

Analysis of Logistical Efficiency of Tomato Distribution from Markets in Northern Senatorial District, Kaduna State to Different Parts of Nigeria

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ABSTRACT

This study examined the logistical efficiency of tomato distribution from markets in the Northern Senatorial District of Kaduna State to various parts of Nigeria. Using Ullman's Theory of Spatial Interaction and the Theory of Demand and Supply, questionnaires were administered to marketers, intermediaries, drivers, channel loaders, and consumers, with a sample size of 400. The analysis revealed several factors hindering efficiency, including gasoline price instability, harassment by law enforcement, extortion at checkpoints, poor road conditions, and a lack of storage facilities. These challenges lead to delays, product spoilage, and increased costs for consumers. Flow line maps indicated that tomatoes primarily flow to South Western states like Lagos and Ogun. The study found significant price variations among different markets, with Lamban Zango having the highest cost per basket at ₦4,900 and the highest net marketing margin of ₦700. This was attributed to its proximity to urban centers and high population areas. On the other hand, Makarfi had the lowest tomato price at ₦2,900 per basket, with a lower return on investment of 0.03 compared to Lamban Zango's 0.14, indicating lower profitability. Overall, tomato marketing in the study area was deemed highly profitable, with efficient gross margin results. Recommendations included government intervention to stabilize gasoline pricing, standardize taxation, improve law enforcement training and remuneration, and address security concerns. These measures were seen as essential for enhancing efficiency in tomato distribution not only from the Northern Senatorial District but also across Nigeria.

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INTRODUCTION

Agriculture is an important sector in most developing countries. Increase in agricultural productivity depends heavily on its marketability. Efficient market does not only link sellers and buyers in reacting to current situations in supply and demand but rather has a dynamic role to play in stimulating consumption of outputs which are essential elements of economic development (Haruna et. al., 2012). According to Katharina and Stefan (2011), the concept of marketing subsumes a set of different innovative advertising instruments which aim at gaining a large effect with a small budget.

Agricultural marketing is defined as the performance of all the activities involved in the flow of agricultural products and services from the initial points of agricultural production until they reach the hands of the ultimate consumers. It is interested in everything that happens to crops after they leave the farm gate; making decision, taking actions and bearing the responsibility of the action. Agricultural marketing also articulates all processes that take place from when the farmer plans to meet specified demands and market prospects to when the produce finally gets it to the consumers (Haruna et. al., 2012).

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Aminu (2020) pointed out that for the usual vegetable marketing that does not require substantial capital, experience and good rapport is essential for the interactions with farmers and commission agent. Olukosi and Isitor (2004) explained that the marketing task involves transferring goods from producers to consumers. It is the marketing function that ensures that consumers acquire the product in the form, places and time desired. Marketing stimulates production, enterprise and specialization, hence resulting in an improved productivity of all sectors of the economy. As the economy of a nation grows, the gap between farmers and consumers widened and the task of marketing becomes more complex (Abbott, 1987). In research conducted by Oladejo and Sanusi (2008), the net returns to marketing were affected by estimated marketing costs and selected personal characteristics of marketers. The authors further disclosed that the marketers in the study area were carrying out their distributing function using diverse channels revealing that 10.9% claimed to supply their wares in wholesales while the remaining 26.4%, 42.7% and 20% sell directly to the retailers, final consumers and processors/food vendors, respectively.

According to Aminu and Musa (2007), the bulk of tomato production lies in the Northern part of Nigeria especially areas around Jigawa, Kaduna and Kano States. Some places in the southern part of Nigeria such as Oyo State also produce some quantity of tomato but the urban centres mostly in the southern region of Nigeria constitute the major consumption areas and market in those areas are the common outlets for all the production zones (Sanusi and Dada, 2016). In recent times, Federal and State Governments of Nigeria have made it a matter of policy attention to diversify the present over dependence of the country's economy on oil by focusing on Agriculture and entrepreneurial development of its citizens. To this end, more people are going into the production of fruits and vegetables such as citrus, water lemon, tomato, vegetables among others, which in the long run necessitated the springing up of more tomato markets and

participation of more people in fresh tomato marketing in Nigeria (Aremu, 2011).

Though marketing is considered very important, it has been a neglected aspect of agricultural development plans (Akura *et al.*, 2018) and this has led to a situation where marketing tomato by farmers and other stakeholders involve lot of cost which invariably influence its market performance. The study hence examined the profitability performance of the participants. Though much work exists on fresh tomato production, little is known on its marketing profitability and operational efficiency of the participants which this study aims at filling such gaps and this study will also add to the existing literatures on marketing of fresh tomato. In order to assess how efficient fresh tomato market is being operated among the actors, critical economic evaluation of institutions involved is essential in the framework of efficiency. (Folayan *et al.* 2007).

Marketing of tomato is a very good source of employment both at the urban and rural levels for the rapidly increasing population size of Nigerians who earn their living as producers, transporters, marketers, middlemen and the professional packing men. Excess production through finished products such as tomato "puree", "paste", and "ketch up" could be exported to the foreign countries and thus gives Nigeria a good foreign exchange (Amao, 2010; Salau and Salman, 2017).

