other components that go into production, which allows for the effective production of goods and services for the consumer. Without doubt, the successful adoption of SCM cannot be accomplished in enterprises without the involvement of their human resources (Bowersox, Closs & Stank, 2000; Mentzer, 2004). Earlier behaviors that were counterproductive to the successful execution of the SCM implementation plan have to be abandoned.

Gattorna (2006), stated that the effective management of the SCM process involves the effective interaction between human resources and the other factors of production, such as IT and infrastructure. This was since the effective management of the SCM process involves the effective interaction between the two. This was a result of the fact that the efficient management of the SCM process required effective interaction between the two parties. To be an effective leader, you need to have a comprehensive awareness of all of the processes of the SCM as well as its dynamics. This allows for the development and execution of an appropriate plan to improve performance.

### *2.2.6 Optimization*

In short, optimization is the process of selecting the activities which are the best result (Liu, Li, Chen & Ma, 2020). It is clear from this description that every livelihood and every company ensures optimization in one way or another. Whether the goal is to survive the species by spreading, maximizing earnings by production decisions, or minimizing risk by purchasing strategies, everyone strives to maximize something or more (Davenport, 2013).

In its broadest sense, optimization is the act of adjusting a pre-existing process with the goal of raising the frequency with which desired results occur while simultaneously lowering the frequency with which undesirable outcomes do. This can be utilized to either improve the expected returns on an investment portfolio or decrease the projected costs of a trading system. It can also be used to make a business model more profitable.

### *2.3 Transport Optimization and Transportation Optimization Practices*

Within the context of a supply chain, the act of moving goods from one point to another is referred to as "transportation." This movement of products begins at the beginning of the supply chain as materials make their way to the warehouse and continue all the way to the end user with the delivery of the customer's order at the customer's doorstep. This movement of products begins at the beginning of the supply chain as materials make their way to the warehouse and continue until the end user. Optimizing transport is a comprehensive term used to cover all actions to improve the position of the transport parties (Nakandala et al., 2016). However, it is, in reality, a multidisciplinary problem which also involves less popular criteria such as comfort, recipient satisfaction, transport quality services, as well as ecological and road wear. The two most evident factors, namely cost and time, are the most important (Koberg & Longoni, 2019).

Logistics optimization involves a variety of activities, including a complete supply chain. The key to building an efficient distribution network is, first and foremost. This includes assessing the location and the needs of customers (which may change over time) and optimizing distribution facilities, distribution terminals and department stores (Shakerian, Dehnavi & Shateri, 2016).

A supply chain that has been optimized has achieved the highest possible level of efficiency; as a result, it has greater potential to cut costs, improve customer satisfaction rates, and provide value for stakeholders. The goal of managed transportation is to streamline and centralize the entirety of the process of inbound as well as outbound logistics. This includes everything from warehousing to delivery of the goods. These processes are inextricably intertwined and necessitate the collaboration and sharing of data among all of the parties in the network. Also, the selection of appropriate fleets (equilibrium of own and external fleets, vehicle size and capacity, such as cargo space, additional facilities: hoists, cranes, refrigerators), because an unsuitable fleet can dramatically decrease the potential of a transport (Mason & Lalwani, 2006). This literature-based study analyses five best practices in transport that reflect transport optimization strategies and, in turn, cost reductions that do not reduce customer service levels. They include straight pooling, shipment aggregation, consolidation of shipments, continuous movement, and cross-docking.

#### *2.3.1 Straight Pooling*

Pool distribution is like sending less than truck loading (LTL) because it allows you to transport your product in a single truck along with other shipping orders (Robinson, 2019). In contrast to LTL transport, however, pool distribution usually does not require sharing loads with other firms. This covers the pooling of a product's several shipments. The pool distribution plan can dramatically reduce transportation expenses for a company and make it much faster and easier to move the product to its destination. LTL, or less than truck loading shipping, makes it possible for companies not to fill the truck in its whole but to pay only the portion of the truck they use (Sodhro, Obaidat, Abbasi, Pace, Pirbhulal, Yasar, Fortino, Imran & Qaraqe, 2019).

