



# Tomato Value Chain in Nigeria: Issues, Challenges and Strategies

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## Authors' contributions

This work was carried out as collaboration among the authors CUU, MAJ and APO. Author CUU designed the study, carried out data collection and analysis, wrote the first draft, formatted and provided finishing touch to this manuscript. Authors MAJ and APO supervised the entire work. All authors read and approved the final manuscript.

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## ABSTRACT

The study was carried out to appraise tomato value chain in order to promote the development of tomato production and processing industry in Nigeria. Currently in Nigeria, about 1.8 Million tonnes of fresh tomato are produced per year, but over 50% of these are lost due to poor storage system, poor transportation and lack of processing enterprises. This makes it important to develop strategies for the development of tomato value chain. The method employed in this study includes semi-structured informal interviews with key value chain actors such as producers, intermediate traders, retailers and input suppliers and a critical review of available literature. The study revealed that there are good varieties of tomatoes in Nigeria, but only a few are suitable for industrial processing with regard to quantity and quality. The research also revealed that Nigeria is still not a major exporter of either fresh or processed tomato products despite the high production of fresh tomatoes. This was found to be due to inadequate supply of good quality seeds, inadequate

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storage facilities, poor disease and pest management, and poor processing facilities. The development of tomato for industrial use is currently gaining momentum, in the area of production of tomato juice, paste, ketchup, puree, and powder. Strategies identified to overcome the challenges include: policy shift to encourage Small and Medium Enterprises (SMEs) as well as Industries along the value chain; improved input supplies; organisation of farmers into cooperatives so as to initiate innovative funding mechanism for them; establishment of clusters for processors; improvement in marketing strategies including guaranteed price for fresh tomato products; adjustment in tariff regime to favour local manufacturers including outright ban on importation of processed tomato products; increased investments in Research and Development (R&D) to produce improved seed varieties and develop technologies for storage and processing; adoption of Good Agricultural Practice (GAP) by farmers and a strong National Commodity Association or Network.

*Keywords: Tomato value chain; production; processing; marketing; value addition; ketchup; puree.*

## 1. INTRODUCTION

The word "tomato" comes from the Nahuatl word *tomato*, literally known as "the swelling fruit" (Online Etymology Dictionary). Tomato belongs to the *Solanaceae* family. Tomato (*Solanum lycopersicum* L) is one of the most important vegetables worldwide. As it is a relatively short duration crop and gives a high yield, it is economically attractive. Tomatoes contribute to a healthy, well-balanced diet [1], as they are rich in minerals, vitamins, essential amino acids, sugars, dietary fibres, vitamin B and C, iron and phosphorus. It can be processed into different products including: Ketchup, puree, powder and juice.

Nigeria ranks as the 16<sup>th</sup> largest tomato producing nation in the world and has the comparative advantage and potential to lead the world in tomato production and exports [2]. The production of tomatoes 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 [2]. 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 170 million people, an estimated national population growth rate of 5.7% 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.

The value chain approach has been utilized by development practitioners and researchers alike to capture the interactions of increasingly dynamic markets and also to examine the inter-relationships between diverse actors involved in all stages of the marketing channel [3,4,5,6,7, 8,9,10,11]. Furthermore, by going beyond firm or activity-specific analysis, value chain analysis allows for an assessment of the linkages amongst productive activities.

The approach thus provides a framework to analyse the nature and determinants of competitiveness in value chain in which small farmers can participate. It also provides the basic understanding needed for designing and implementing appropriate development programs and policies to support their market participation. Indeed, many development interventions now utilize the value chain approach as an important entry point for engaging small farmers, individually or collectively, in high value export markets [12]. Value chain approach to agriculture focuses on improved quality of agricultural products, increased agriculture systems efficiencies or development of differentiated agricultural products, for achievement of a more rewarding position in the market place (competitive advantage) through the collaborative efforts of industry partners. This approach emphasizes on value addition and agriculture innovation driven by the needs and demands of end users and consumers [13].

The current Agricultural Transformation Agenda (ATA) being implemented by the Federal Government of Nigeria is anchored on using the value chain approach to develop some target crops from production to processing into different products [14]. This programme has led to an upsurge in agricultural production and processing activities in Nigeria. For tomato in particular, a number of State governments and private companies is currently investing in product handling and processing. The success of these ventures requires critical appraisal of the value chain of tomato in order to remove barriers to production, processing, marketing and distribution of the product. Such studies have been done in Nigeria for potato, shea, spices and cashew [15,16,17,18]. Related studies on tomato in Nigeria were reported by Abba and Musa, [19], and Adegbola et al. [20] and for Kenya by Sigei et al. [21]. Not much published work is available on value chain analysis for tomato in Nigeria.

