Tomato Production and Marketing Value Chain Analysis©

GEMS4 Wholesale and Retail

DEPARTMENT FOR INTERNATIONAL DEVELOPMENT
Nigeria

Tomato Production and Marketing Value Chain Analysis©

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DFID

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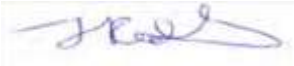


Jonathon Ridley, Project Director

Cover photo: Tomato loading facility in Kano, Nigeria

Contents

Section 1:	Report Preview	1
	Review of Tomato Production and Marketing	2
	Production	2
	Annual supply and demand	5
	Supply, demand and locality	7
	Seasonal supply and demand	9
	Best post-harvest practices and standards	10
	SWOT analysis	13
Section 2:	Current Value Chain Analyses	14
	Current supply and distribution chain	14
	Analysis of current value chain	21
Section 3:	Identification and Selection of Interventions	27
	Constraints identified	27
	Selection of interventions	31
Section 4:	Analysis and Comparison of Interventions	32
	Analysis of intervention value chains	32
	Comparison of intervention options	42
Section 5:	Impact Analysis of Interventions	43
	Impact analysis on number of actors	43
	Impact on value of tomatoes traded	44
Section 6:	Evaluation of Interventions	47
	Direct sales to wholesalers-retailers	47
	Introduction of plastic crates	48
	Introduction of crates and up-graded transport	49
	Ranking of risks	49
Section 7:	Research	51
	Information research	51
	Capacity building	51
Annexes:	Assumptions	

Production, population and consumption

Value chain analyses details

Packing centre costs

References

Report Preview

This report and assessment of the fresh tomato industry in Nigeria is dealt with in three sections; a review of the literature and available data is made, tomato value chains are analysed and proposed interventions assessed.

- The purpose of the review is to provide perspective to tomato production and marketing system in Nigeria and focus on significant constraints in the system that would be most responsive to appropriate interventions. Attention is given to sale of produce by farmers, distribution lines, marketing systems and the dynamics of supply and demand involving wholesalers, retailers and consumers. This is analysed to highlight the systems' strengths, weaknesses and possible opportunities, and to predict future trends.
- Analysis of current tomato value chains identifies causes and effects of shortcomings in the system; this enables identification of specific opportunities for practical changes that could have significant and sustainable impact. These analyses enable quantitative comparisons with proposed changes.
- The appropriate interventions are, however, not without risk; procedures must be evaluated to assess chances of successful implementation and long-term expansion and sustained growth.

Review of Tomato Production and Marketing

The cultivated tomato is widely grown around the world and is the second most consumed vegetable after potato. Nigeria produces the second most tomatoes in Africa after Egypt and is the 14th largest worldwide (11). However the production and marketing systems often do not compare favourably with other countries and deficiencies mean that returns to farmers, wholesalers and retailers are marginal and the selling price to consumers high.

Over time, several formal studies have been done on tomato production and its value chains, but in recent years much attention has originated from the media. This is partly because of the governments' policy of reducing dependency on food imports. The main issues highlighted in the press and to which attention must be paid are outlined below.

- Since 2000 import of tomatoes and tomato products has increased by over 400% and in a study by the Central Bank of Nigeria (CBN) it was estimated that $ 360 million (N 58 billion) was spent on import of 300 000 tons of tomato products in 2011 annually (NISRAL Study, 2011; 14). This compares with the average annual sales of about 1 500 00 tons of fresh tomatoes in the country. The Federal Ministry of Agriculture and Rural Development, FMARD, estimates that there is a demand gap of 500 000 tons of tomatoes albeit in fresh and processed product (12).
- Much of the tomato crop is produced in the north and sold in the south. At the peak of seasonal production in the north, selling prices in the south drop and it is uneconomic to transport tomatoes; this excess is then abandoned in the field and ploughed in. Attention has been drawn, by the press, to the irony of the ever-increasing imports contrasting with the wastage in the field.
- It is estimated that up to 50 per cent of production is lost, not only through crops being abandoned but also due to the poor supply chain system (19). The product that is damaged is discarded (or used for seed for the following crop), and if not discarded much of it is down-graded to a lesser quality.

The review of tomato production, supply and demand provides not only indications of the weak links in the value chain but also enables trends in consumer demand to be identified and the direction of future development in the market to be forecasted with more confidence.

It must be noted that the system is a free trading system with few regulations and those that do exist are often self-imposed. Players in the distribution and marketing system will react to and be influenced by commercial issues. Commercial benefits must therefore, be clearly stated, exhibited and demonstrated for adoption and sustained growth of any proposed changes.

1.1 Production

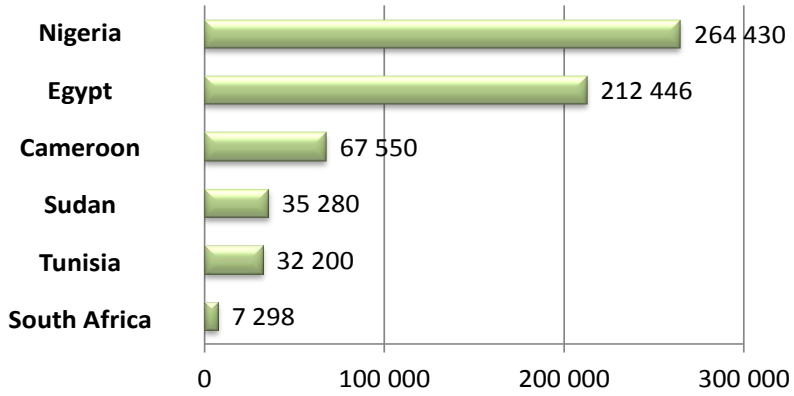
Small-holders growing from 0.5 to two hectares of tomatoes produce most of the crop. There are also farmers growing on even smaller areas but mainly for their own domestic consumption; there are some larger scale producers in the north. Tomatoes are grown in every state but production is more suited to the climatic conditions of northern states; high rainfall and longer rainy seasons in the south lead to higher levels of pests and diseases, leaching of nutrients and poor yield levels. In the north tomatoes are planted with the rains and towards the end of the rainy season (5). This enables the crop to grow through the cooler part of the year (tomatoes are sensitive to high temperatures and flowering and fruit formation is limited over 35oC). Planting at the end of the rains is made possible by growing the crop in the flood-prone plains and river basins, together with irrigation developments. Some of these are the Kano River Development Project, Bakolori Project and Lower Anambora Irrigation Project and cover, in total, about 35 000 ha. These conditions are suited to larger scale tomato farms.

Annually tomatoes are grown on over 250 000 ha throughout the country, yields are low and on average at least 1 500 000 tons are produced countrywide per annum. The deficiencies in production systems are reflected when comparison is made with other African countries (see table below). However yields per hectare and total production reflect the amount of product sold and consumed; wastage in the supply chain

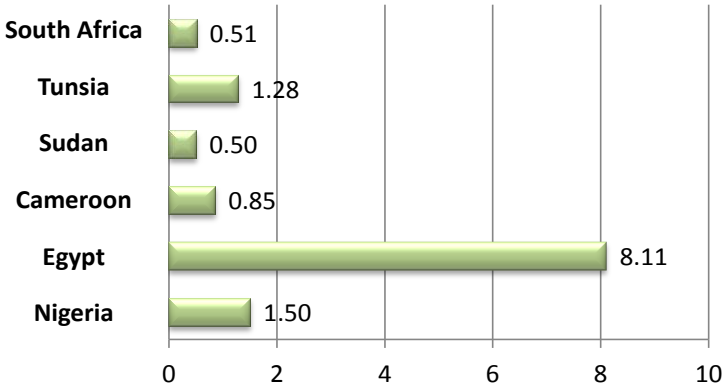
from the farm to the consumer is estimated to be up to 40% (this excludes production abandoned in the field in some seasons).

Graph 1: Production statistics of the six top tomato producing countries in Africa

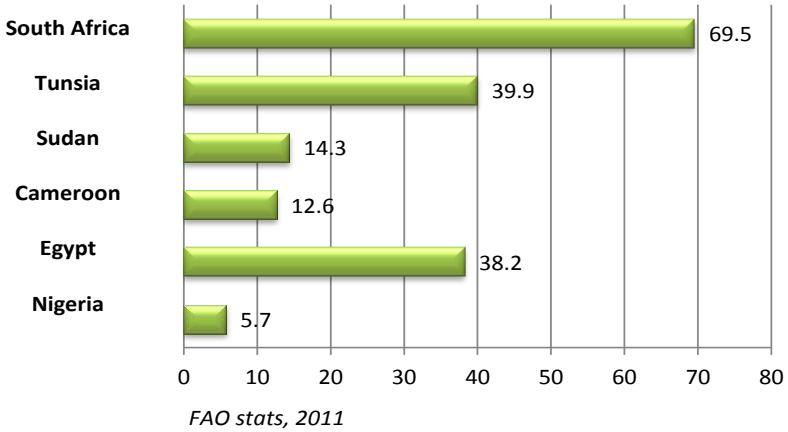
Total area of tomato production, ha (FAO stats 2009, ref. 11)



Total production, tons (million) per annum



Yield of tomatoes, tons per ha



FAO stats, 2011

As mentioned most production originates from the north. Production in individual states has been proportionally calculated from areas under production in each state and the annual production for the country (see figures on individual states in in the Annexure; Abba Aminu and Shehu A. Musa, 2007 (2) and

FAO stats, 2009. These figures have been aggregated into six main regions within the country to provide an estimate for comparative purposes (as shown in the table below).The aggregation of states to form these regions is shown below.

Figure 1: Six regional areas used to summarise tomato production in Nigeria.