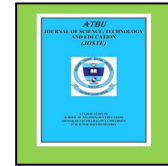
Nigeria ranks as the 16th largest tomato producing nation in the world and has the comparative advantage and potential to lead the world in tomato production and exports (NBS, 2010). The production of tomato in Nigeria in 2010 was about 1.8 million metric tonnes, which accounts for about 68.4% of West Africa, 10.8% of Africa's total output and 1.28% of world output. Unfortunately, the country still experiences deficiency in critical inputs, lack of improved technology, low yield and productivity, high post-harvest losses and lack of processing and marketing infrastructure. The demand for tomato and its by-products far outweighs the supply. With a population of over 200 million people, an estimated national population growth rate of 5.7%

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per annum, and an average economic growth rate of 3.5% per annum in the past five years, Nigeria has a large market for processed tomato products. Apart from the Nigerian market, the advantage of the trade liberalization in the West African market could be used to enhance the sale of processed tomato products in this region. At present, a significant percentage of processed tomato products used in Nigeria are imported, resulting in unnecessary pressure on foreign exchange reserve. It is therefore necessary to study the entire value chain for Nigerian tomato to improve its production and processing (Ugonna et al., 2015).

The distribution component of the value chain is separated in three parts. First, part of the tomato is sold to end users either in the vicinity of the farm or through wholesale marketers to local market or processors. Processors get their supplies directly from the farmers or the dealers. This component of the value chain is not organized in Nigeria, resulting in little or no value addition to the product.

LITERATURE REVIEW

Logistics

The origin of the term “logistics” is military: the Webster dictionary since 1963 has defined logistics as a branch of military science dealing with “the procurement, maintenance and

transportation of military material, facilities and personnel” (Marini, 1990). Similarly, Barros, Riley and Brown (2001) define logistics as “the science of planning and carrying out the movement and maintenance of forces (and aspects of military operations dealing with) design and development, acquisition, storage, movement, distribution, maintenance, evacuation, and disposition of material, personnel, facilities and services”. Actually, firms have always and everywhere carried out typical activities today included in the concept of logistics, such as inventory and transportation. “Almost every sphere of human activity is affected directly or indirectly by the logistics process” (Lambert and Stock, 1993).

However, before the development of the discipline of logistics, the historical practice was to manage them separately, without any co-ordination (Ballou, 2009). Lambert and Stock (1993) observed that some principles of logistics were taken into consideration by the economic theory even then at the beginning of the 1960s but they were not applied by the companies until the 1990s. Initially, logistics was considered to be just one of the centres of cost in a firm. It is only in recent years - earlier in USA and later in Europe - that business organizations have recognized the strategic contribution of logistics in achievement of competitive advantage (Christopher, 1992).

Table 1: Evolution of Logistics Concept

No of Phase	Logistics Definition	Logistics System to be Optimized	Level of Log. Integration	Focus on
1	Outbound logistics	Distribution System	Functional	Distribution Area
2.	Inbound Logistics	Procurement System	Functional	Procurement Area
3.	Production Logistics	Manufacturing System	Functional	Production Area
4.	Integrated Logistics	Internal Logistics System	Internal	Firm
5.	Supply Chain System	Channel Logistics	Channel	Channel

Sources: Ballou (2009)

The purpose of logistics can also be described by adopting the expression of the Society of Logistics Engineering (SOLE), which

has been called the “Eight R”. It is to provide availability of (Ferrozzi and Shapiro, 1992; Kobayashi, 1998): the Right product, in the Right

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quantity, with the Right quality, in the Right place, at the Right time, with the Right method, with the Right impression and at the Right (least) cost. In a system each logistics function (i.e.: transportation, warehousing, storage, etc.) cannot pursue an individual goal but must be subordinated to the global logistics aim, which consists in achieving the customer's satisfaction in the most cost-effective way. It doesn't consist in, for example, minimizing the transport cost or inventory cost. The total cost analysis (Ballou, 1999; Christopher,

1992; Lambert and Stock, 1993; Johnson and Wood, 1993), which includes in the total logistics cost the cost of lost sales, is the key to manage the entire logistics process.

Responsibility is not fragmented in the functional areas but is integrated in a single entity, which we have called "internal logistics system", to distinguish it from the "channel logistics system".

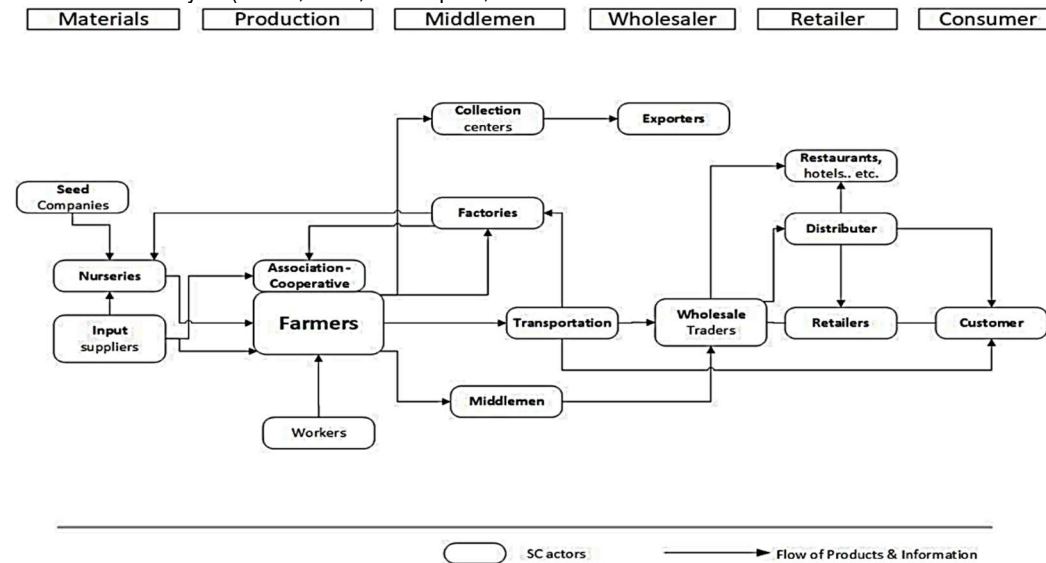


Fig. 1: The logistics system structure in the different supply chain actors. Sources: Ballou (2009).