The overall objective of the study is to contribute towards promoting the development of tomato value chain in Nigeria. The specific objectives are to: study the value chain for tomato namely production, processing and conversion to different products and marketing; identify existing technologies and technology gaps in tomato production, handling and processing; identify the challenges associated with the development of tomato value chain and suggest ways to make all components of the chain to be more competitive.

## 2. METHODOLOGY

The method employed in this study includes semi-structured informal interviews with key value chain actors including: input suppliers, farmers, producers, intermediate traders, wholesalers, retailers, processors and end users. This approach afforded the researchers the opportunity to gather required information from several value chain actors. Organisations such as: Federal and State Ministries of Agriculture and Rural Development; Agricultural Development Projects (ADPs), the Food and Agriculture Organization Corporate Statistical Database (FAOSTAT); EUROSTAT, National Horticultural Research Institute (NIHORT); Federal Institute of Industrial Research Oshodi (FIRO); National Research Institute for Chemical Technology (NARICT), Zaria; International Institute of Tropical Agriculture (IITA), Raw Materials Research and Development Council (RMRDC); Manufacturers Association of Nigeria and others provided published reports and databases used for secondary data gathering.

Extensive use was made of information from a national survey by the Raw Materials Research and Development Council, Abuja [22]. Information including production figures, agronomy technologies, products, previous research findings, traditional and modern handling procedures, processing methods, and equipment for processing tomatoes into different products were analysed.

## 3. RESULTS AND DISCUSSION

### 3.1 Varieties of Tomato in Nigeria

There are about 7500 tomato varieties worldwide [23]. One of the types known as Heirloom tomatoes is becoming increasingly popular, particularly among home gardeners and organic producers, because they produce more interesting and flavourful crops and are disease resistant [23].

While virtually all commercial tomato varieties are red, some cultivars – especially heirlooms – produce fruit in other colours, including green, yellow, orange, pink, black, brown, ivory, white, and purple. In Nigeria, the elite tomato varieties as shown in Fig. 1 [24] developed in the 1970's for the industries, by the Institute for Agricultural Research (IAR), Ahmadu Bello University, are still in use [25]. In addition, there are new varieties from Taiwan, but producers now prefer to plant hybrid seeds instead of local elite varieties due to their higher yield.



Fig. 1. A tomato variety in Nigeria

Table 1 [25] highlights the different varieties of tomatoes available in Nigeria. However, there are few varieties that were recommended by the International Institute for Tropical Agriculture (IITA) because of their high yield (Table 2).

### 3.2 Tomato Production Trend in Nigeria

Tomato grows in most parts of Nigeria, however the best area is the Savannah agro-ecological zone, where diseases and pests affecting tomatoes are less common. Major producing areas lie between latitude 7.5°N and 13°N and within a temperature range of 25°C- 34°C. These areas include states in the northern parts namely Bauchi, Benue, Borno, Kano, Kaduna, Plateau, Jigawa and some southern states like Delta, Kwara and Oyo. Tomatoes are warm season crop and are sensitive to high humidity / rain. Thus, increases in yield are experienced in well-drained, sandy loam, and rich in humus soils. The planting season is between August and September. However, where irrigation farming is practiced, the best time for planting is during the dry season.

The trend in tomato production in Nigeria from the year 2000 to 2010 is shown in Fig. 2 [2]. The highest yield was recorded in year 2010 and the lowest in 2006. Total yield in 2010 was 1,860,600 metric tonnes valued at \$687,610,000. Most tomatoes produced are destined for domestic market and yet they are scarce during off season.

The national demand for fresh tomatoes is about 2 – 3 million metric tonnes annually, leading to demand gap of about 500,000 metric tonnes. Between the year 2009 and 2010, a total of 105,000 metric tonnes of tomato paste valued at over N16 billion was imported to bridge the deficit gap. This points out the great opportunity to develop the value chain with improvements in productivity and competitiveness of all actors.

### 3.3 Tomato Wastage

Over 45% (750,000 metric tonnes) of tomatoes produced in Nigeria is estimated as annual loss due to poor food supply chain management, price instability resulting from seasonal fluctuation in production and the supply preference of farmers and middle men to urban market than processors due to low farm gate price [2]. As shown in Fig. 3 [26], tomato wastage occurs mainly at the processing, packaging and distribution stages. This is due to the poor processing technology, lack of good storage system and the transporting system used for the distribution of fresh tomatoes.