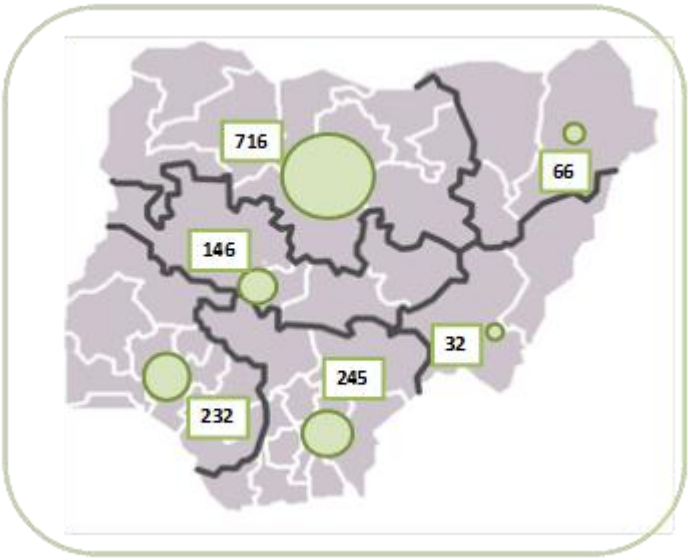
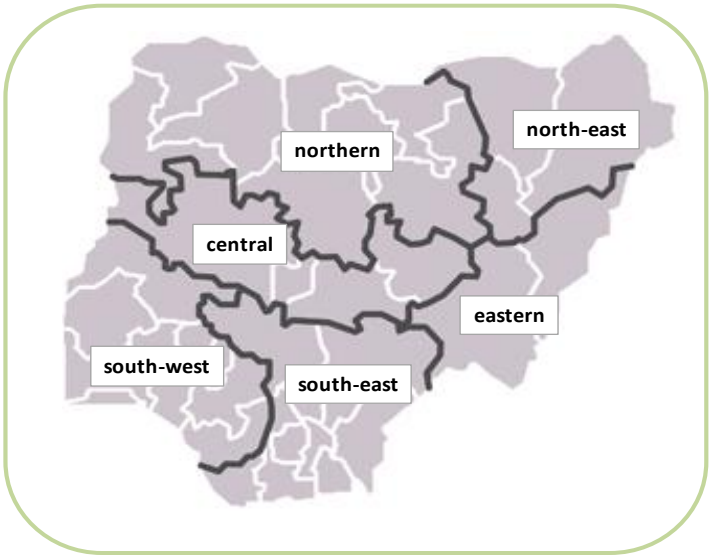


Figure 2: Estimated tomato production in 6 main regions of the country (tons x000 per annum, based on total production in 2009)



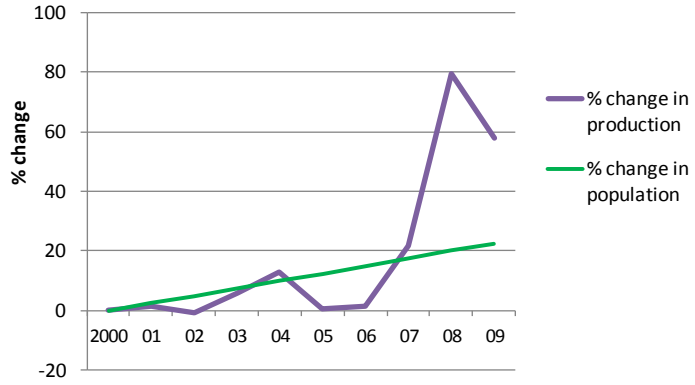
1.1.1 Analysis

- Yields are low because of various inappropriate production practices (poor seedlings, old varieties, low fertility, inadequate pest and weed control).
- Yield losses are further exaggerated by significantly high post-harvest losses, a result of the often poor handling and distribution system.

1.2 Annual supply and demand

Production of a commodity is characteristically related to demand and increases with increasing population growth (demand). However, tomato production in Nigeria has increased by over 60% in 10 years from 2000 to 2009 while the population has increased by 20% (see graph below).

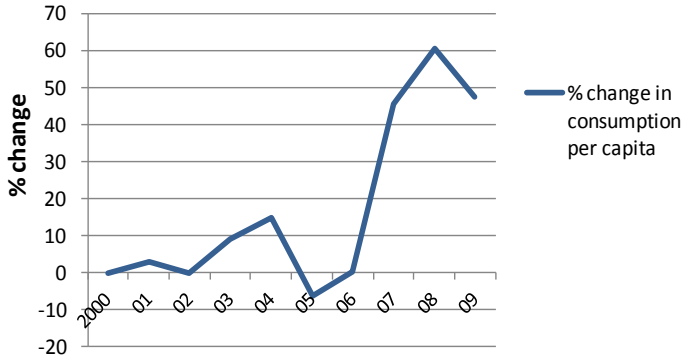
Graph 2.
Change in production with increase in population



(All changes are a percentage of the parameter values in 2000)

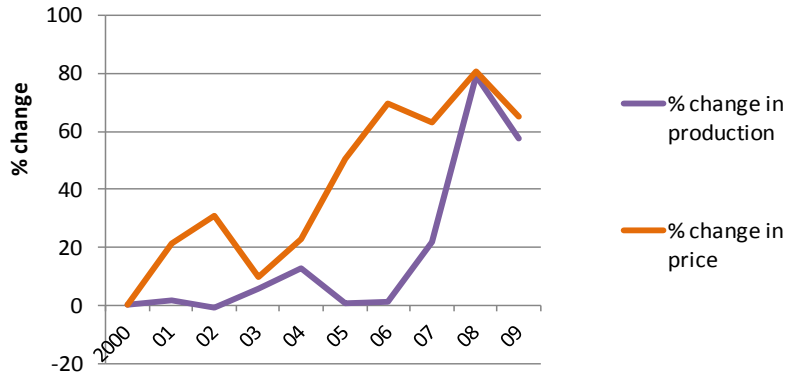
This obviously means that the consumption per capita is increasing annually indicating generally improved economic circumstances of the consumer. This is shown in the graph below. In 2005 and 2006 total production decreased when there was obviously insufficient supply.

Graph 3.
Change in consumption



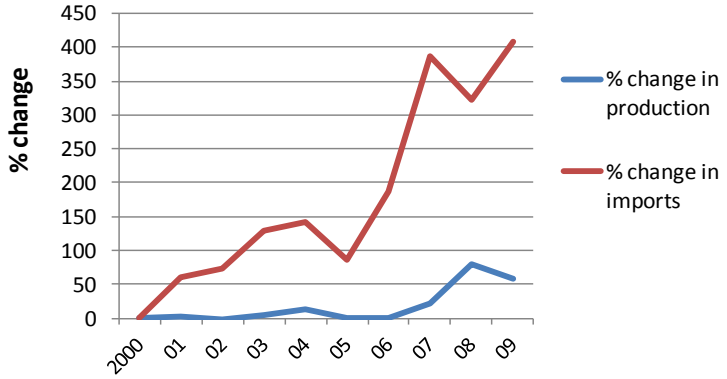
With increasing supply, demand is normally diluted and there is downward trend in prices. However this has not been the case and over the 10 year period both production and prices have increased by over 60%. There have been three decreases in price, the first two probably in response to marked increases in the following year's production and the third following the downturn in the economy in 2008.

Graph 4.
Change in price and production



These are overall figures for the country and do not differentiate between consumer demand within the country either for quality or between locations. To segregate types of demand, production over the 10 years is compared with changes in import of tomato products, and a significant trend can be seen.

Graph 5.
Change in tomato production compared with change in imports

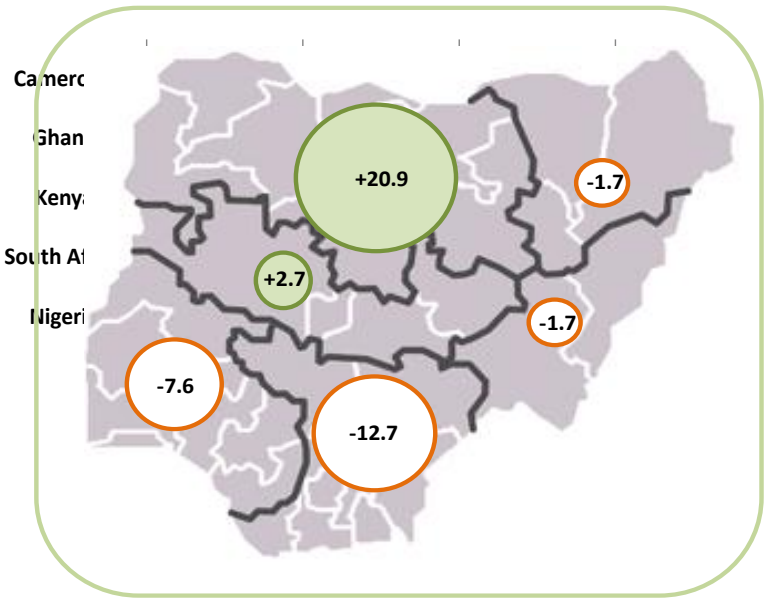


Imports have increased by up to 400%, while production increased about 60%. This increase in imports could be partly due to more lenient import regulations but it does, regardless, show a large demand for these products from this consumer sector. That is, there are consumers willing to pay for products which are more expensive in relative terms than the local fresh tomatoes. (However comparisons between fresh tomatoes and canned products must be done with caution as they often fulfil different consumer needs).

1.2.1 Analysis:

- On an annual scale, the supply of fresh tomatoes is not meeting demand and the shortfall is probably about 500 000 tons per annum as estimated by FMARD (12).
- The demand per capita (consumer consumption) is increasing indicating the improved average economic circumstances of individuals. Obviously this contributes to the increasing annual total demand. Comparing the per capita consumption with neighbouring countries and other African countries it is apparent that individual consumption could still increase significantly more, in favourable economic conditions.

Graph 6: Consumption of fresh tomatoes per capita, kg/capita/annum

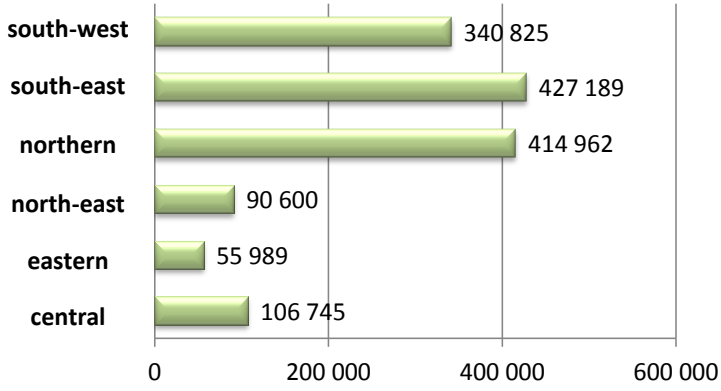


- There is an indication that the demand for tomato products from the increasing middle class consumers is increasing very rapidly. This indicates increasing demand for good quality fresh tomatoes.