### 2.3.2 Shipment Aggregation and Consolidation

Aggregation creates single multiple shipments originating on the same shipper at the same location on the same day as the separate shipments would otherwise have (Cortes & Suzuki, 2020). The terms aggregate shipments relate to several shipments from various exporters to a single consignee (Melo & Ribeiro, 2015). It is reinforced and treated as one consignment. An aggregator, which has the capacity to make complete payments to carriers upfront, is then able to decide the timing of shipments. This cuts shipping time because the aggregator could choose to have the products shipped weekly, while local delivery businesses are left to take the goods to customers' doorsteps. It is the shipment of many units of a good on the same vessel, often as a container load (Hillberry, 2017).

### 2.3.3 Continuous Move

Continuous movements are groups of loads that are transported by the same carrier at the same time. This allows the carrier to make more efficient use of a particular truck or asset (Robinson, 2019). In return, the shipper participates by gaining a reduction in the improved use of assets. Both sides benefit by connecting movements between drop-offs and pick-ups in minimum deadhead or empty miles. The strategies discussed thus far were designed to maximize vehicle capacity or increase the usage of assets (Malladi & Sowlati, 2017). If there is no further opportunity for optimization, the shipment must be sent out the door, and the vehicle must be loaded. Continuous movement solutions provide a reduction in the number of miles driven without cargo. To put this plan into action, several shipments are combined into distinct legs of a single continuous movement. The rate structure of a specific carrier takes account of empty miles and instances where the network has unfavorable backhaul chances (Lohatepanon, & Adulyasak, 2006)

### 2.3.4 Outsourcing

Outsourcing means contracting out a third-party business process, in which an organization moves some internal operations and resources from a company to external suppliers (Akbari, 2018). It is actually an extension of the contractual and sub-contractual production of the product, both of which have existed for a long time. These procedures might either be tasks that the company has completed in the past or new duties that have arisen as a result of various requirements imposed by the organization. As businesses or companies grow, the specific jobs of their employees become increasingly specialized, making it harder to achieve excellence in all their activities and processes that may require expertise that the company does not have its own employees but rather relies on outside consultants.

## 2.4 Influence of Transportation Optimization and Supply Chain

Combined shipments on a larger truck will save expenses across the supply chain because there will be fewer trucks on the road, and you will be able to save money on fuel overall (Robinson, 2019). The overall cost of distribution centers can be reduced if less than truckload (LTL) trucks must dock for the hub-and-speak model. Liakos and Delis (2015) further suggests that shipping companies can easily manage inventories and arrange routes, reducing overhead and offering more economic efficient rates. The method of pooling saves a great deal of time in transit and distribution centers. In many "spoke calls" or centers, LTL carriers frequently must unload when products reach the regions in the end. Pooling services, on the other hand, typically only stop at one central location en-route to their final destination. The tour across the country takes place quickly and consistently after the items are first loaded. Then, after they have arrived at the final distribution, they unload, and the items can go to their destination just in one more short leg. Although in this region of the world, this style of aggregation for transportation is not yet popular, it is able to enhance logistics greatly for Africa (Cortes & Suzuki, 2020).

Additional unification of fees and costs could be possible for aggregators. Not only would a uniform system improve retailers' import speeds and lower costs, but it also might provide the aggregator with financing facilities. Implementation, logistics and the establishment of a good shipping strategy are key to the conduct of a profitable e-commerce business. Aggregate allows retailers to increase the price visibility of various courier services to select the lowest (Hillberry, 2017). Many carriers are added to one platform to supply shops with reduced charges than usual (Melo & Ribeiro, 2015). It gives retailers more insight into the pricing of different courier services, helping them to choose the cheapest.

It is now possible, thanks to improvements in methods for optimizing the supply chain, to incorporate quality control into the entirety of the production process, from the sourcing of raw materials all the way through to the delivery of finished products to end users. Keeping quality as the primary focus will help to drive efficiency while also decreasing waste. Transportation is one of the most important activities in the structural process of logistics, and it is also responsible for a significant portion of the expenditures associated with logistics, around one to two-thirds of the total (Ballou, 2006). A supply chain's efficiency can be improved by increasing the effectiveness of its transit, which can be accomplished by cutting down on or doing away with, wastes of both time and materials.