Many authors have used the term transport logistics (Lai et al. 2004; Ehnert et al. 2006; Wong et al. 2009b; Lun et al. 2009) but they do not define it or identify its activities. Button (2010) finds that definitions of transport logistics are not always accurate, but defined transport logistics as the relationship between transport and integrated approaches to logistics and supply chain management. In other words, the main focus is on movement of goods in a supply chain, which is more than mere transportation of goods, since it covers full business and operational frames within which the movement of the cargo is planned, managed and ultimately carried out (Button 2010). Transport logistics can therefore be considered as a broader term than transport

alone, but a sub-activity of logistics and supply chain management.

According to Lai et al. (2002) "Transport logistics in a supply chain is usually an intermediary that facilitates the physical flows of goods from a point of origin, i.e., shipper, to a point of destination, i.e., consignee. Firms in transport logistics perform the physical distribution function to move goods from one place to another (Coyle et al. 2016); and the business process spans organizational boundaries, encompassing shippers and consignees". "The goal of a transport logistics service provider is to satisfy the customers (both upstream and downstream) in the chain with greater effectiveness and efficiency than their competitors'. Although a lot of authors have defined logistics in numerous ways based on

their understandings, the definition of Button (2010) best meets the expectation of today logistics.

According to Button (2010), logistics involves the movement of goods through the supply chain, but is more than just the freight transport aspect and embraces the full commercial and operational frameworks within which the movement of goods is planned, managed and finally carried out. Transport logistics performs an intermediary role in the supply chain since it enables physical flow of

goods from the source point suppliers to the point of use destination or consumer (Coyle, et al 2016)

According to Rick (2019), logistics and logistics management are subsets of processes that fall under supply chain management which plans, executes, reports and coordinates the movement of goods within an organization's network of stakeholders. These include suppliers, manufacturers, wholesalers, retailers and final customers. The goal of logistics is to move product efficiently and securely from point A to point B at the least cost and best service.

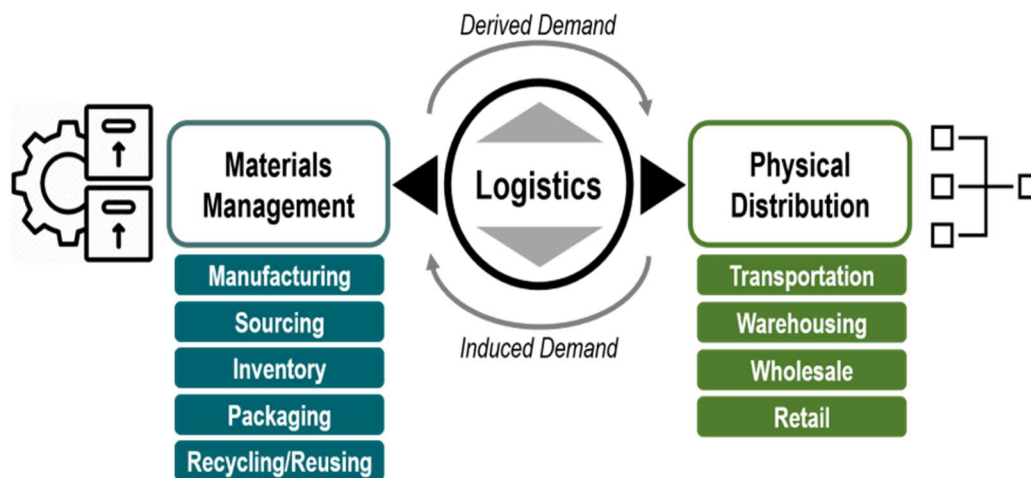


Fig. 2: Concept of Logistics. Source: Rodrigue, 2020

As inbound logistics points out, a good logistics system becomes an advantage that can easily outperform any other marketing your competitors may be running. During the recent two decades, goods flow has been tremendously increased. Increased variety of goods, the just-in-time delivery system, low load rate, specialization and centralization of production systems, globalization of marketing and seasonal variations are among the main challenges of logistics system which may lead to the necessity of developing effective logistics in the sector. Effective logistics and technologies are critical success factors for both manufacturers and retailers (Brimer, 2015; Tarantilis, Diakoulaki and Kiranoudis, 2014). Effective logistics requires delivering the right product, in the right quantity, in the right condition, to the right place, at the right time, for the right cost

(Aghazadeh, 2004) and it has a positive impact on the success of the partners in the supply chain (Brimer, 2015).