1.3 Supply, demand and locality

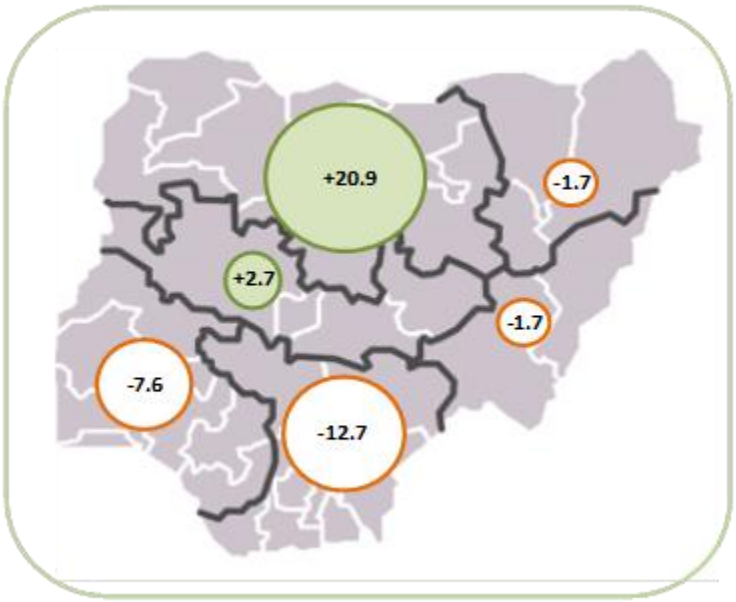
It has been shown that production (supply) of tomatoes in the northern region is up to three times higher than the next two main tomato producing regions, the south-west and south-east. However the demand from each of these regions has not been well defined as yet. To estimate the demand, it is assumed that the population in each region consumes 10.2 kg/capita/annum.

Graph 7: Estimated consumption, tons / annum (assumption based on 10.2 kg consumed /capita/ annum; FAO data 2009)



The question is, however; what is the surplus or deficit in each region. This is shown in the figure below as a percentage surplus or deficit of the total production.

Figure 3: Surplus or deficit in tomato production within each region (%age of total annual production, 2009)



From this it is obvious there is major distribution of fresh tomatoes from the northern (and to a lesser extent central areas) production areas to the markets in the south. It is of importance is to establish the actual amount of product being moved to the south.

If the production in the northern region is used in an estimate of the tonnage to be moved, this would be 20.9% of the annual production of 1 436 310 tons (data from 2009 analysed; FAO stats, 11). This is an amount of 300 200 tons. The production season in the north can last for up to 7 months (200 days) so this amount would constitute 75 trucks carrying 20 tons of produce each, leaving the north (Kano and Kaduna) daily, for 7 months.

However anecdotal reports state that at peak periods up to 80 or more 20-ton trucks of tomatoes arrive daily at Mile-12 market in Lagos, alone (6 and 18). There will be other trucks distributing to other centres during the northern production season.

1.3.1 Analysis:

Two assumptions in the initial calculations must be questioned.

- The assumption that a uniform 10.2 kg/capita of tomatoes is consumed per year could be more in the south, particularly Lagos. This means the demand in the south is related not only to the population size but also significantly related purchasing power of the consumers through better economic conditions enabling the routine purchase of tomatoes. Gross domestic product per capita per annum in the south is estimated at N 230 000 and N 115 000 in the north (14).
- It is also possible that yields across the country are not uniform. It is possible they are higher in the north, lower in the south (because of climatic conditions) and that deficit of tomato supply in the south are greater than assumed.

Approximately 30% of the total annual production is moved from the production areas in the north to the markets of the south. This is a trip of 985 km from Kano to Lagos and 755km from Kaduna to Lagos which takes 48 to 72 hours. The poor supply chain conditions result in wastage (discards) of about 20% or 65 000 tons. Several elements in this supply chain are the weakest links in the whole tomato value chain and have the most significant impact on the industry (besides shortcomings in production).

Demand in the south, particularly Lagos, for fresh tomatoes is very strong. Strong consumer demand translates into discerning demand for quality; this is being exhibited by rising consumption of imported fresh tomatoes and canned products. These purchases are often at the expense of originally good quality tomatoes from the north which are down-graded during distribution.

Figure 4: Transport route of tomatoes from north to south (Kano – Lagos 985km; Kaduna – Lagos 755km)

(USAid, 2013; 15)

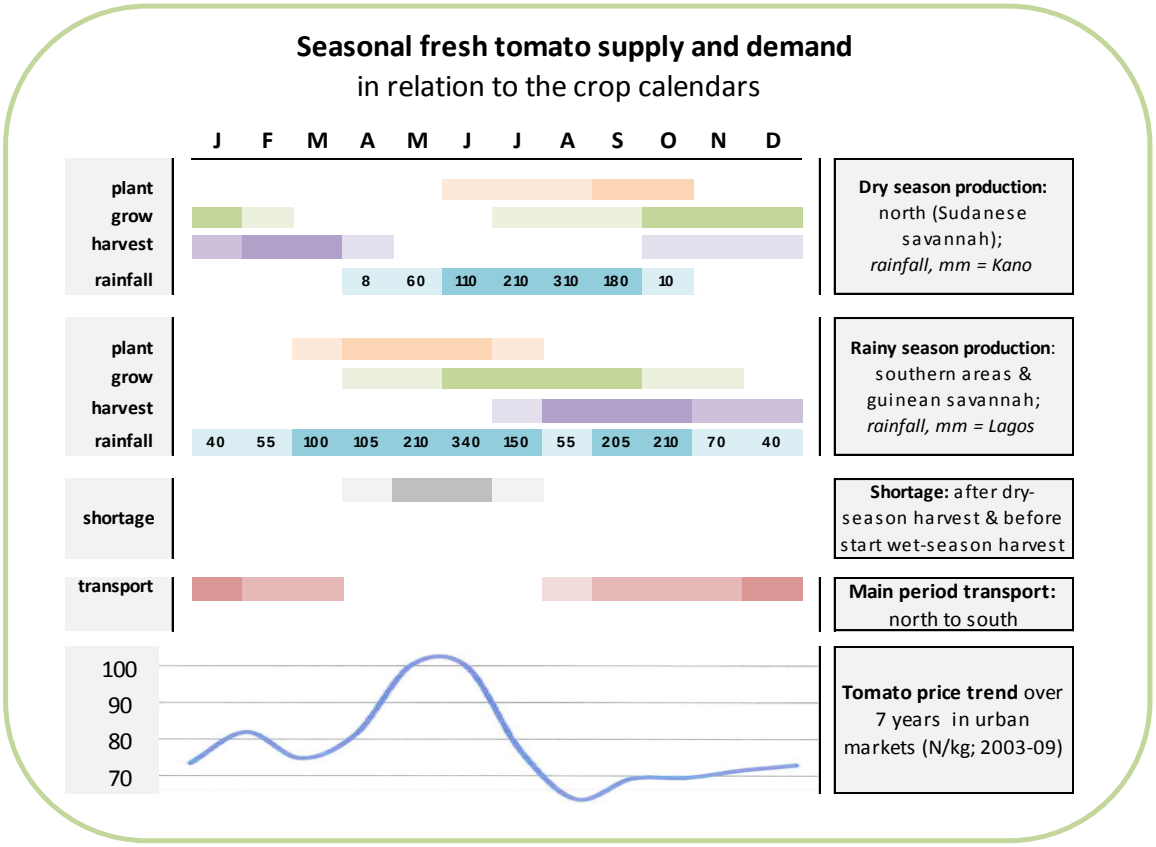
1.4 Seasonal supply and demand

The prices of fresh tomatoes are characteristically volatile and unpredictable in most markets worldwide. Long term price averages do, however, show trends, enabling analysis and identification of the causes of fluctuations in prices.

Monthly urban prices over a 7 year period were averaged from data of Adenegan, K. O. and I. B. Adeoye, 2011 (5). These prices trends are compared with the crop calendars (10) of the dry season production (in the north) with the wet season production (in the south).

- This shows, in particular, periods of main harvesting and selling which appear to peak from August to December. At this time over-production can lead to distribution of product to the south being non-viable and abandonment of crops in the field.
- In May and June the supply of tomatoes is low and prices high in the urban markets.
- Transport of produce to the south is mainly during the period September to march (7 months).

Figure 5



Prices: N per kilogram of tomatoes at urban markets; 7 year average (Oyo State; 5)

1.4.1 Analysis

The average prices varied from lows of about N 60/kg in August to N 102 /kg in May, an increase of about 70%. However the extreme prices in the original data ranged from N 40 /kg in September 2004 to N 130/kg in May 2009, an increase of 325%. Analysis of value chains must account for these variations in order to identify periods when selling northern-produced tomatoes in the south is marginal. Data for Lagos markets are critical in any analysis because of the size of the market.

1.5 Best post-harvest practices and standards

Best practices for handling, storing, transporting and marketing fresh tomatoes have been summarised mainly from the EU regulations “Marketing Standards for Tomatoes”, 2011 (9). This is compared with information from a study done in Kano State on the post-harvest challenges for small-scale tomato growers (16).

Tomatoes, in a similar way to other fresh perishable produce, need to be sold as soon as possible after harvesting to ensure their quality. To prevent deterioration of quality, growers, wholesalers and retailers invest in equipment and procedures that preserves the quality as long as possible. This is apparent from the stipulated best practices shown in the table below. Of critical importance with perishable produce, especially tomatoes, is the ability to cool them and preserve quality for appropriate periods. However in Nigeria it is obvious that this level of investment by actors in the value chain has not been possible because of the marginal returns at all stages. Added to this, are the intermittent power outages which make effective storage-cooling difficult.