## 3. Methods

A quantitative research approach was used to conduct this study. According to Kelly, Feeley and O' Bryne (2016), quantitative research approaches the problem of determining facts and causes by applying mathematical and statistical techniques.

In their view the purpose of a quantitative research technique is to collect numerical information that would then be analyzed statistically or mathematically to draw meaningful conclusions. They maintain that quantitative research employs numbers as the fundamental entry point of analysis. With this approach, it is easier to recognize patterns or relationships and generalize such results where possible.

### 3.1 Data Collection and Sample Size

The study adopted survey questionnaires to obtain information from staff members of seven (7) shea nut firms (Kasajan company, Ghana Nuts company, Sekaf Ghana limited, Wilmar company, Agro center, global shea, Intercontinental grains) in Ghana engaged in buying shea nuts. The respondents for this study included only officers capable of making optimal transportation decisions for the firms and they are (logistics and supply officers, quality control officers, transport officers, warehousing officers, finance officers). The questionnaire was tested through a semi structured interview schedule with five (5) practitioners in different settings. This provided an opportunity for some of the indicators to be realigned and some to be removed. The questionnaire was then well structured, incorporating an agreement of confidentiality and anonymity.

The target sample size for the study was (210). A total (30) questionnaire each were distributed to the (7) shea nut companies employed in the study. However, not all the target respondents were able to fully participate in the study. About (6) staff members could not complete the survey questionnaire for varying reasons. These reasons included the inability of some respondents to complete the questionnaire returned, or complete satisfactorily the questionnaire. The response rate for the study was over 90%.

### 3.2 Measures

The survey was design in Likert scale format with (1) for not at all to (5) for always in the first four sections contained in the survey. The design of questionnaire was in two parts. The first section contained information relating to the respondent's bio-data of respondents. The study employed four measured variables widely adopted by shea nut companies in Ghana. The second section contained methods used to optimize transport of shea nuts in firms. These methods include: pooling, shipment aggregation and consolidation, continuous move, and outsourcing.

### 3.3 Data Analysis Procedure

The study employed regression (multiple regressions) and correlation using Pearson in this statistical analysis. A multiple regression model, in which a single variable might have numerous predictor variables, was utilized for the research. That is, the model is expressed as

$$Y = \sum_{i=1}^n B_i X_i + \varepsilon$$

where  $Y$  is the dependent variable,  $B_i$  are the regression coefficient, and  $X_i$  are the independent variables.

## 4. Results

### 4.1 Multicollinearity Test and Reliability Test

The multicollinearity test is undertaken to verify the absence or presence of inter-correlations within the independent variables. Multicollinearity occurs when there are high correlations among the predictor variables. When there is multicollinearity present, it is difficult to determine the relative relevance of the variables that are being studied independently in terms of how well they explain the variable that is being studied. In addition, Variance Inflation Factor (VIF) values were used in the investigation to check for the absence of multicollinearity. If there is no multicollinearity, then the VIF values should be less than 10.00, and in the best-case scenario, they should be less than 5.00. The results indicate that all the VIF values are below five, and hence the data meets the assumption for the absence of multicollinearity. The Cronbach's alpha results obtained also prove that the test for reliability was significant for the study data.

**Table 1**  
Multicollinearity Test

Model	Tolerance	VIF
Outsourcing	0.996	1.005
Continuous Move	0.982	1.018
Shipment Aggregation and Consolidation	0.966	1.035
Pooling	0.956	1.046

### 4.2 Correlation Analysis of Supply Chain and Transportation Optimization Practices

From the results, the supply chain correlated positively and significantly with outsourcing (r-value = 0.640, sig = 0.000 < 0.05) and pooling (r-value = 0.239, sig = 0.000 < 0.05). The implication is that the supply chain directly relates to outsourcing and pooling. An improvement in both outsourcing and pooling will lead to an improvement in the supply chain of shea

nuts. There was, however, a positive but non-significant correlation between supply chain and continuous move ( $r$ -value = 0.115, sig = 0.058 > 0.05) as well as supply chain and shipment aggregation ( $r$ -value = 0.113, sig = 0.062 > 0.05). There is, therefore, no correlation between the supply chain and continuous move as well as supply chain and shipment aggregation.