### 3.4 Tomato Production Seasonality

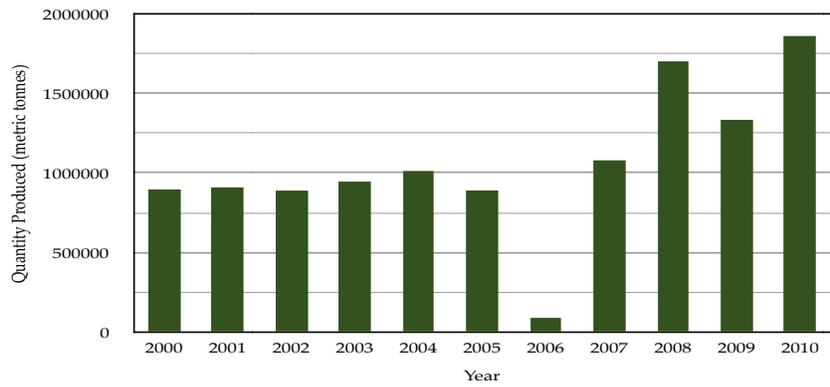
Fig. 4 [26] shows tomato product consumption trend in Nigeria Between January and April (months 1- 4), supply of fresh tomato is high and thus consumers rarely use other tomato products. However, from April to September (months 4-9), the supply of fresh tomato drastically declines representing the off season during which consumers turn to other forms (imported tomato paste). These changes result in fluctuation of tomato product prices and affect consumption pattern. At off season, imports of paste and concentrates increase to fill the gap in demand of tomatoes. Between September and November (9-10) both imports and fresh tomato supply decrease, while, towards the end of the year, imports of tomato paste increase due to the low supply of fresh tomato. Thus, to ensure steady supply of tomato, processing systems should be developed further.

### 3.5 Tomato Value Chain

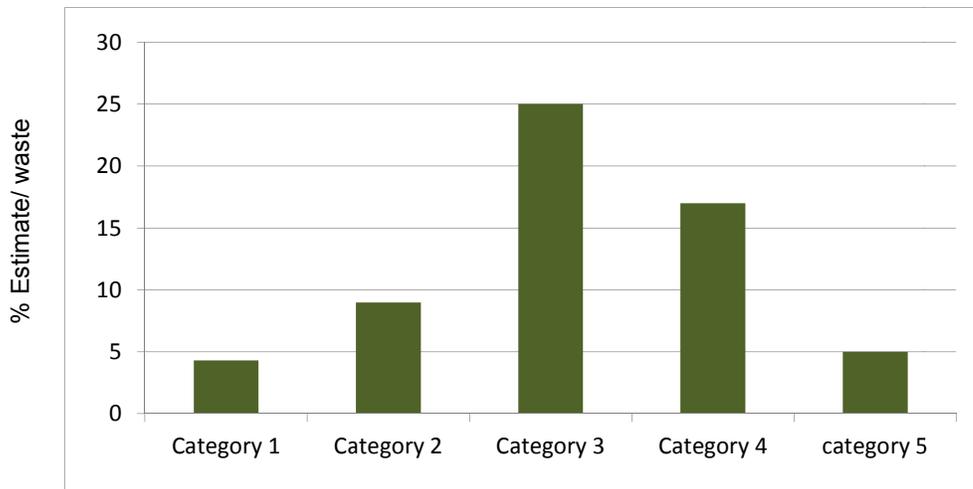
Value chain can be described as the chain that links various stages a product goes through, from its production, handling, processing and distribution to the consumer as shown in Fig. 5 [27]. According to FAO [27], in value chain system, farmers are linked to consumers' needs, working closely with suppliers and processors to produce specific goods to meet consumers' demand. Similarly, through flows of information and products, consumers are linked to the needs of farmers. Under this approach and through continuous innovation, the returns to farmers can be increased and livelihoods enhanced. Rather than focusing on profit on one link alone, players at all levels of the value chain can benefit. The tomato value chain system in Nigeria is made up of input suppliers, farmers, marketers and processors as shown in Fig. 6.

### 3.6 Production of Tomato

Fig. 6 shows that the first part of the value chain is input supplies. Tomatoes are first raised in nurseries before transplanting to the field. The input supplies required include seeds, fertilizer, pesticides, nursery supplies, greenhouse, ancillary equipment, etc. Most of the inputs are not produced in Nigeria, making them a little more expensive than what the farmers can afford. The difficulty in accessing inputs and technology makes it impossible for farmers to maximise production. Most of them have very small holdings, making commercial production impossible.