1.5.1 Analysis

- The distribution and marketing model that has evolved in Nigeria involves numerous participants between the grower and the consumer. These players are mostly traders buying and selling the produce and not service providers. This in itself leads to inefficiencies.
- The energies of these small traders are focused on maximising the returns between buying and selling and there is little awareness of up-stream and down-stream consequences which they seemingly do not have control over. For example, the grower concern, that producer's in more established markets have, about quality is lost once the product is sold to the wholesaler at the collection centre.
- In comparison in established markets, growers sell to the retailer albeit through commission agents and distributors (or even through direct contracts with retailers). This ensures sale of better quality produce, better returns and the ability to invest in cooling equipment and appropriate transport.
- There is timely transfer of market information (quality and price) from the consumer via the retailer and other parties to the grower with each shipment. Obviously this is only possible if the source (grower and distributors) is known.

Table 1: Summary of best post-harvest practices compared with actual practices (from study in Kano State, 2010; 16)

		Best practices:	Actual:
Harvesting:		Depending on market:-	
		- Mature green	seldom
		- Light red	25%
		- Firm-ripe	75%
Packing and grading facilities:		- Covered pack shed with temperature control; 12 to 20^{o}C - Washing facilities	- Under tree, 90% - Farm structure, 10% - (Collection point, uncovered)
Storage:		8^{o}C; 3 days storage possible 10^{o}C; 8 days 12^{o}C; 10 days 14^{o}C; 13 days 18^{o}C; 10 days 20^{o}C; 8 days	Not stored
Transport:			
Vehicle:		Refrigerated vehicle, 12 to 18oC (heat injury >32oC)	- Open lorry, 63% (temperatures >32^{o}C at times) - Closed lorry, 37%
Packing:		Rigid stackable crates or boxes	- Baskets, 63% - Sack bags, 37%
Wholesale and retail facilities		Covered off-loading, sorting, trading and re-loading areas. Cool room, 12 to 20^{o}C, if needed.	Wholesale areas open; some retail areas covered at point of sale.
Market:			
Minimum requirements		Tomatoes should be intact, fresh and sound without spots, cracks, bruises . They must be clean, free from foreign matter, off-smell or taste. They should be regular in shape and colour typical of the variety.	none
Grades:	Extra grade:	Tomatoes in this class must be of superior quality. They must be firm and characteristic of the variety and/or commercial type.	individual trader standard
	Class 1	Tomatoes in this class must be of good quality. They must be reasonably firm and characteristic of the variety and/or commercial type.	individual trader standard
	Class 2	This class includes tomatoes which do not qualify for inclusion in the higher classes, but satisfy the minimum requirements specified above.	individual trader standard
Marking requirements:		- Identification of supplier (agent or producer) - Nature of produce and variety - Orgin of produce (farm, district) - Produce: Class Size	none " " "

1.6 SWOT analysis

1.6.1 Strengths

The climate, particularly in the north, is favourable for tomato production and with reliable water supplies production can compare favourably with any other region worldwide. The only limitation is the heat which can consistently exceed 35^{o}C at times resulting in flower abortion and reduced fruiting. Heat tolerant varieties are available.

- The country's population, and thus the potential market, is growing at a current estimated rate of 2.54%.
- There is increasing affluence and buying power within the population. The gross domestic product is currently growing at 6% and this is predicted to be sustained through to 2016 (8). This can be compared with South Africa which is less than 3%; Nigeria should soon overtake South Africa as the continent's largest economy.
- Analysis shows that demand is not meeting supply at present.
    - With increasing affluence there is potential for individual tomato consumption to increase when compared with other countries.
    - It is estimated that nationally the deficit in supply is 500 000 tons as mentioned (FMARD, 2012;12)
- There is support for the tomato industry specifically from the government and other bodies (CBN, etc.) to promote local production and processing, and to reduce reliance of imported tomato products.

1.6.2 Weaknesses

Production can be very seasonal resulting excess of supply in certain periods (with wastage in the field) and shortages at other times. Growers incur losses at these times and, with inconsistent supply, logistics and marketing are made more difficult.

Poor infrastructure in the supply chain from the farmer to the consumer results in significant losses.

- Collection centres, wholesale and retail markets do not have covered areas and protection from the climatic elements.
- Transport infrastructure and vehicles are poor. Roads are often in poor condition and damage vehicles; collection depots and markets are not easily accessible and have no organised off-loading and parking areas (there can be considerable delays accessing Mile-12 market in Lagos).

The distribution and marketing business model is inherently inefficient.

- There are several traders between the grower and the consumer motivated mainly by buying and selling margins.

There is no flow of market intelligence from the consumer up-stream ultimately to the grower.

- This is hampered by the fact that there is no traceability and consequently no destination for any market intelligence.
- The traders see no perceived benefit in doing this.

1.6.3 Opportunities

Opportunities must be approached with the awareness that supply chain is a commercial exercise at every stage and if players are engage they will only participate in response to financial incentives. The participation can only be sustained by the success of financial results.

- Seasonality of production means there are windows of opportunity (low supply) and these can be taken advantage of through use of new varieties (long and short season varieties, indeterminate

varieties) and expanded use of irrigation. This is however dependant on an improved distribution and marketing system.

There is opportunity for processing of excess supply, both small-scale and large scale processing. Large scale processing requires investment in the plant, contracting of growers, provision of credit to growers and provision of agronomic support with appropriate varieties and practices (Dangote's N 4.0 billion investment at Kadawa Valley, Kano with support of CBN, 2013; 14).

There are numerous opportunities for improving the supply chain thereby reducing losses (increasing volumes) and improving the quality. However it must be ensured that any such exercises are rewarded in financial terms.

- Stackable containers being used during transporting produce will reduce losses and improve quality.
- Covered collection centres (ultimately with grading and washing facilities) and ultimately cooling will have a similar effect.
- Insulated and refrigerated transport will also do the same.
- Market intelligence (price and quality comment) is required so all parties can respond and ensure quality and reduce losses. This cannot be done without traceability.
- Retail packaging will add value to produce and sustain market contracts for quality fruit.

The question is which measures should be introduced first; obviously the simplest must be done together with any complementary activities. That is, any intervention that improves the proportion of good quality fruit (and reduces losses) must be complemented by market intelligence system so players through the supply chain can immediately see the benefits of their efforts.

1.6.4 Threats

Fresh tomatoes are imported from neighbouring countries when supply is slow. There is however no statistics on these amounts.

The import of tomato products is increasing rapidly satisfying the consumers that can afford it; this in effect at the expense of local production which is currently being wasted or lost.

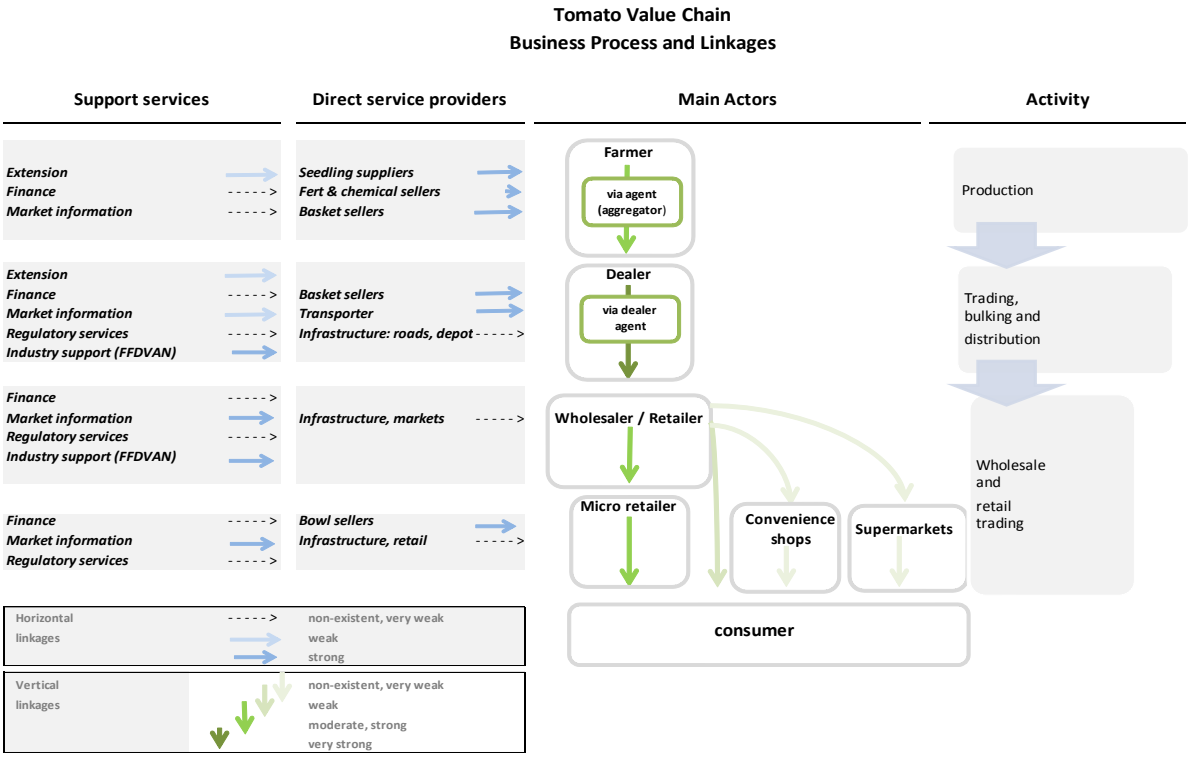
2 Current Value Chain Analyses

At present the umbilical cord linking tomato production in the north to consumers in the south is the thousands of trucks transporting produce daily, representing about 30% of the national tomato crop (6).

To model this, the distribution and supply chain from the northern region (Kano – Kaduna and other states) to Lagos markets (Mile 12) has been investigated in greater detail. This constitutes the busiest and one of the longest routes along which the greatest losses are most likely to occur.

The overall value chain is depicted in the chart below and shows the linkages between various players in the chain. The linkages of the direct input service providers and support services are shown horizontally with their relative strengths while the linkages between actors within the supply chain are shown vertically with similar strength depiction. The importance and relevance of these linkages is discussed in greater detail within the analysis when appropriate.

Figure 6.



2.1 Current supply and distribution chain

2.1.1 Production

As already shown, surplus production is in the northern region.

Farmers arrange themselves to harvest at different times of the season from September to April, in different areas. Dealers (bulking and delivering) arrange to receive the produce at the collection centres during this period. Farmers can manipulate harvesting in the north with more ease because of the dry conditions. For example, around Kaduna farmers can harvest once per week if needs be, while further north it may have to be more often (because of hotter conditions). In the south tomatoes must be harvested every 2 days, or more frequently, to avoid fruit rotting on the bush in the wet conditions.