**Table 2**  
Correlation Analysis of the Variables

		Supply chain	Outsourcing	Continuous move	Shipment aggregation	Pooling
Supply chain	Pearson Correlation	1	0.640**	0.115	0.113	0.239**
	Sig. (2-tailed)		0.000	0.058	0.062	0.000
	N	271	271	271	271	271
Outsourcing	Pearson Correlation	0.640**	1	-0.007	0.050	0.074
	Sig. (2-tailed)	0.000		0.910	0.413	0.227
	N	271	271	271	271	271
Continuous mode	Pearson Correlation	0.115	-0.007	1	-0.101	-0.123*
	Sig. (2-tailed)	0.058	0.910		0.096	0.042
	N	271	271	271	271	271
Shipment aggregation	Pearson Correlation	0.113	0.050	-0.101	1	0.192**
	Sig. (2-tailed)	0.062	0.413	0.096		0.002
	N	271	271	271	271	271
Supply chain	Pearson Correlation	0.293**	0.074	-0.123*	0.192**	1
	Sig. (2-tailed)	0.000	0.227	0.042	0.002	
	N	271	271	271	271	271

\*\* Correlation is significant at the 0.01 level (2-tailed).

\* Correlation is significant at the 0.05 level (2-tailed).

#### 4.1.3 Regression Analysis of Supply Chain and Transportation Optimization Practices

The results give a correlation coefficient of 0.686, which is significant ( $P$ -Value = 0.000 < 0.05) significance level. The implication is that the supply chain positively relates to transportation optimization practices. The  $r$ -square value achieved is 0.471, which implies that the variables explain 47.1% variation in transportation optimization in the supply chain of Shea nut firms in Ghana.

**Table 3**  
Regression summary

Model	R	R <sup>2</sup>	Adjusted R <sup>2</sup>	Std. Error of the Estimate	Sig.
1	0.686	0.471	0.463	0.48696	0.000

Note: Predictors: (Constant), Pooling, Outsourcing, Continuous Move, Shipment

Dependent Variable: Supply Chain

The results indicate that outsourcing significantly and positively predict an effective supply chain ( $b$ -value = 0.624,  $p$ -value = 0.000 < 0.05). Similarly, continuous move ( $b$ -value = 0.150,  $p$ -value = 0.001 < 0.05) and pooling ( $b$ -value = 0.200,  $p$ -value = 0.000 < 0.05) positively and significantly predict effective supply chains. The implication is that outsourcing, continuous moving and pooling positively predict an effective supply chain. Improvement in outsourcing, continuous move and pooling leads to a better supply chain of shea nuts in agro processing industries.

**Table 4**  
Regression Coefficient of Supply Chain and Transportation Optimization

Model	Unstandardized Beta		Standardized Beta	t-value	Sig.
	Beta	Std. Error			
Constant	0.453	0.296		1.529	0.127
Outsourcing	0.469	0.034	0.624	12.942	0.000
Continuous move	0.131	0.039	0.150	3.329	0.001
Aggregation and consolidation	0.068	0.053	0.059	1.296	0.196
Pooling	0.180	0.041	0.200	4.364	0.000

Source: Field Data (2022).

#### 4.2 Discussion

The supply chain within the institution was found to be moderately effective. From the results, the supply chain correlated positively and significantly with outsourcing ( $r$ -value = 0.640, sig = 0.000 < 0.05) and pooling ( $r$ -value = 0.239, sig = 0.000 < 0.05). An improvement in both outsourcing and pooling will lead to an improvement in the supply chain of shea nuts. There was, however, a positive but non-significant correlation between supply chain and continuous move ( $r$ -value = 0.115,

sig = 0.058 > 0.05) as well as supply chain and shipment aggregation (r-value = 0.113, sig = 0.062 > 0.05). A supply chain is positively related to transportation optimization practices such that transportation optimization explains 47.1% of the variation in the supply chain.

In accordance with previous studies, according to Robinson (2019) consolidating multiple shipments onto a single larger vehicle helps cut costs across the supply chain. This is because there are fewer trucks leaving the facility, which means that you can typically spend less money on fuel.