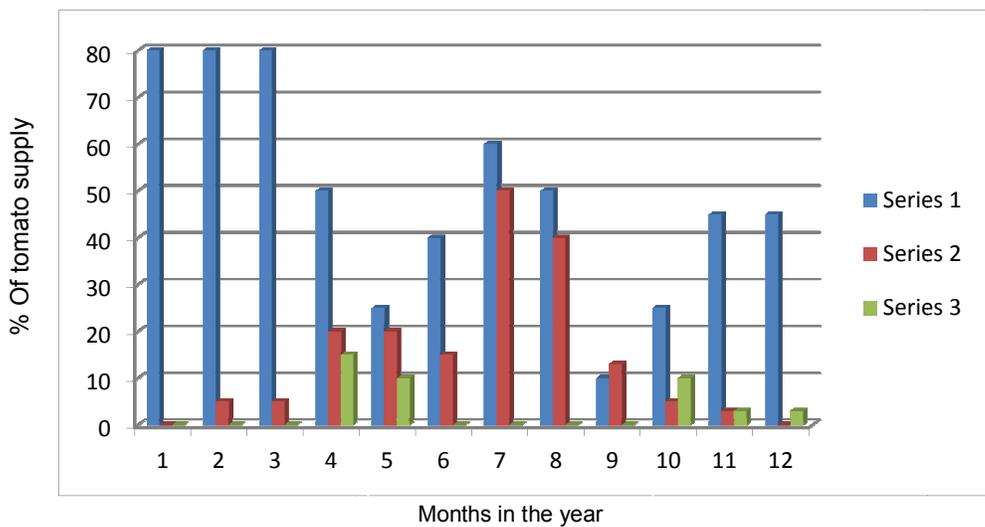


**Fig. 2. Tomato production trend in Nigeria (2000-2010)**



**Fig. 3. Tomato wastage at different stages in the value chain**

Category 1: Agricultural production; Category 2: Postharvest Handling and Storage; Category 3: Processing and Packaging; Category 4: Distribution; Category 5: Consumption



**Fig. 4. Seasonality of tomato production**

Series 1: Fresh Tomato supply; Series 2: Dried Tomato; Series 3: Canned Tomato

**Table 1. Tomato varieties available in Nigeria**

Name of variety	Original name	National code	Origin /source	Developing institution	Outstanding characteristics	Year of release
SAMTOM- 1	CIRIO – 56	NGLE-91-1	Introduction from steziona Agraria Sperimental e, bari, Italy	IAR, Samaru Zaria	High yielding, good paste qualities, field tolerance to leaf diseases and moderately resistant to fusarium race1.	1980
SAMTOM- 2	MARANI O	NGLE-91-2	Stazione sperimentante, parma Italy	-do-	-do-	1980
SAMTOM -3	PIACENZA 0164	NGLE-91-3	Institute NazionaleG ertica Rome Italy	-do-	High yield under heavy leaf spot disease pressure, good taste qualities.	1980
SAMTOM -4	Harvester	NGLE-91-4	FMG Corp, California U.S.A peto, Italian, parwa Italy USDA, Beltsville	-do-	High yield and some heat tolerant. Good paste qualities.	1980
SAMTOM– 5	CHICO	NGLE-91-5	Texas-A&M Weslaco	-do-	High yield and good paste qualities.	1980
SAMTOM -6	La bonita	NGLE-91-6	-do-	-do-	Uniform size, round and attractive fruit with skin suitable for salad	1980
SAMTOM -7	Roma- VF	NGLE-91-7	Royal sluis, Enkhuizen, Holland	-do-	Combines high yield with good paste qualities, good processing tomato	1980
SAMTOM– 8	Gamad	NGLE-91-8	Hazera seed ltd, Itafalsreal	-do-	High yield and good paste qualities, good processing	1980
SAMTOM -9	Gamed –F	NGLE-91-9	Hazara seeds ltd., Haltalsreal, Dizing of W.A.(Nig) ltd, Apapalagos.	-do-	Similar, to SAMTOM -8, but also resistant to fusarium yield 42,100-45,600kg/ha	1980
SAMTOM-10	Ife-1	NGLE-91-10	Faculty of Agriculture O.A.U. Ile Ife.	Faculty of Agriculture O.A.U. Ile Ife.	Medium size, round and attractive fruit with their skin, god for salad	1980

SAMTOM-11	Enterpriser	NGLE-91-11	USDA, Beltsville, Maryland, U.S.A	I.A.R. Samaru Zaria	Produces very large and attractive skin for salad.	1980
SAMTOM-12	Ronita	NGLE-91-12	Station and Arnwlioration des plates maraicheries monfave, France	-do-	High yielding and good paste qualities.	1980
Tomato	NHLE30	NGLE-00-13	Ibadan	NIHORT	Big pink fruits when ripe, high fruit setting under wet humid condition. Tolerant to root knot nematode.	1985
Onityre	NGLE-158-3	NGLE-00-14	Ogbomosho	NIHORT	Pinkish red puffy (ridged) fruits high fruits setting under wet humid condition. Tolerant to foliage diseases and root knot nematode	1985