In tomato marketing, there are actors involve, each performing their roles according to their specialization. Tomato must pass through the following channel of distribution before it gets to the final consumer (s). This is depicted in Fig. 3

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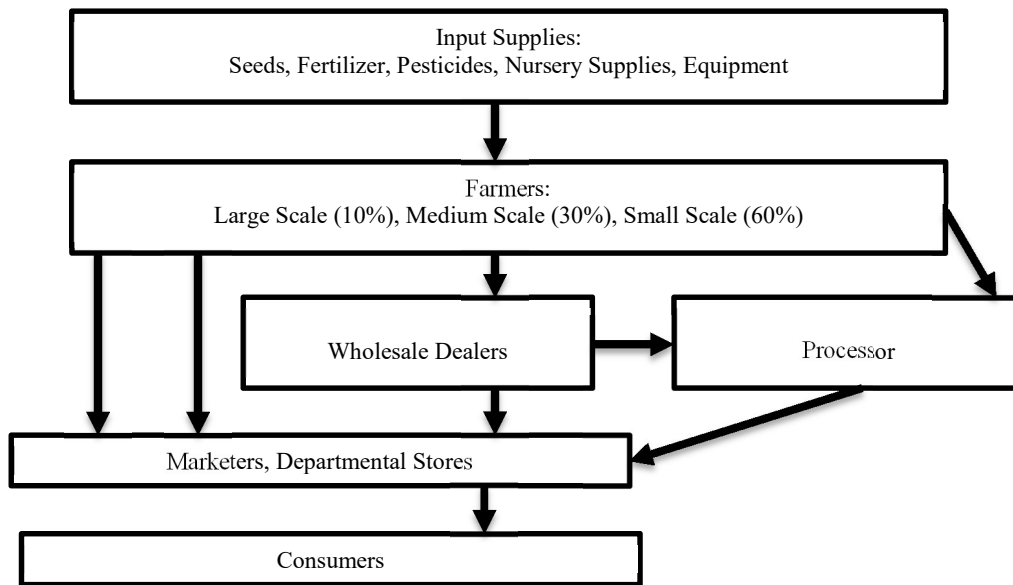


Fig. 3: Tomato Value Chain in Nigeria. Source: Ugonna, 2015

From the above diagram, tomato production and marketing start from the input suppliers. The input suppliers sell the farm inputs to the farmers, who farms, produce and sell it to the wholesaler-retailer-consumer. The wholesaler sells directly to the retailer-marketers-store, the retailer in turn sells it directly to the consumer. While the farmer-wholesaler can either sell to the processor. The processor processed into finish good and sells to the departmental store and the departmental store to the consumer(s). At each marketing level, transportation is considered very vital. However, Yayock et. al. classified the intermediaries associated with the marketing of farm produce into several categories viz; local and urban. The local traders live in the village takes their produce to the market and then sells collections in village markets, either through village retailers or directly to consumers while the urban traders on the other hand purchases farm produce in rural markets from retailers or directly from farmers, and transport the material to other markets or to urban centres for sale and his purchases are larger than the local trader. Retailers generally purchase produce from

wholesalers and sells to the consumers who buy in small quantities at a time. The functions performed by retailers of farm produce include: reducing produce to small units where relatively low-income consumers can easily afford or buy, buying and displaying produce for sale at places that are convenient to consumers and sorting, processing and repackaging produce to suit consumers' needs. The wholesalers as individuals who rent stalls in urban markets and handle large quantities of farm produce performing marketing functions such as buying, storing and financing the exchange produce. Marketing through wholesalers, channels have important advantages.

Firstly, wholesalers buy produce from farmers or local traders and sell to the retailers, to other wholesaler's domestic and foreign markets and to manufacturers and agricultural processors. Secondly, wholesalers often finance the movement of produce and invariably bear most of the marketing risks. In general, farmers who are able to sell their produce directly to wholesalers at the village markets has better chance of receiving higher prices than those who dispose of theirs



through local traders to wholesalers. The transporter is another intermediary in the chain of middlemen who perform marketing functions.

Food chain logistics is a significant component within logistics system as a whole. The food sector plays a significant role in an economy being one of the main contributors to the GNP of many countries, particularly in developing countries. The current trend in food value chain is characterized by three overriding features: greater concentration of farms, food industries, and wholesalers into smaller number with large sizes; the evolution of integrated supply chains linking producers and other stakeholders; and ever-increasing consumers demand for food quality and safety (food that is fresh, palatable, nutritious and safe) and animal welfare (Opara, 2003). However, to date, the linkage between logistics systems of the stakeholders in the agriculture and food supply chains is rather loose and fragmented. Even within individual firms, the vertical and internal integration as related to freight and logistics is loose, and therefore they are both economically and environmentally inefficient and not sustainable. In this regard, effective and efficient logistics will be a critical success factor for both producers and retailers in not only in Zaria and its regions but in the whole of Nigeria, which is why this study is undertaken. In addition to the increase in transport of agricultural and related goods in the recent decades, empty haulage is common in agricultural sector and the load capacity utilization level of vehicles is very low (it varies between 10 and 95%). Therefore, efficient use of vehicles could be among the methods to reduce transport work and attenuate negative environmental impact (Gebresenbet, 2017).

Supply chain management has become a major part of companies/firms' management systems due to the numerous benefits associated with supply chains in today's business environment. Several researches have indicated the prevalence of disruptions to firms and its supply chain due to the unstable environment and the negative consequences of disruptions to firms (Martha and Subbakrishna, 2002; Chopra and Sodhi, 2004; Coleman, 2006; Hendicks and Singhal, 2005; Wagner and Bode, 2008).

Similarly, the Food and Agriculture Organization (FAO) highlights the importance of Food Supply Chain (FSC) management in its 2021 reports, and points out that Food Loss and Waste (FLW) reduction is a crucial part of FSC management to which greater attention needs to be paid. The FAO estimates that one third of edible food for human consumption in the world is lost or wasted, which is equivalent to 1.3 billion tons per year. The target set by the United Nations on FLW is to "halve the per capita global food waste by 2030 at the retail and consumer levels and reduce food loss and waste along the production and supply chains".