It is assumed that for these reasons that yields in the north are higher and an amount of 7000 kg/ha is used (compared with country average of 5.7 kg/ha).

Farmers deliver from once to three times per week to the collection centre during the pre-arranged period. Farmers deliver about 10 to 15 baskets per trip to the collection centre while the crop is being harvested (over 8 weeks 7 000 kg are delivered twice a week; that is, 11 baskets per delivery per trip, on average, over 16 trips; production being based on one hectare average).

Production costs of the farmer are estimated from standard average information available (2). The only marketing cost is the transport of produce to the collection centre. Farmer's financial margins are the difference between selling price obtained from the dealer's agent, and these costs.

2.1.2 Role of the dealer's agent (aggregator)

The aggregating agent works with specific dealers.

The agent makes contact with farmers and ensures that they will supply to a particular dealer. Deliveries and timings are coordinated to ensure trucks will be filled.

The agent supplies baskets to the growers to facilitate the delivery of produce to the collection centre. These baskets remain with the farmer until they need replacing.

Closer to the time of delivery a price per basket is negotiated between the agent and the farmer for the delivery.

The dealer pays the agent a commission of 10% of buying price for his services.

2.1.3 Role of the dealer (bulking and distribution)

Dealers can operate in one collection centre for the designated period then move to another once harvesting of tomatoes has ceased. For example, dealers at Chinko market (collection centre), Nawuche, move to Kwanaga in Kano state after February.

The dealer or dealer's contract trucks to move the tomato baskets from the collection centres in the north to the south. The baskets loaded on a truck may all have been bought by one dealer or one truck load maybe shared between up to 30 dealers. This is shown in the table below and is used to estimate an average number of dealers contracting one truck (one dealer can contract up to 3 trucks).

Table 2: The variations in the number of dealers loading tomatoes onto one truck (transport north to south).

Dealers / truck	Trucks	Dealers
0.3	3	1
1	2	2
2	2	4
3	1	3
5	1	5
10	1	10
20	1	20
30	1	30
Total	**12**	**75**

Dealers estimate of average = 6 per truck

Collection centres are open-air with some grass stalls providing shade for baskets of tomatoes until they are loaded. Leaves and paper are also used for protection from the weather.

Tomatoes delivered by the farmers are removed from their baskets and loaded into baskets bought by the dealer (cost is about N 250 to 300 per basket). These baskets are sent to the south and generally not re-used because of their poor condition after the journey. However it is estimated that 10 to 20 % are retrieved (at no cost), repaired and sent back to the north for sale at reduced price (N 100 per basket).

Loading:

- Trucks are loaded and packed by, on average, 12 individuals with 8 in the truck and 4 on the ground. They are paid by the dealer an amount of N 12 000 per truck (N 1 000 each).
- It takes 1 ½ to 2 hours to load the truck.
- Loaders are well organised with a Loaders Association which negotiates rates and conditions with dealers. There are 200 loaders at Dutsen-Wai collection centre at present and 30 to 50 trucks are loaded on the 3 main market days of the week. Thus each 12 man team loads 2 to 3 trucks; each individual earns up to N 3 000 during these days.

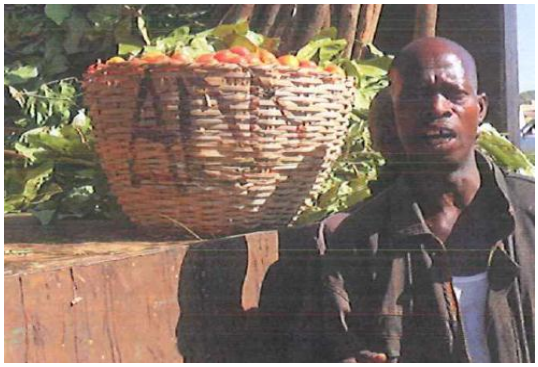
Transport:

- The average size truck used for the trip from the north to the south is a 12 wheeler which can carry up to 500 baskets maximum. This is dependent on the number of layers of baskets packed on the truck; 4 layers will total 400 to 450 baskets and 5 layers will total 500 to 550 baskets per truck. An average of 450 per truck is used for calculations, which is 20 tons of tomatoes.
- The transporters charge an amount of N 150 000 for the trip from Kaduna to Lagos (755 km) and N 195 000 from Kano to Lagos (980 km) or about N 200 /km equivalent to USD 1.25 per km (15). This compares favourably with other international rates such as South Africa USD 1.74 /km (1). This is paid by the dealers.
- The transporter pays all costs related to the trip such as fuel, levies, tolls and any other costs.
- Unscheduled delays and breakdowns are at the dealer's risk. The dealers pay the transporter 50% of the fee prior to departure; any loss of produce is at the dealers risk.
- Trucks are loaded during the day at the collection centres and leave in the afternoon or early evening. The trip takes 18 to 20 hours (up to 22+ hours from Kano) without any major delays, resulting in trucks arriving in the south, from the following midday into the afternoon.
- Trucks are not covered generally, although some baskets maybe packed with paper covering secured with string.

Dealers trip agent:

- The agent makes the trip to the markets in Lagos with the truck.
- The agent has a list of all the wholesalers that deals have been made with by the dealer.
- The agent also has the negotiated prices that have been agreed upon.
- The agent then assures delivery of the correct number of baskets to each wholesaler and receives payment which is then transferred to the dealer's administrative agent's bank account in the north.
- If several dealers are sending baskets on one truck then baskets are marked with the dealers initials (as shown below). Thus dealer is accountable for the quality delivered to the wholesaler (in an aggregated without identity, blame for poor quality could be passed onto another dealer).
- The agent is paid a commission of 10% of sales.

Image 1:.Marked basket to identify ownership by dealer.



Off-loading:

- Seven to 10 people off-load one truck taking 2 to 4 hours; distribution to wholesalers is done at this time slowing off-loading.
- They are paid about N 1 000 each, to off-load on truck.
- Trucks are off-loaded in the afternoon from about 14-00h to 18-00h; if they arrive during the evening or night they will be off-loaded from 06-00h to 0900h.

The dealer also engages a banking (administrative) agent who ensures money is received from the agent in Lagos. The banking agent uses his own account and may make payment in advance on trust, to farmers, if proceeds from sales in Lagos have not yet been received. For this work the agent takes a commission of 3% of sales.

2.1.4 Role of the wholesaler

The wholesaler buys baskets of tomatoes from the truck in Lagos (at prices pre-arranged by the dealer). The dealer's agent oversees the transaction and ensures payment is transferred to the north. This is the second financial transaction in the supply chain.

Wholesalers buy a varying number of baskets from the truck. Generally there are at least 10 wholesalers buying from one truck; that is, up to 50 baskets each. However this maybe as few as 10 baskets per truck but possibly an average of 20 baskets per truck.

Wholesalers sell their produce in designated areas close to the off-loading point (10 to 40m away). The selling areas are arranged according to the origin of the produce. For selling space for produce from the south-west wholesalers must pay N20/basket and N20/basket for cleaning up leaves, whereas wholesalers from the north do not pay anything for space because this is included in the market entrance levy paid by the dealer.

The Fresh Fruit and Vegetables Dealers Association of Nigeria, FFVDAN, organise the market (Mile 12) and demark routes for truck movement, off-loading, wholesaler selling and retailer selling areas.

Wholesalers buy produce at off-loading in the afternoon or in the early morning. They will start trading and selling to retailers from 04-00h at the earliest.

Retailers buy a varying number of baskets from the wholesaler. One basket maybe sold to a group of people possibly combined consumers (wholesalers cannot sell less than one basket, a mutually agreed regulation). Up to 10 baskets maybe sold to one retailer. The average sales to retailers are about 5 to 10 baskets per day. However a weighted average of baskets sold to retailers from 20baskets bought from one truck is likely to be about three to four (per 20 baskets bought).

2.1.5 Role of the retailer

As mentioned above, retailers purchase about 3 to 4 baskets of tomatoes from each wholesaler (who has purchased from one truck load). This compares with retailer information stating that 2 to 5 baskets were purchased per day from Monday to Wednesday and 6 to 8 baskets from Thursday to Saturday.

This is the third financial transaction in the supply chain**.**

Product is preferably purchased in the morning**.**

Retailers selling these amounts are often referred to micro-retailers in the supply chain. They split the baskets of tomatoes into smaller amounts after grading and washing them.

The tomato grades are “good – average – poor – very poor” and bad (baje-baje). The bad grade is sold and cooked in stews or prepared as sauce.

These smaller amounts vary from larger bowls of 5kg, to smaller bowls of about 2 kg, to a hand-full of about 8 fruit of 0.5kg (60g each).

They are sold at the market place, or in the vicinity, or on Lagos Island, for example. Trading is done on the street or on the road-side in stalls. There can therefore be a transport cost and obviously this is incorporated into the final price.

The actual bowls, larger ones, cost N 50 each and last for a year. They are not sold with the produce.

2.1.6 Consumer markets

Purchase of tomatoes by consumers from the retailers is the fourth financial transaction, and the final transaction in the supply chain.

The vast majority of fresh tomatoes are sold on traditional markets by street traders and hawkers on side-walks and from road-side stalls.

Other potential consumer markets are through convenience stores or shops. These stores stock and sell non-perishable goods. No fresh produce, that requires chilling or cool storage, is sold in these stores. This is because power outages from NEPA mean that generators must be used constantly to operate refrigerators. The cost of this can be 4 to 6 times the cost of power from NEPA and if this cost is passed onto consumers products become unaffordable (Ashmart Stores, Ikeja).

On the other hand, super-markets sell various fresh produce including tomatoes. However the consumers frequenting these stores have greater purchasing power and are willing to pay the higher prices. Shoprite stores sell more than 33 tons of tomatoes each per year. The group has 11 stores so it is estimated at the maximum they may sell up to 500 tons annually in total. There are 10 or more supermarket chains in Nigeria so 5 000 tons or more maybe sold through these markets. However 5 000 tons represents only a fraction of the total production (1 500 000 tons) or less than 1 % (0.33 %).