(Source: NIHORT)

**Table 2. IITA recommended varieties of tomatoes for high yield**

Variety	Description
Ife No.1	High yielding, determinate bushy plant.
Ronita	Plum-shaped high quality fruits. Moderately resistant to root-knot nematode.
Local Cultivars	Fairly resistant to virus, round and irregular shaped fruits, soft and prone to cracking. Plants are intermittently tall and produce fruits for longer period.
H9 - 1-6	Resistance to foliage disease, high yielding with firm fruits

(Source: IITA, Ibadan.)

Most of the tomato producers are peasants or small-scale farmers (60%), although there are a few medium scale farmers (30%) and large scale farmers (10%) as shown in Table 3. Land preparation for small-scale farmers is done with manual tools (hoe). Medium scale farmers use a combination of hoes and tractor operated ploughs. Large-scale farmers use ploughs for land preparation and other preparation activities (transplanting, weeding, fertilizer application, etc.). Harvesting is done manually for all farmer categories.

### 3.7 Distribution of Tomato

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 (Fig. 6). Processors get their supplies directly from the farmers or the dealers. This component of the value chain is not organised in Nigeria, resulting in little or no value addition to the product.

### 3.8 Post-harvest Handling

Tomatoes are delicate fruit and if they are not handled carefully they deteriorate. In Nigeria, fresh tomatoes are packed in baskets for transportation to the market (Fig. 7). Although the aim is to allow air for ventilation, the baskets end up being stacked on top of each other, resulting in many injured fruit.

Grading simply consists of arranging the tomatoes into a number of uniform categories according to the economically important physical

and quality characteristics. The process involves identification, classification and separation. Grading of tomatoes is carried out because uniformity is one of the first attributes that buyers look for. The appearance attracts customers and

the different qualities can be sold to different customers, while the standards will create customer confidence in the product and more importantly in the producer.