Transport logistics and distribution is a summary of complicated activities and relationships that take place in the logistics systems (production and manufacturing, assembly and distribution centres, warehouse, transportation and transshipment and retail outlets), Ghiani, et al. (2004). The logistics activities performed (ordering process, inventory management and freight transportation), have their problems. Because the goods or commodities transported are by nature heavy, bulky or highly perishable and as such, need to be transferred with adequate efficiency from areas of production to areas of consumption with the least delay, cost and safety (Bayles, 2000).

According to Kee-Hung et al (2004) transportation logistics services are important activities which assist in national and global distribution. It enables materials and goods to be moved from a location where they are in excess or surplus to a location where there is demand or shortage or non-existent (Ballou, 1998). It also provides services which link manufacturers to markets and enable individuals to access employment, goods, services and social opportunities. Different modes of transport are used in the transfer of passenger, agricultural commodities and manufactured goods from places of supply or production to areas of scarcity or consumption which are found in different regions in Nigeria. The agricultural sector is one sector that has an important role in supporting the Nigerian economy.

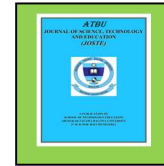
The agricultural sector in Nigeria needs to be developed in line with population growth and

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technological developments in order to increase agricultural production. Agriculture plays an important role in development and as a measure of the welfare level of a country's population, especially in meeting the needs, supplies, and food consumption of its population. One of the commodities that is very important and in line with the government's program of food self-sufficiency is food crops. Food crops are one of the commodities and are currently being developed and are of concern to the government of Nigeria due the exponential growth in population, the need for good Gross Domestic Product (GDP), Net Domestic Product (NDP) etc. (Bamaiyi, 2011 and Musa, 2008).

Distribution is the process flow from one process to the next. Supply Chain Management includes management information systems, purchasing, customer service, resources, transportation, production schedules, demand fulfillment processes, inventory management, warehousing and marketing (Nabhani & Sholeri, 2009). Logistics service activities are divided into three parts namely: management of raw materials (material management), exchange/conversion management (conversion management), and physical distribution (Iriani, 2010). Furthermore, physical distribution service includes several activities such as transportation, facility structure management, inventory management, and handling of raw materials for packaging or loading (material packaging and handling) (Iriani, 2010). Logistics distribution is dynamic and involves a constant flow of information, products, and finance between different levels. In fact, the main goal of various logistics is to meet customer needs and in the process, generate profits for companies' competitive advantage of logistics distribution is how the ability to manage the flow of goods or products in a supply chain, in other words the logistic distribution network model is an important activity that must be done on supply chain management. Implementation of supply chain strategies only takes place effectively if the supply chain has a network with the appropriate configuration (Pujawan, 2010) because network configuration can determine whether a logistics distribution will be responsive or efficient.

Basically, the network in logistics distribution is the result of several strategic actions. First, the actions regarding the strategic location of distribution centers, warehouse facilities, workforce reliability, smooth transportation and product availability. In this study an attempt was made to analyze the problems of transport and logistics in freighting of tomato from Northern Senatorial District, Kaduna State, Nigeria.

EMPIRICAL REVIEW

Ogaji et. al. (2013) studied the technical efficiency in tomato Production in Zaria Local Government Area of Kaduna State. A multistage sampling technique was used. It was found that 70% of the farmers were men between the ages of 31 and 50. It also showed that increase in farm size, fertilizer and seeds will led to a considerable increase in tomato production. Furthermore, the mean technical efficiency was 0.6 and this was influenced by age, farm experience, contact with extension agents and access to credit. The study concludes that farmers can further increase their output and therefore recommends that credits should be made available to farmers and also extension agents should be encouraged to visit the farmers more often as this translates into increased efficiency.

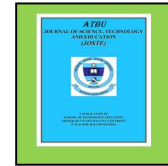
Odemero and Okoh (2014) studied the effect of post-harvest properties of tomato on its marketing efficiency. The study investigated 60 tomato marketers. Surveyed tomato marketers were purposively selected from two major tomato markets (Ogbegonogo and Igbodo markets) in Delta state, Nigeria. Primary data were collected from the respondents with the use of observation and interview schedule. Data collected were analyzed using price correlation coefficient and shephered-futrel coefficient of marketing efficiency. From the result, the price correlation between the two markets was 0.7 indicating the presence of fairly high spatial price integration. However, inter seasonal price correlation coefficient of 0.4 implies the existence of weak inter seasonal price integration in the tomato marketing system. The Shephered-Futrel coefficient of marketing efficiency of 78.15% suggests that the level of marketing efficiency of

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tomato in the study area is low 21.8%. Further analysis of data revealed that profitability and hence efficiency of tomato marketers is significantly affected by post-harvest perishability in the study area. It is recommended that marketing infrastructures should be provided to improve post-harvest properties of tomato and its marketing efficiency.

Aminu, et. al. (2019) studied the marketing efficiency of fresh tomato in Ijebu North LGA of Ogun State Nigeria. Specifically, it determined the profitability of fresh tomato marketing, analyzed the marketing margin and efficiency of fresh tomato marketing and examined the factors determining income from fresh tomato marketing in the study area. Data were collected from 80 fresh tomato marketers with the aid of questionnaire using simple random sampling techniques. Budgetary analysis, marketing efficiency analysis and multiple regression analysis were used to analyze the data. Results from the budgetary analysis revealed a benefit cost ratio of 1.23k indicating that fresh tomato market was a profitable enterprise in the study area. The marketing margin was 21.13%. The marketing efficiency value of 0.26 (26.01%) reflected an inefficient marketing system in the study area. The multiple regression results revealed that income from fresh tomato marketing in the study area was significantly determined by purchase price of tomato ($p < 0.01$), transportation cost ($p < 0.05$), marketing experience ($p < 0.01$), education ($p < 0.05$) and age of marketer ($p < 0.05$). The study recommends that road network and transportation facilities should be improved upon to reduce marketing costs in the study area.