Partnering with a third-party logistics provider (3PL) that has a large and expanding fulfilment network and the capacity to distribute inventory across many fulfilment center locations is one way to achieve this goal. It is also easier for shippers to handle inventory and organize routes, which allows them to cut down on overhead expenses and deliver more cost-effective rates, as stated by (Liakos & Delis, 2015). The pooling method saves a lot of time spent in transit and in distribution centers. In investigating the influence of pooling on transportation optimization, Pooling and supply chain management was found to have a beneficial association by Cortes & Suzuki (2020). The authors added that although this shipment aggregation model is not yet common in this part of the world, it has the potential to significantly improve logistics for Africa.

In contrast to this study, Hillberry (2012) indicated that shipment and consolidation give retailers greater visibility across the pricing of many courier providers, which helps them choose the cheapest one.

The findings of the study indicate that supply chain performance has a significant correlation with outsourcing strategy. Supply Chain Management can take up a lot of a company's valuable time, which otherwise could have been spent on generating new ideas, marketing, strengthening customer connections, and a variety of other activities that are essential to the long-term survival of a business. Therefore, once a corporation has handed over the management of its supply chain to a third party, it will be much simpler for it to devote more of its resources to growing the business and concentrating on the development of a long-term strategy. This finding conforms with previous studies that asserts that inventory-risk sharing contract effectively coordinates supply chains, reducing inventory risk and maintaining competitive advantage for manufacturers, third-party logistics service providers, and retailers (Narulidea & Wijaya, 2018). The study conducted with Chu and Wang (2012) in the transport logistics services in China indicates that quality in logistics outsourcing is positively influenced by 3PL importance, logistics performance. This finding conforms with the finding revealed in this study.

The findings of the study that there is a significant and positive relationship between pooling resources and the supply chain performance. The process of pooling resources is a form of collaborative problem solving that adds value by combining various logistics and transportation procedures. Deliveries from numerous manufacturers who produce compatible goods are combined and then sent to distribution networks that are compatible with those goods. It enables better service, helps save money, and optimizes stock levels for a supply chain that is more environmentally friendly. This finding agrees with previous finding by Oorschot, Wang and Akkermans (2018) that resource pooling can improve performance in service supply chains. He argues that resource pooling is seen to impact on the performance supply chain services through reduced congestion and particularly on homogenous demand of product.

## 5. Study Implications

Transport optimization practices are critical to the effective development of transport systems in the Agro-processing industry and therefore, this research domain is important in supply chain research. This paper adds to the existing body of literature on the supply chain systems of Agro processing firms but departs from previous studies which seeks to concentrate not on the transport optimization of the Agro processing firms but rather on the challenges, production, and profit maximization of these firms. Studies conducted in the supply chain of Agro processing focused on the challenges of the supply chain in these firms. For instance, Asamoah et al. (2016) argued that a lot of activities impede the supply chain of Agro processing firms in the quest to achieve customer satisfaction and in their study, it revealed that collaboration, lack of government support, intense competitions and unqualified personnels form the major hindrance in the fulfilment of customer satisfaction in Agro processing firms. Further studies in transport optimization are by Agbo and Zhang (2017), which investigate the sustainability of freight transport optimization in beverages and Agro food. Their findings revealed that this innovative concept has the potential of ensuring sustainability, cost reduction and flexibility in the freight transportation sector. The closest study made within the Ghanaian context that investigates the supply chain of Agri food firms similar to our study looks into the transparency and institutional quality in the value chain of the Agri-products. The findings in their study revealed that value chain transparency and institutional quality positively influence agri-food firms performance (Nyamah et al., 2022). Our study is unique unlike any other research previously authored as it seeks to reveal the option of transport optimization that is cost effective and efficiently productive for Agro processing firms to adopt. In the Agro-processing firms, demonstrating the transport optimization method that is most suitable to the Agro-processing firms in Ghana is critical for the continuous existence of this firms and curbs the collapse of firms as it has been largely argued that firms incur substantial portion of the organization financial resources on transportation cost and therefore it is necessary to identify the most cost effective means of transport to adopt (Sodhro et., 2019). One of the main theoretical contributions of this paper is that it focuses on firms engaged in the purchase and transport of shea nuts in Ghana. The focus of this study is limited to only the transport practices in the Agro firms that can improve organizational performance. By discussing the transport methods used in the shea nuts firms in Ghana, it provides an understanding into the best methods to adopt and use



that improve organizational performance. The study findings show that outsourcings and pooling provide the best form of transport optimization in Agro firms than the other methods used in this industry. At the management level, this study will afford managers of the Agro firms the opportunity to resort to the use of the applied method of transport optimization established in this study to provide the needed cost reduction to firms and improved efficiency of delivery.