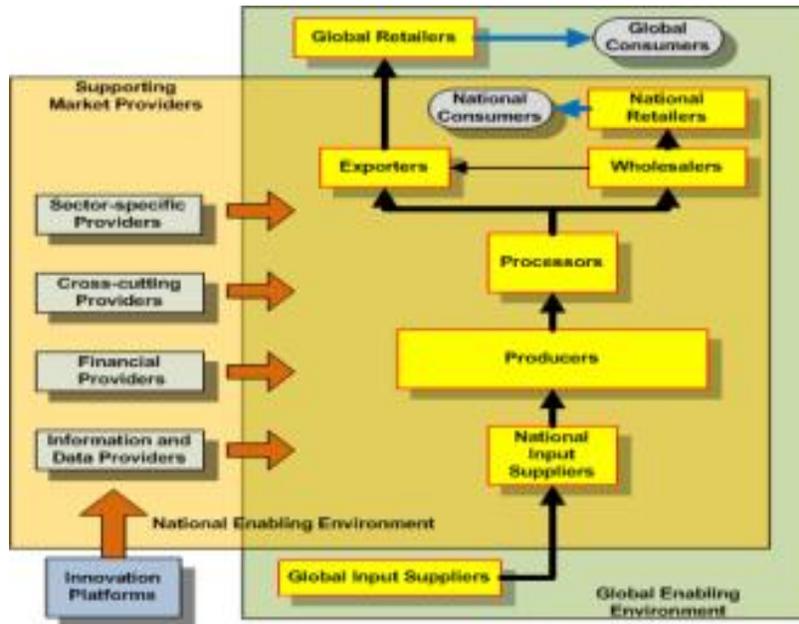


Fig. 5. An overview of the value chain system from suppliers to consumers

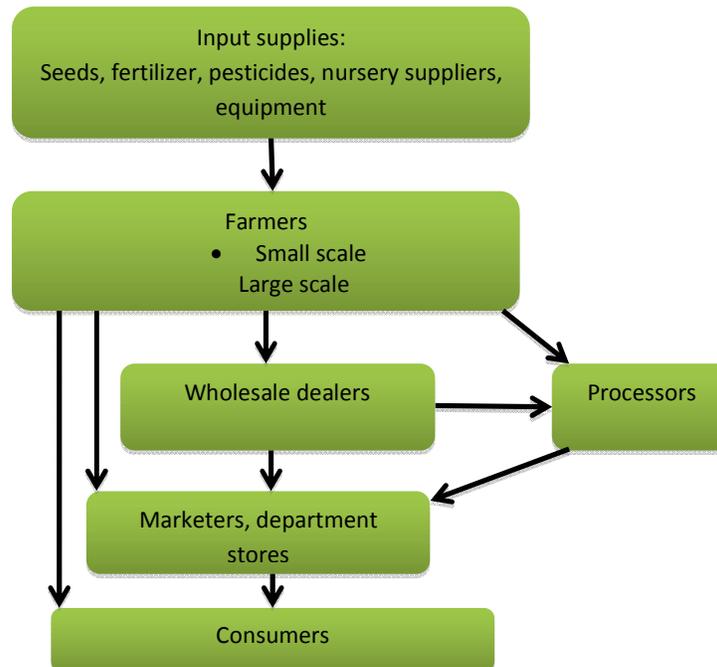


Fig. 6. Elements of tomato value chain in Nigeria

**Table 3. Categories of tomato farmers**

Category of farmers	Size of farmers (ha)	Percentage of total
Small scale	0.1 – 1.5	60
Medium scale	1.6 – 4.0	30
Large scale	>4	10



**Fig. 7. Tomatoes in the market**

Cold storage facilities are not readily available; as such tomatoes to be sold fresh must not be stored for long. Tomatoes that have been processed, for example into tomato purée or juice, or dried or pickled can be stored from several months to a few years. Tomatoes often need to be stored at different points while they are in transit to a final destination. For example the tomatoes are picked when ripe and stored for a few days in a cool room, after which they are transported to distant markets, but this component of the value chain needs technology input.

### 3.9 Marketing

Most of the fresh tomatoes produced in Nigeria are sold in the open market in baskets to the middlemen (Fig. 8b) while roadside vendors sell those sold to the consumers in small plates and baskets (Fig. 8a). The tomatoes for processing are supplied to the companies in baskets by the middlemen. However, currently there are no packaging systems for fresh tomatoes like in other countries except for a few supermarkets, where tomatoes are kept in the refrigerator until sold. There are no guaranteed pricing regimes.

### 3.10 Tomato Processing

Traditionally, the most important processing methods of processing used are concentration (to a paste or purée) and drying either fruit pieces or to a powder. Processing allows tomatoes to be kept longer, provides a more varied diet and also means that tomatoes are

consumed out of season. For commercial purposes, it is a way of generating extra income and more products are offered to buyers. Tomato processing has attracted some processing companies in Nigeria. Most of the processing companies are into packaging of concentrates rather than actual processing although a few of them process fresh tomatoes. The list of tomato processing companies, their status and the reason behind the ones that have closed down are shown in Table 4 [28].



**Fig. 8a. Tomato sold in the market**



**Fig. 8b. Tomatoes sold in baskets**

Table 4 shows that some of the industries are faced with different problems from lack of good quality fruit for processing to infrastructure problems and lack of processing equipment. Thus, most of the tomato products (ketchup, puree, fresh juice, powder, soup) found in the grocery shops are imported (Fig. 9). In total, only a few (20%) tomato products are produced in Nigeria, while the majority (80%) are imported (Table 5).



**Fig. 9. Imported canned tomatoes in supermarkets**

It must be noted that currently, there is an upsurge in tomato processing activities within the country. This needs to be sustained through protection of local industries and development of the value chain to ensure sustainable supply of raw materials to the industries. In addition, we note that these are mostly large-scale industries. There is a need to assist Small and Medium Enterprises (SMEs) in this sector to grow, to satisfy the market. There is also need for packaging systems for retail markets. These and other needs of local consumers provide vast investment opportunities for entrepreneurs.

### **3.11 Challenges of Developing Tomato Value Chain**

Challenges facing tomato value chain include: production, processing and storage, marketing, funding, Research and Development (R&D).

#### **3.11.1 Production constraints**

The production constraints identified include: use of poor agricultural practices; unwillingness of communities to give out land to interested investors to go into commercial production; lack of good quality seeds and over application of fertilizer and other insecticides by farmers. Other constraints include: high cost of critical production inputs such as irrigation equipment, greenhouse, machinery, fertilizer and pesticide, lack of experienced technical manpower in tomato production and management, infrastructure and basic amenities such as electricity, roads and water. The lack of good quality seeds and non-adoption of Good Agricultural Practice (GAP) result in poor yields and low productivity. For example, the average yield, using local production practices is about 10

tonnes per hectare. With improved seed varieties and GAP, yields as high as 60 tonnes per hectare can be obtained [29]. Inadequate transport facilities, for example the conditions of the roads linking the farm areas to the markets are poor and they are sometimes inaccessible. To farmers, it leads to losses, as their produce will not be accessible and high transportation cost reduces the profit. The breakdown of vehicles and basket containing tomato lead to losses and high marketing cost for wholesalers, retailers and consumers.