Ojo et al. (2016) examined the marketing efficiency of tomato fruits in Abuja Municipal Area Council, Nigeria. The market structure analysis with gini-coefficient of 0.7152 implied that, there was a high degree of inequality and high level of concentration within the markets. Analysis of income distribution among the marketers with gini-index of 0.4 revealed that there was less inequality in the income of the marketers. The market conduct results indicated that there was no fixed/regulatory pricing by the government or any marketing cooperative for

tomato product. Rather, prices were determined mostly by price bargaining power (17.8%), forces of demand and supply (34.7%) and Marketing cost and margin (40.5%). Market performance analysis involved the estimation of the marketing margin and costs and returns analysis. The gross marketing margin of wholesalers was ₦66.27/kg while that of the retailer was ₦68.14/kg. Costs and returns analysis with gross ratios of 0.31 and 0.62 for the wholesalers and retailers showed that tomato fruit marketing was a profitable business venture in the area. Marketing efficiency estimation for wholesalers and retailers indicated a low level of efficiency though wholesaler was more efficient than retailers. Based on the findings, it is therefore recommended that premium motor spirit should be made available to the road transport workers at lower rate to reduce transportation cost due the long queues at filling stations and patronage of black marketers.

Wahid et. al. (2017) examined technical efficiency of tomato growers in Malakand district of Khyber Pakhtunkhwa, Pakistan. A sample of 120 tomato growers was selected employing multistage sampling technique. An interview schedule was used for data collection during November-January, 2016. Maximum likelihood technique was used for the estimation of the Cobb-Douglas stochastic frontier production model. After running various econometrics software the output of the Frontier 4.1 was found good fit. The findings of the study showed that technical efficiency ranges from 0.83 to 0.99 with the mean technical efficiency of 0.93. The findings further showed that among the inefficiency factors experience was significantly contributing to the technical efficiency of the farmers.

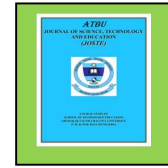
Ogunniyi and Oladejo (2011) studied the technical efficiency index and further examined the factors influencing technical efficiency for the sampled tomato farmers in Oyo State of Nigeria. The study made use of a cross-sectional data to obtain information from 150 tomato farmers in the four agricultural zones of Oyo State. The technical efficiency index ranged from 0.031 to 1.000 under both Constant Return to Scale (CRS) and Variable Return to Scale (VRS) specification. The mean technical

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efficiencies were 0.423 and 0.548 under CRS and VRS specification respectively. The scale efficiency range between 0.175 and 1.000 with a mean of 0.826. Of the 150 tomato farms, 26 show constant return to scale and 94 show increasing return to scale while 30 shows decreasing return to scale. This result shows that there is small scale inefficiency in the study area. There is excess use for all inputs especially for fertilizer, family and hired labour. The determinants of technical efficiency are education, experience, diversification, marital status and gender.

Jimjel et. al. (2014) studied the technical efficiency of tomato production in Guyuk Local Government area of Adamawa State, Nigeria. Data were collected from 100 farmers using purposive and simple random sampling with aid of structured schedule. The result of the stochastic frontier production function analysis shows that the variance parameters, that is the sigma squared (σ^2) and the gamma (γ) were statistically significant at 1% level for tomato production. The coefficient of farm size and seed were positive and significant at 1% level while family and hired labor was negative and insignificant. Profit level can be increased by increasing the farm size and quantity of seed, and decreasing the use of manual labor. Mean efficiency were 0.69, Farmers operated at 31.03% below frontier level due to variation in technical efficiency. The inefficiency model shows that the coefficient of Age, Gender and family size have negative apriori sign and in consonance with the apriori expectation. Better use of technology dissemination was suggested to enhance the production level at farmers field and optimum utilization of resources.

Karuku et. al. (2017) employed Cobb-Douglas stochastic frontier analysis to examine the ability of small-scale tomato farmers to flourish in Benue state, Nigeria from technical efficiency point of view. Evidence shows that tomato output was significantly influenced by farm size, labour, seeds, and quantity of fertilizer used. Technical efficiency among the tomato farmers varied considerably ranging between 0.20 and 0.99 with a mean technical efficiency of 0.58, implying that an estimated 42 percent of tomato output is lost due to inefficiency. Thus, suggesting the presence

of considerable inefficiency among the tomato farmers in the state. In order words, if current resources available to the farmers were used efficiently, tomato output would increase by about 42 percent, resulting in an increase large enough to meet the demand of the state as well as neighbouring states. Consequently, going by this result, there is a huge potential for tomato farmers in the state to flourish. Furthermore, education, experience and extension were found to impact significantly on tomato output.