## 6. Conclusion and Limitation

From the findings of the study, the supply chain within the institutions were found to be moderately effective. The results show that supply chain correlated positively and significantly with outsourcing and pooling as transport optimization practices on the supply chain performance. An improvement in the adoption and effective implementation of outsourcing and pooling will lead to improvement in the supply chain of Agro firms. A supply chain is positively related to transportation optimization practices such that transportation optimization accounted for 47.1% of the variation in a firm supply chain. There was, however, a positive but non-significant correlation between supply chain performance and continuous move and shipment aggregation. From the study, the supply chain performance correlated positively and significantly with outsourcing. This again was manifested in the regression coefficient table as it was noted that outsourcing significantly predicts the dependent variable than the other independent variable. However, outsourcing was not indicated to be the main transportation optimization practice. We therefore recommend that Agro-processing industries should prioritize outsourcing in their transportation operations. These organizations can gain knowledge through outsourcing that could be difficult to locate in-house or might be too expensive to hire full-time. This study espoused four transport optimization methods used in the Agro-processing industry in Ghana. We therefore suggest that further research be conducted on other available transport optimization methods that may be adopted by the Agro-processing organizations to ensure cost efficiency and savings. Again, the survey was conducted in Ghanaian Agro firms. Further studies will be carried in other firms across other African countries in the same experimental context which could expand participants' participation and increase precise results.

## Data Availability Statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

## Conflict of Interest

The authors declare no conflict of interest regarding the publication of this study.

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**Appendix 3**

**Research Questionnaires**

Dear respondent,

This questionnaire is administered to solicit data for a research paper. I assure you that the research data will be used for only academic purpose and the anonymity and confidentiality of respondents is guaranteed in all instances. Please indicate your response by ticking (√) to your appropriate response.

Thank you.

**SECTION A: BIO- DATA**

- 1. Gender: [ ] Male [ ] Female
- 4. Qualification: [ ] certificate [ ] Diploma [ ] First degree [ ] Master’s [ ] PhD
- 5. Experience: [ ] 1-5yrs [ ] 5yrs and above
- 6. Specify the position you occupy .....

**SECTION B: Transportation Optimization Practices of Shea Nuts Companies**

1. Please indicate whether your company adopts any of these practices by **ticking [√] the scale** that reflects your opinion. Use the keys below.

<b>Key:</b>	<b>1 = Not at All</b>	<b>2 = Rarely</b>	<b>3 = Sometimes</b>	<b>4 = Often</b>	<b>5 = Always</b>
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No	Factor	1	2	3	4	5
	<b>Pooling</b>					
1	The firm transport its product along with other firms’ orders in a single truck					
2	The firm pools multiple shipments from different firms					
3	The firm partners with another when loads are few					
4	The firm transport products to add other firm’s products at central place before they are fully transported					
	<b>Shipment Aggregation and Consolidation</b>					
5	The firm transport its products from different locations to a central place before they are fully					
6	The firm accumulates its products to be later transported in a single truck					
7	The firm pools multiple shipments of its products together before transporting them					
8	Multiple products are consolidated and treated as a single consignment					
	<b>Continuous Move</b>					
9	Products are identified and transported from nearby locations at scheduled time					
10	Trucks are set to continuously move at scheduled time for products					
11	Trucks undergo long haul operations with open (one-way) routes					
	<b>Outsourcing</b>					
12	The company hire outside businesses to procure products					
13	The company hire outside businesses to transport goods					
14	Other businesses takes charge of the inventory management of the company					
15	The company engages on external drivers to convey their products					



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