#### **3.11.2 Storage constraints**

The perishable nature of tomatoes requires good transportation network and storage and adequate processing facilities. The limited access to these facilities has led to the loss of about 50% of the tomatoes produced in the country. The use of baskets instead of crates for storage and transportation causes heavy spoilage, low fluctuating prices and low tomato quality. High cost of storage materials has been a major problem leading to high wastage. The poor dissemination of research information on tomato storage and also the issues of pest and disease management and low productivity due to the use of unimproved varieties also affect tomato losses. There is the need to have supply management companies that can use the right type of technology to store tomatoes before sales or processing.

#### **3.11.3 Marketing challenges**

The market showed that price fluctuation resulted from the raw product availability changes during the season. The instability of prices implies that actors face difficulties in forecasting their revenue, leading to poor planning. This supports the result of Godwin et al. [30] that commodity prices may reflect seasonal production patterns by being at their lowest at peak production and highest at lean season. Also according to Amikuzuno and Ihle [31] tomato production shows a pronounced seasonal pattern, and prices of fresh tomatoes, but in Nigeria this typically vary substantially. Furthermore, the lack of knowledge or different ways of marketing, affects the marketing decision and production of the produce. The lack of a good marketing structure and marketing information is a major challenge that affects producers.

**Table 4. Tomato processing companies in Nigeria**

S/no	Name & Address of Company	Products	Status	Remarks
1	Quality Foods, Ibadan, Oyo State	Tomato paste	Closed down	Closed down due to raw material shortage
2	Erisco Foods Ltd Oyeleke Street, OregunAlausa, Ikeja. P.O. Box 55886, Falomo Ikoyi, Lagos	Tomato paste	Functioning	
3	Tropical General Investment Nig. Ltd 14, Chinta Avenue, Ajao Estate, Lagos	Tomato paste	Functioning	
4.	Vitals Products Limited. Vital House, Plot 22A Cocoa Industry Road Ogba, Ikeja Lagos, Nigeria. 7914466,791298	Tomato paste Tomato Concentrates	Operational	Producers of vitali tomato puree, vitali double concentrates tomato paste, introduced in 2005
5	Vegefresh Company Limited, Lagos	Tomato paste	Rehabilitation and execution	Signed MOU with National Horticultural Research Institute (NIHORT) to boost tomatoes processing in Nigeria.
6	Savannah Integrated Farms Dadin-Kowa, Gombe	Tomato paste	Rehabilitation and execution	Bought Vegfru plant, Gombe state in late 1990s
7	Jigawa State Tomato and Citrus Processing Complex	Tomato paste Fruit juice	Commissioned 1998, closed 2002	-Difficulties in obtaining finance - problems with supply of raw materials - No training of any kind was done - lack of packaging materials
8	Perfect Integrated Foods Industry Limited, Arigidi Akoko, Ondo State	Tomato paste	Functioning	
9	Cadbury Nigeria Limited	Tomato paste Puree, sauce, ketchup, and juice.	Functioning	
10.	Gongola Fruits Processing Industries	Tomato paste Puree, sauce, ketchup and juice.	Closed down	
11.	Ikara Foods Processing Company Ikara, Kaduna	Tomato juice	Not functioning	Water and power installed and looking for core investors.
12	Dangote, Kadawa, Kano	Tomato paste	Functioning	

**3.11.4 Processing constraints**

Processing of tomatoes is faced with challenges including: inadequate raw material, especially improved varieties for processing, high cost of processing and packaging machinery and equipment, preference of farmers and middlemen to sell to urban markets rather than sell to processors, inadequate infrastructures such as water and power supply, harassment of investors by law enforcement agencies on raw materials and finished products. These challenges result in high cost of production for industries involved in processing tomato. In addition, these industries battle with excessive imports of tomato products. These products are imported into Nigeria at lower prices. In order to protect the investors who are currently investing billions of Naira to establish processing plants for tomato, it may not be out of place to adjust tariff regimes or place outright ban on imports of finished tomato products into Nigeria.