Afolami and Ayinde (2001) studied tomato production in Yewa North Local Government Area of Ogun State, Nigeria. Survey method was used to collect data from 70 respondents randomly chosen from a sample frame of tomato farmers obtained from National Agricultural Land Development Authority (NALDA), for the study area. Production function analysis was used to show the equilibrium or disequilibrium of resource use from the optimum. Analysis of costs and return was used to establish the profit level of tomato production in the study area. The study revealed that most of the tomato farmers are married males with an average of 9 people in the household. Most of the tomato farmers were literate with an average of secondary school education, and their average

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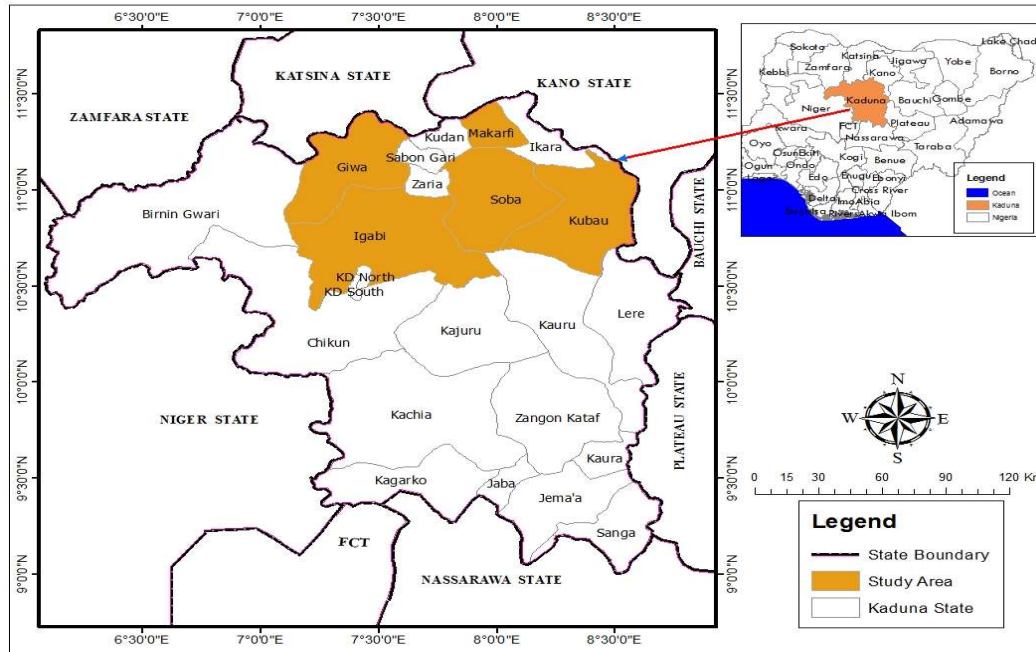


Fig. 4: Map of Kaduna State Showing Study Area. Source: GIS Lab Department of Geography Using Arc GIS 10.3 Software.

age of 35 years fall within the active age group. The study also revealed that tomato production is a profitable venture, but the levels of resource use with respect to fertilizer, land and seed were below optimum. The problems militating against tomato production were identified to be high cost of fertilizer, pest and disease problems, and inefficient transportation network resulting in spoilage of output and inadequate credit facilities.

MATERIALS AND METHODS

Zaria is located between Latitudes 10° 12' 0" N to 11° 24' 0" N of the Equator and Longitudes 6° 54' 0" E to 8° 42' 0" E of the Greenwich Meridian. The study is which at the present time lies within eight (8) Local Government Areas in [Kaduna State](#) and a major city in the state. These Local Government Areas includes: Giwa, Kubau, Zaria, Lere, Sabon Gari, Soba, Makarfi and Kudan in [Kaduna state](#), Nigeria. It is the capital city to the [Zazzau Emirate Council](#) as well as being one of the original seven [Hausa city-states](#). It covers a total land area of 563km² with an altitude of about 762 meters above sea level. It lies in the Northern part of Kaduna State (Ogunleye, 2006).

Sample Size and Sampling Technique

The study sampling frame comprised of eight districts predominant in tomato trading. The population of the eight districts was 1,896,640 (NPC, 2006). The sample size was gotten using Taro Yamane (1967) sample size formula. The formula is stated as:

$$n = \frac{N}{1 + N(e)^2}$$

Where n = sample size
N = Total number of population under (1,896,640)
e = sampling error of 0.05 significance \ level

$$n = \frac{1,896,640}{1 + 1,896,640 (0.05)^2}$$

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$$= \frac{1,896,640}{1 + 1,896,640 (0.0025)}$$

$$= \frac{1,896,640}{1,896,641 \times 0.0025}$$

$$= \frac{1,896,640}{4,742.6}$$

= 399.9, approximately 400

The efficiency of tomato distribution from the study area was analyzed using Shepherd formula technique to estimate wholesaler marketing efficiency (Shepherd, 1993). The marketing efficiency of tomato is specified as:

$$ME = \frac{V}{I} - 1$$

$$\text{Marketing Efficiency (ME)} = \frac{\text{Total Revenue (Consumer Price)}}{\text{Total Marketing Cost}} - 1$$

Where:

ME = Index of Marketing Efficiency

V = Value of goods sold or Consumer Price

I = Total Marketing cost or marketing cost per unit

Table 2: Shepherd Formula for Marketing Efficiency of Wholesale in Tomato Markets

Variable	Estimate at Collection Centres								
	Kidandan	Anchau	Lambam	Tundun Saibu	Soba	Makarfi	Maigana	Giwa	Average
Consumer retail price	4000	4500	5000	3100	4000	3500	4000	4300	4050
Selling price	3500	3900	4900	3100	3450	2900	3500	3900	3643.8
Marketing cost	200	250	200	150	300	200	200	300	225
Marketing Efficiency (%)	19.0	17.0	24.0	19.67	12.33	16.5	19.0	15.0	15.66