This means that at the least 98% of production is sold through traditional outlets.

However, of interest is the supply chain that has been established by Shoprite to obtain fresh tomatoes from farmers in the north.

- The supermarket chain obtains produce directly from farmers in the north by providing them with an attractive fixed selling price (avoiding any fluctuations in the market). Farmers deliver directly to the Shoprite marketing depot (Fresh- Mark) using their own refrigerated transport (often jointly owned) or Fresh-Mark transport product from the north after supplying their stores in the north.
- Shoprite are ensured a consistent supply (matching their demand) of know quality in return.
- There are support partners such as Syngenta who provides technical support and inputs (indicating strong horizontal linkages). Furthermore an agreement with Dangote will mean that any excess production at peak periods from their growers could be absorbed Fresh-Mark (information from Fresh Mark, Ikeja).
- Intermediary inefficiencies are eliminated with product being sold directly from the farmers to the retailer and the retailer selling to consumers in their stores (two financial transactions). Vertical

linkages are direct and strong between the farmer and the market (well integrated). Market information (quality and price) is easily fed back to farmers and technical support is provided to rectify quality and yield problems.

2.1.7 Summary

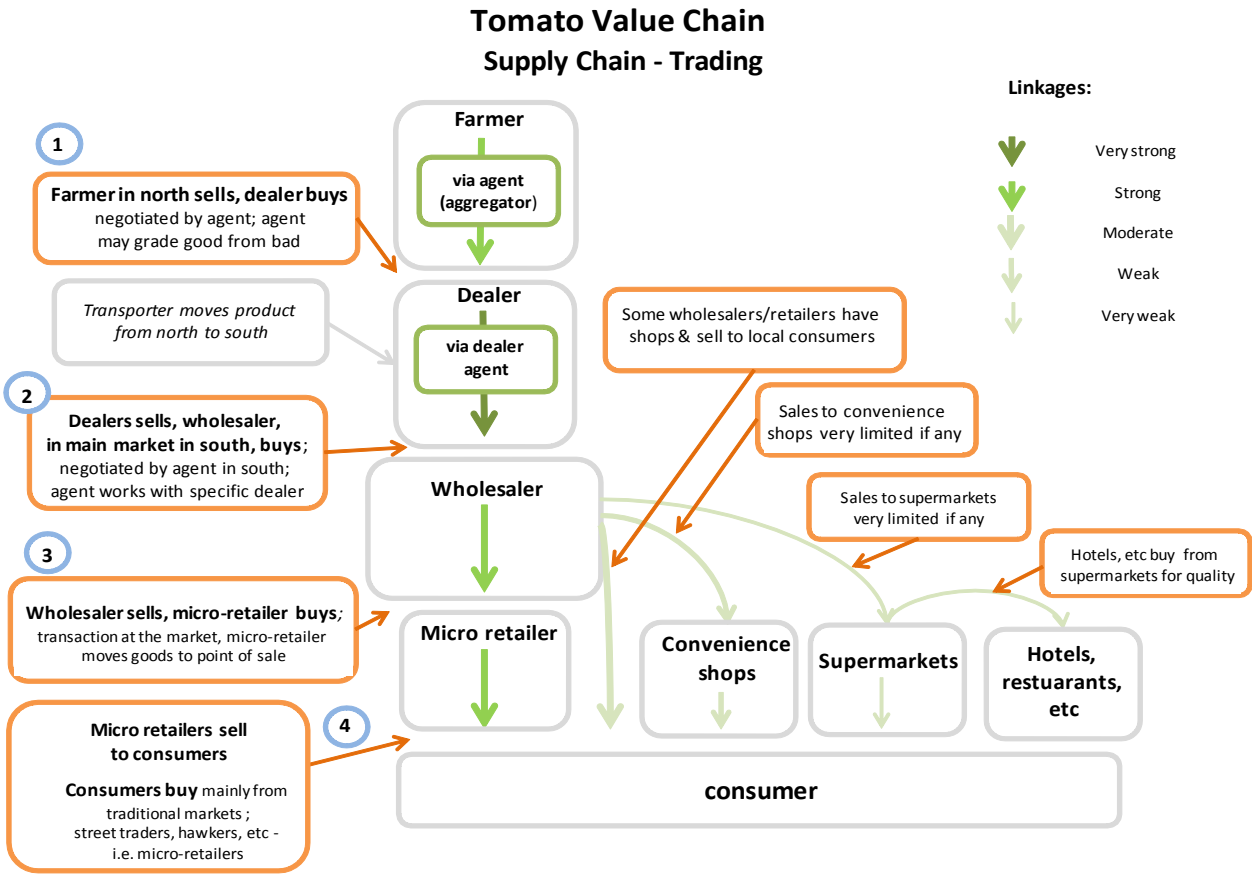
The business model upon which the distribution and supply of tomatoes from the north to markets of the south is based, is illustrated in the figure (flow chart) below.

The points of financial transaction are noted and identify the main actors in the chain.

The linkages between actors are graded; this is based upon their inter-dependence most importantly financially and logistically. The stronger these linkages the more likely both parties, on either side of a transaction, will benefit.

Weaker linkages suggest domination by one party or inappropriate supply and demand linkage (resulting in minimal interaction).

Figure 7



2.2 Analysis of current value chain

2.2.1 Value chain business model

The value chain (distribution and supply), already described, is shown in the figure below highlighting the actors and their activities within the chain. Their interaction is shown as “vertical” linkages the strength of which identifies the degree of mutual benefit within each interaction (e.g. financial transaction).

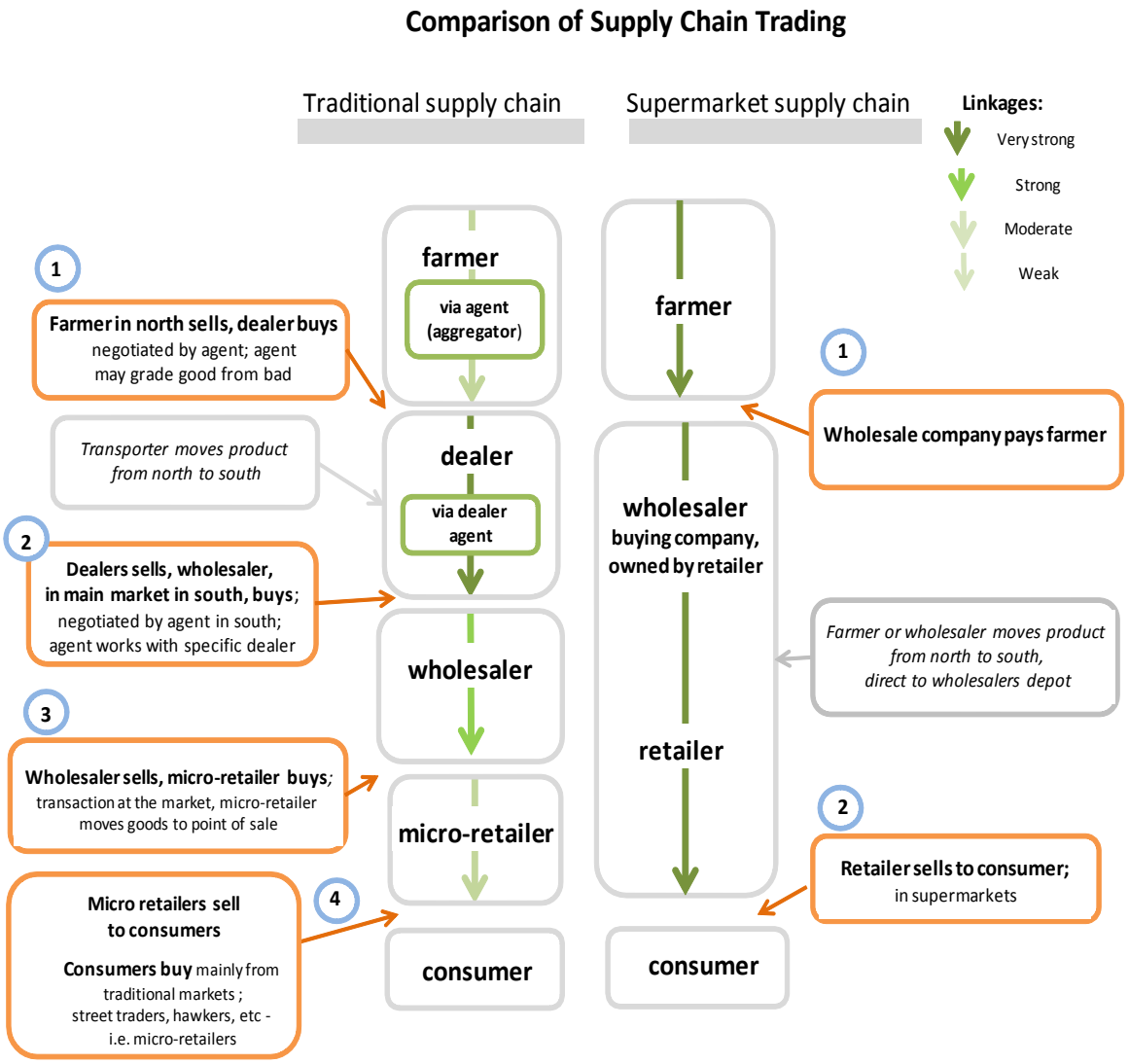
Tomatoes in the supply chain are traded four times illustrating the fragmented nature of the chain. Not only are margins diluted by the number of intermediate players but also the feed-back of improved margins from the market may not be realised. As mentioned before, traders within the chain are probably primarily focused on ensuring their own margins rather than ensuring strong vertical integration of the supply chain. Fragmentation also means that transparency is more difficult to achieve.

On the other hand, with several intermediate players dealing in small volumes it means that there are a significant number of people dependent on the industry; a great number of these are solely dependent on the business with few if any alternative options for gainful work. Thus any attempted modification to the system should not disrupt roles but be aimed firstly at improving their efficiencies as broadly as possible across the distribution, supply and marketing spectrum.

The comparison between the current traditional supply chain and that of the Shoprite supermarket are compared in the figure below. The super-markets obviously sell directly to the consumer and buy directly from the farmer ensuring both are satisfied as long as supply is consistent and of required quality.