**Table 5. Percentage of tomato products found in Nigeria**

Sources of tomato	Percentage of total
Locally produced	20
Imported tomato	80

**3.11.5 Finance and funding constraints**

Like many agricultural ventures in Nigeria, tomato production, processing, marketing, storage etc. are faced with the challenge of raising adequate funds for acquiring the infrastructure and technology required to make the business to be competitive. To produce competitive products proper machinery is required, and these machines are costly since most of them are imported. Raising business capital is difficult in Nigeria because of high cost of funding and few available venture capital companies and the fact that commercial banks require stiff collaterals. According to Robinson and Kolavalli [32] due to the risky nature of agriculture, lending institutions are usually unwilling to extend credit to the sector and, when they do, it is often untimely with high interest rate. The only viable option is development banks such as Bank of Industry (BOI), Bank of Agriculture (BOA) and Nigerian Export Import Bank (NEXIM).

**3.11.6 Research and development constraints**

Some of the constraints faced by components of the value chain for tomato can be solved by

adequate Research and Development (R&D). Most research centres lack equipment and laboratories to do cutting edge research. In addition, when they do research and come up with good results, commercialization is a major problem. Areas that require research intervention include: improved planting materials; cultural practices; technologies for harvesting, handling, storage, processing and transportation.

Closely related to R&D is the issue of relevant skills required to use modern technology in all aspects of the value chain. Operators of the components of the value chain require training in relevant skills. Organisations such as Raw Materials Research and Development Council (RMRDC), Nigerian Horticultural Research Institute (NIHORT) and Federal Ministry of Agriculture and Rural Development (FMARD) have in the past organised training workshops, conferences and seminars on tomato production and processing in different states in Nigeria. These need to be deepened in order to convey new research findings and for researchers to interact with other stakeholders. The R&D needs in the sector include: development of improved varieties; GAP; technologies for production, handling, storage and processing of tomato.

**3.12 Strategies for Improving the Value Chain for Tomato**

This paper has brought up the need for a policy shift to transform the entire tomato value chain through increased sustainable production to provide primary raw materials, encouraging the establishment of more industries for processing, build skills on Good Agricultural Practice (GAP), establish certification procedures to maintain standards and establish appropriate marketing regimes. In addition, fresh tomato should also be better packed in improved boxes for sale in department stores. There is the need therefore to have new generation of supply chain managers and processors, who can add value and transform tomato into well packaged and properly handled products for storage and at the same time process into different products. The major challenge is the acquisition of relevant equipment and logistics to improve the value chain. This can be solved through research, development and commercialization of R&D findings.

Entrepreneurs can also acquire imported equipment for this purpose. One major challenge is funding. This can be solved by setting up a

Tomato Revival Fund which can be used to finance improvement in all sectors of tomato value chain. Such fund can be used to support R&D work and local production of equipment and at the same time make soft loans available to entrepreneurs willing to go into the business of production, handling, transportation, processing and marketing of tomato. Two groups of entrepreneurs need to be encouraged namely large-scale industries and SMEs. The SMEs can be assisted to form clusters and these clusters, working in collaboration with large-scale industries, can encourage farmers with input supplies and guaranteed prices for their products.

There should be more synergy among the various stakeholders in tomato value chain. These include government agencies, equipment manufacturers and vendors; Research Institutes and Universities; entrepreneurs, SMEs, large scale manufacturers; wholesale dealers; traders; financiers and farmers. These different groups should be organised into a vibrant Commodity Association for tomato to encourage collaboration towards improving the competitiveness of each component of the value chain. Finally, government should consider a new policy of backward integration in the sector and possibly a ban on the importation of processed tomato products into Nigeria.

It must be noted that some of the suggestions above are already being implemented by the FMARD of Nigeria through the ATA programme [26]. This should be sustained.

#### 4. CONCLUSION

The study on the development of tomato value chain in Nigeria was carried out to bridge the gap in knowledge and to promote the tomato value chain. The study revealed that although tomato is produced in large quantities in the northern part of Nigeria, a lot of it is lost due to its perishability and lack of processing companies to process the raw tomatoes into paste and other products. Furthermore, only a few of the tomato varieties in Nigeria are suitable for industrial processing.

The value chain approach could be used to improve tomato production through an improved process technology to reduce the losses arising due to the perishability of the harvested product. Furthermore, the inadequate funding of research work on tomato inhibits developing knowledge for solutions to the problems faced by farmers and

processors. There is need to encourage research work on improved seeds, the use of modern agricultural equipment to enhance the mass production of tomato which could lead to reactivation of the companies that have closed down due to lack of raw materials and processing equipment, and opening of more processing industries in the country. Also the tomato farmers need to be assisted with improved quality seeds as some of them do not know the good varieties to grow in their area. Processors also require good quality tomato for processing and an increased financial assistance to enable them acquire modern equipment for production, processing and marketing of tomatoes. The local industries need some level of protection either in form of tariff adjustment or total ban on imports of tomato products.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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