Estimates are valued in ₦ per basket. Source: Field Work, 2022

RESULTS AND DISCUSSION

As presented in Table 4.5, on aggregate, ₦700 wholesaler net marketing margin per basket (highest) was reported in Lamban Zango market and ₦450 in Anchau market while the lowest was found in Soba market. The average marketing cost at ₦225 per fresh tomato basket, resulted in average net market margin of ₦250 for wholesale market. However, a very high average farm gate price of ₦3143.8 per basket was observed due to the seasonal scarcity usually associated with tomato vegetable marketing especially during the dry copping season. The net marketing margins of Lamban Zango and Anchau wholesalers' markets might be due to their lower purchasing prices due to their benefit of economies of scale. The lowest

net marketing margin of Soba market wholesalers reflects higher transportation and handling costs. This result agreed with previous study that inadequate marketing services such as transport, packing and handling represent major obstacles that face marketing activities (Altoum, 2008)

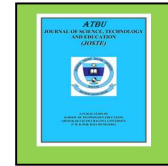
Market efficiency of 24.0% was estimated for Lamban Zango market (highest), Tundun Saibu market recorded 19.67% efficiency and Soba market recorded 12.33% (lowest) as indicated on Table 4.5. Average marketing was 15.66% efficiency. A market that is efficient does not only bring sellers and buyers together, it enables entrepreneurs to take advantage of opportunities, to innovate and improve in response to demand and price changes (Fakayode et al., 2010). The high market efficiency implied that wholesalers in Lamban

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Zango market got higher coefficients of marketing efficiency because they run marketing activities more efficiently than others, perhaps due to their closeness to the urban retailers and efficient price control. This result could therefore be seen as highest pricing efficiency in fresh tomato marketing in the study area.

In reality, given that market will not self-regulated in terms of efficient use of resources and that no excess profits will get to any operator under perfect competitive condition, economists face difficulty in defining the criteria for evaluating economic efficiency of markets. Agricultural economists have applied two approaches for analyzing market performance. The first approach analyzes the productive efficiency of well-defined marketing subsystems while the second approach focused on analyzing the market structure and the resulting performance.

The methods and criteria used by both approaches are instrumental in identifying actual and potential inefficiencies in the marketing system and characteristically, lead to the development of marketing policy recommendations to government (Kilmer and Armbruster, 1999).

Performance is a measure of pricing and operational efficiency. Individual producers as well as the public have a stake because the degree of efficiency attained affects producer's prices and profit, costs to the consumer and their real income, and the general resource utilization. Improved marketing efficiency is a common goal of farmers, marketing organizations, consumers and society (Kohls and Uhl, 1985). Higher efficiency means better performance, while lower efficiency denotes poor performance. Markets are efficient when the ratio of the value of output to the value of input throughout the marketing system is maximized (Abbot and Makeham, 1981). Performance of the market is reflection of the impact of structure and conduct on product price, costs and the volume and quality of output (Cramers and Jensen, 1982). If market structure resembles monopoly rather than pure competition, one can expect poor market performance.

Marketing margin is the most commonly used measure of market performance. It describes price differences between other points in the marketing chain, for example between producer and wholesale, wholesale and retail, prices. It measures the share of the final selling price that is captured by a particular agent in the marketing chain (Mendoza, 1995). Marketing margins consist of marketing functions such as grading, packing, loading, unloading, transportation, storage, and levies. They are the same as returns to all factors of production, that is, land, labour, capital and entrepreneurship involved in marketing (Adeyokunnu, 1973). The data on marketing costs are needed to disaggregate the gross marketing margin of an enterprise at different marketing stages. This provides information on the costs of particular marketing functions, which can be compared with costs incurred by other enterprises to assess the operational efficiency (Scarborough and Kydd, 1992). Large gross margins may not necessarily express high profit, but increased qualities and quantities of service, low labour, capital and management productivity, leaving producers and consumers better off while small gross margins may co-exist with inefficient resource use, poor coordination and consumer satisfaction, and disproportionate profit elements due to low productivity (Trotter, 1992).

CONCLUSION AND RECOMMENDATIONS

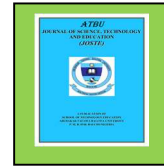
In terms of productivity in the study area, the study revealed that tomato trading is highly profitable most especially in Lamban Zango market which enjoy close proximity to Zaria Metropolis and Kaduna metropolis with high population and easy accessibility to transport. The study also shows high market efficiency especially in Lamban Zango market. The high market efficiency implied that wholesalers in Lamban Zango market got higher coefficients of marketing efficiency because they run marketing activities more efficiently than others, perhaps due to their closeness to the urban retailers and efficient price control. This result could therefore be seen as highest pricing efficiency in fresh tomato marketing in the study area.

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Based on the foregoing, it is recommended that government should make effort towards stabilizing the price and supply of gasoline. This should be by way of ensuring efficiency and available in all nooks and crannies of the country. While those found sabotaging governments' effort, in that regard, should be made to face the full wrath of the law. The issue of extortion through multiple taxes at all kinds of check point should be addressed by the concerted efforts of various state governments (inland revenue offices). In other words, state governments should come up with an agreed pattern of collecting revenues from itinerant transporters in such a way that multiple taxations and or extortions could be curtailed.

Tomato marketers should strengthen themselves by forming cooperative groups whereby tomato could be purchased in bulk on behalf of members at a reduced purchase cost. In addition, stakeholders should improve the transportation system in order to reduce transportation cost and deterioration during transportation. Due to the perishability nature of tomato, the government at all level should repair and reconstruct major and minor roads so as to avoid post-harvest losses due to mechanical injury.

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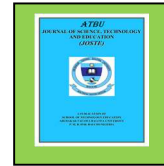
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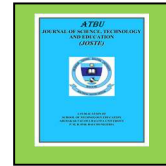
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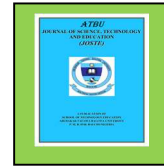
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