However, the difference between the two supply chains is that the super-markets deal in volumes which are extremely smaller than the traditional supply chain and consequently control of the supply and distribution chain is very much easier. Also a limited number of players are involved in the system.

Figure 8



2.2.2 Direct services

Furthermore services within the chain are identified as those providing direct services which the actors pay for directly. Linkages between these services and the actors are shown by “horizontal” linkages which are generally strong and enable viable activities within the chain. For example, separate businesses have grown around the tomato distribution chain such as the production of raffia baskets in the south-east which are transported to the north for use on the trucks there. This could be an industry with a turnover of up to N 3.0 billion per annum (over 10 million baskets per annum).

2.2.3 Support services

Support services involve various organisations from the departments within government to associations within the distribution chain (FFVDAN). Depending on the level of support this provides an enabling environment for the tomato supply industry. Obvious strong support comes from the dealers association, FFVDAN, who organise transport, collection centres and market logistics.

Within the value chain there is a flow of market information of prices facilitating commercial interactions. However this is an informal arrangement and is necessary in order to set prices between players. Farmers are only aware or prices dealers are willing to pay and there are no comparisons.

Finance is at times provided between actors in the form of short-term credit to facilitate payments and deliveries. Dealers use the formal banking system through their agents to facilitate transactions. However no credit is obtained from banks.

There is no investment in infrastructure of collection centres and markets resulting in poor conditions for handling, hygiene and longevity of product. This means produce can be contaminated at any time up to the point of sale to the retailer. It is necessary for retailers to wash and grade produce before presentation for sale because of the market conditions.

Transport system:

Although the road system is adequate, there is **congestion and delays** during the journey at various points, mainly the destination markets.

Transport is generally not suitable. Trucks are open, only a very few are refrigerated, and packing containers (baskets) are unsuitable for handling and moving produce (major losses occur through damage on the long journey from the north to the south; produce is squashed through pressure from baskets above and movement within baskets).

From harvesting to selling to the consumer it takes a minimum of 5 to 6 days if there are no delays. Without cooling this is close to the limit of the shelf-life of the tomato being transported at high temperatures before it begins to deteriorate internally and become soft and rot.

2.2.4 Financial margins analysis

As already described, there are four transactions and main actors within the supply chain from the farmer to the consumer. The financial margins for each of these actors have been calculated in the following table.

The gross margins are the difference between the price that the goods are bought for and what they are sold for. The net margin is calculated after deducting all costs associated with the transaction (between buying and selling). The cost of individuals labour is not included in the costs unless people are employed for an activity (such as loading or off-loading trucks).

The net margin of the farmer is the price that the produce less the cost of production and transporting produce to the collection centre (where it is bought by the dealer).

These margins are summarised in the following graphs which highlight the significance of the net margins of each actor.

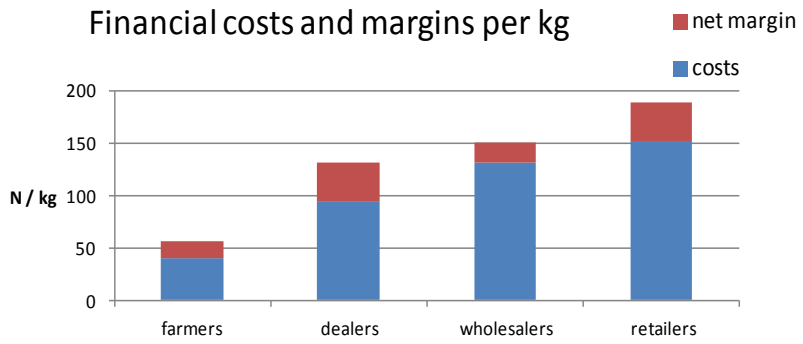
Table 3. Financial analysis of the current value chain of tomatoes transported from the north (Kaduna) to the markets in the south (Mile 12, Lagos).

Analysis of Financial Margins

actor	description		unit size	unit	N costs	N costs/kg	N selling price		N income/kg	margins N/kg	margins %age
Note: Assumptions of finacial margins are based on current buying and selling prices; November 2013. Analysis of high season and low season prices have also been done (refer to.)											
1 producer (grower)											
expenses:											
growing costs	seedlings, fert., chemicals, labour (ref. 8); yield kg/ha =	7,000	1	ha	220,000	31					
marketing costs:											
transport	to collection centre (N 120/km); 500km 16 trips of 30km return over 8 weeks		500	km	60,000	9					
expenses total						40					
income (selling)	basket size, 40kg		40	kg			2,250		56		
nett margin										16	41 %
2 dealer (bulk and distribute)											
expenses:											
buying price (cost of sales)			40	kg	2,250	56					
aggregating agent	10% farm price		10	%	225	6					
operating expenses:											
loading cost	N 12 000 per truck; baskets =	500	1	truck	12,000	1					
transporter fee	Kaduna - Lagos N 150 000; baskets =	500	1	truck	150,000	8					
unloading cost	x10 people @ N 1000; baskets =	500	1	truck	10,000	1					
baskets	500 baskets; @ basket price =	300	1	truck	150,000	8					
marketing costs:											
admin.agent	3% wholesale price		3	%	158	4					
dealers agents fee	10% wholesale price		10	%	525	13					
expenses total						95					
income (selling price)			40	kg			5,250		131		
nett margin										36	38 %
gross margin										75	133 %
3 wholesaler											
expenses:											
buying price (cost of sales)			40	kg	5,250	131					
operating expenses:											
space rental fee	equivalent N 40/basket		40	kg	40	1					
expenses total						132					
income (selling price)			40	kg			6,000		150		
nett margin										18	13 %
gross margin										19	14 %
4 retailer											
expenses:											
buying price (cost of sales)			40	kg	6,000	150					
operating expenses:											
grading labour	own labour					0					
bowls	negligible					0					
space rental fee	equivalent N 40/basket		40	kg	40	1					
transport local (if used)	N 2/km/basket; 10 km		40	kg	20	1					
expenses total						152					
income (selling price)						/ 5kg	/ kg	within 40 kg	weighted income/kg		
quality grade 1	good 40%		16	kg		1,600	320	5,120	187		
2	average 10%		4	kg		1,250	250	1,000			
3	poor 20%		8	kg		700	140	1,120			
4	very poor 10%		4	kg		200	40	160			
5	bad 20%		8	kg		50	10	80			
	total		40	kg				7,480			
nett margin										36	23 %
gross margin										37	25 %

The selling price of one actor is obviously the buying price of the subsequent actor in the supply chain. Thus if the margins per kilogram of produce are analysed through the supply chain it can be seen where margins per amount of produce are greatest. However, this is of little significance to each actor; of interest to each trader (actor) is this product of this net margin and the total amount (kilograms) that is traded.

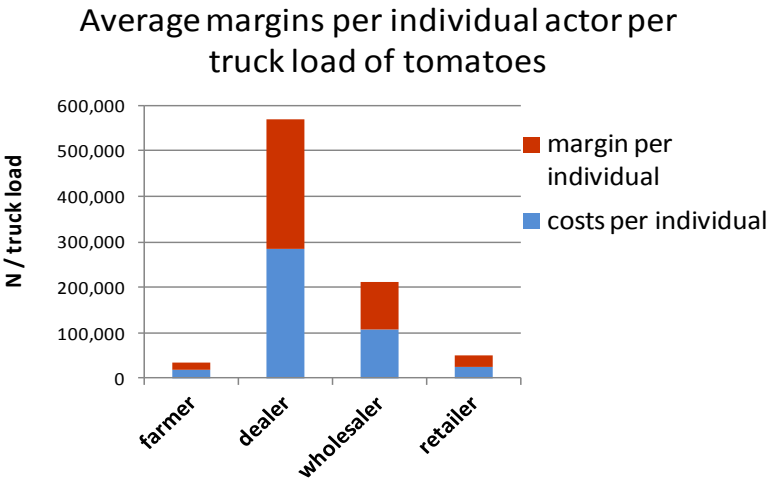
Graph 8.



This can be expressed in a number of forms but initially it is shown as the return per individual trading the produce on one truck. This has been estimated from questions presented at the various meetings and visits to the actors in the supply chain.

- The produce on one truck comes from 41 farmers.
- This produce is bought on average by 6 dealers.
- They sell all the produce to 23 wholesalers.
- A wholesaler sells to an average of 5 retailers which means there are 115 retailers selling the produce from one truck to the consumer.

Graph 9.



It is important to express these margins in figures, as in the table below. These figures can then be extrapolated to estimate the returns per individual per annum (that is, per season).

Table 4.: Current costs and net margins per actor per truck load of tomatoes (average prices) (November, 2013)

Actor	Costs, N per truck load	Net margin, N /truck load	% return	Amount / actor / truck, kg	Actors / truck
Farmer	17,600	7,040	41	440	41
Dealer	285,000	108,000	38	3,000	6
Wholesaler	105,600	14,400	13	800	23
Retailer	24,320	5,760	23	160	115

Estimated costs and net margins per actor per truck load of tomatoes, during the period when prices are **low** (August – September)

Actor	Costs, N per truck load	Net margin, N /truck load	% return
Farmer	17,600	275	2
Dealer	211,613	13,388	6
Wholesaler	60,800	6,200	10
Retailer	13,640	3,640	21

Estimated costs and net margins per actor per truck load of tomatoes, during the period when prices are **high** (May - June)

Actor	Costs, N per truck load	Net margin, N /truck load	% return
Farmer	17,600	26,400	150
Dealer	470,925	241,575	51
Wholesaler	190,800	69,200	36
Retailer	52,240	22,640	30

The current costs and net margins are compared with high and low prices during the season. These prices have been estimated from various sources (5, 18). It shows returns to the farmer, and a lesser extent the dealer, are most affected by price variations. When prices are low returns to the farmer are marginal and when prices drop even further farmers will be losing money; this is obviously when produce is abandoned in the field (as often publicised).

3 Identification and Selection of Interventions

3.1 Constraints identified

The constraining effects of various components of the value chain have been analysed and discussed. This involves direct and support services, infrastructure and the overall business model of trading between actors in the supply chain.

Various actions could potentially be taken but they must be appropriate within the whole value chain environment and feasible. That is, changing an activity maybe dependent on other activities being changed down-stream; if they are not changed then it will be ineffectual.

A structured approach is used in an attempt to identify and select most appropriate interventions with a good potential for sustained success. Constraints are ranked to identify them and then a process used for selection. This is described below.

3.1.1 Infrastructure constraints

This is a direct service requiring more detailed comment.

Infrastructure, collection centres and markets:

- There is no infrastructure at collection points to facilitate off-loading and loading, and to protect product from the weather (rain and sun) while this is being done. Furthermore access for trucks is not well defined and when busy, leads to delays.
- Most importantly there is no infrastructure at the markets for transport access, off-loading, trading, and loading of goods purchased. Trading by wholesalers (and any retailers) is done in the open on unpaved ground. Containers are placed on the ground and when it rains, splash will result in most of the produce being contaminated. Any preparation and cleaning of produce before this stage will be pointless and only serve to further delay the delivery of produce to the market (further shortening its shelf-life).

Image 2: Current conditions at Mile-12 market.

- This can only be remedied by covered facilities with appropriate simple covered off-loading, loading and trading areas. The Lagos State Ministry of Agriculture and Cooperatives is aware of these problems and frequently gives notice to organisations at Mile-12 to improve aspects of the market. Exact policies and plans from the State Ministry and local authorities are needed.
- Floor area in any planning should be such that cool-rooms can be installed at some stage, for clients who need to use them in the future. This will always be dependent on uninterrupted power supply (cold-room compressors cannot tolerate many power interruptions without breaking down;

generator power is too expensive for continuous use being 4 to 6 times more expensive than grid electricity).

3.1.2 Transport related constraints

This is similarly a direct service requiring more detailed comment.
Transport:

- Most direct losses are currently associated with the trip from the north to the south and it is generally estimated from 30 to 50% in terms of quality and quantity is lost. For definitive estimates of this, research is needed through grading before the trip and then after the trip.
- The trip takes on average 3 days from the north to the markets in Lagos (similar time to return) without delays. Thus from the time of harvest to the time of sale to the consumer will be 5 to 6 days and close to the limit on shelf-life (before the fruit starts going soft) under ambient temperatures, less than 30^{o}C. The prime objective after harvesting any fresh produce is to move it to the consumer as quickly as possible especially in hot climates.
- Losses can be attributed to factors below.
    - Basket containers are inappropriate for transporting fresh produce and lead to bruising and squashing from loading and from the pressure and movement during the journey; this is probably a major cause and relatively easily remedied.
    - Trucks are open to direct sunlight and rain. Temperatures could rise to levels where degeneration of the fruit increases rapidly. Temperature monitoring through research is needed. “High temperature ripening” in tomatoes leads to yellowing, a characteristic of many of the fruit arriving in Lagos.
    - Delays and breakdowns are estimated to affect up to 50% of trips. This information is anecdotal and more definitive estimate is needed identifying the causes of the delays and the average time period of delays.

3.1.3 Support service constraints

Few of the support services providing an enabling environment, are well established within the tomato value chain.

The Fresh Fruit and Vegetable Dealers Association of Nigeria, FFVDAN, is well organised and well established both at the collection centres in the north and at the markets in the south. However, they do have a strong vested interest in their own business with weak linkages to other actors in the chain (with the possible exception of the wholesalers). On the other hand, they are open to some changes and could be a important partner involved in interventions.

3.1.4 Supply chain model constraints

The current fractured nature of the supply chain leads to great inefficiencies. Changing this can only be brought about by disrupting the model. This can be done by introducing competition which is already being proposed and implemented, albeit currently on a small scale. Considering the size of the value chain in terms of total number of participants dependent on the system, any such changes would have to be done prudently and gradually to ensure as little disruption as possible and new roles for some of the actors.

3.1.5 Summary

The main areas for showing weaknesses in the value chain are shown in the figure and table below. This is identified from a general viewpoint in Figure 7 and then specifically in Table 5.

Figure 9: Market system map for horticultural sector (R. Ogundele, 2013; 17)

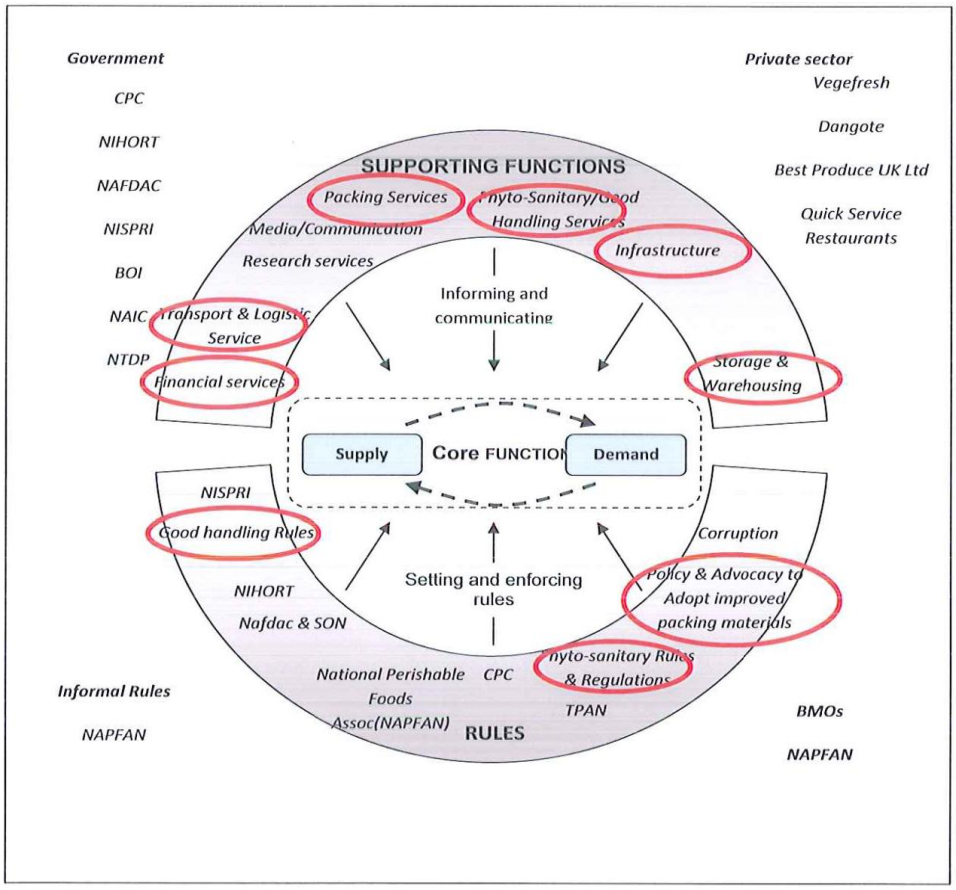


Table 5.

Ranking of current services in tomato distribution chain

Support Services		Direct Services	
Production			
Extension	1	Farm packing:	
Finance	0	basket dealers	2
Market information	0	alternate packing	0
		Farm infrastructure:	
		pack shed, cooling	0
Trading, bulking and distribution			
Extension	1	Transport:	
Finance	0	delays	0.3
Market information	1	vehicles	1
Regulatory services	0.5	packaging (baskets)	0.3
Industry support (assn.'s)	3	cooling (refrigerate)	0
		Infrastructure, collection:	
		collection depots, roads	0.5
		cooling (refrigerate)	0
		Handling, preparation	0
Wholesale and retail trading			
Finance	1	Packaging, wholesale:	
Market information	2	basket dealers	1
Regulatory services	0.5	alternate packing	0
Industry support (assn.'s)	2	Infrastructure, marketing:	
		markets, depots	0.5
		cooling	0
		Handling, preparation	0
Finance	1	Packaging retail:	
Market information	2	bowl dealers	2
Regulatory services	1	alternate packaging	0
Industry support (assn.'s)	1	Handling, preparation	1
Consumer market research	1	Consumer info.	
		quality & content display	1

Average ranking:

Support Services		Direct Services	
Extension	1.0	**Farm packing:**	
Finance	0.5	basket dealers	2
Market information	1.3	alternate packing	0
Regulatory services	0.7	**Farm infrastructure:**	
Industry support (assn.'s)	2.0	pack shed, cooling	0
Consumer market research	1	**Infrastructure, collection:**	
		collection depots, roads	0.5
		cooling (insulation)	0
		Handling, preparation	0
		Transport:	
		delays	0.3
		vehicles	1
		packaging (baskets)	0.3
		cooling (refrigerate)	0
		Infrastructure, marketing:	
		markets, depots	0.5
		cooling	0
		basket dealers	1
		alternate packing	0
		Packaging retail:	
		bowl dealers	2
		alternate packaging	0
		Handling, preparation	1
		Consumer info.	
		quality & content display	0.5

GAP based rankings:

good	5
	4
	2
	1
poor	0

3.2 Selection of interventions

3.2.1 Infrastructure

Ideally pack shed structures on the farm would enable grading of produce in protected conditions enhancing quality (on-farm changes are not proposed for these interventions). Covered areas at collection centres in the north would protect produce, improve off-loading and loading efficiencies (ramped areas) and access roads improve efficiency vehicle movement.

Of critical importance is the improvement of market places in the south. Designing of new facilities must take into consideration the following points.

- Access and exit areas large enough to accommodate traffic.
- Off-loading and loading facilities that are covered and ramped to improve efficiencies.
- Covered, paved areas designated for wholesalers and retailers (who may sell at the market).
- Water, washing and grading areas for retailers (and wholesalers).
- Extra covered space for future cooling facilities.

3.2.2 Transport

Vehicles are not suitable in many respects.

- Generally open to sunlight and high temperatures. Covering could help and monitoring of temperatures in this respect will provide answers.
- Similarly vehicles sides are not protected; insulated sides and roofs would help with temperature control (monitoring of temperatures through the load would provide perspective to the problem). Potentially refrigeration would improve conditions immensely; the use of refurbished cooling units could be possible (e.g. “Thermo-King” reference Christopher Shyers).
- Delays through breakdowns and roadblocks add to journey time (without problems this is 3 days on average). Facilitating movement through state tariffs maybe possible. Reducing incidence of breakdowns requires vehicle owner’s commitment.

Vehicle packing:

- At present produce is packed in baskets and loaded onto the truck. The baskets are not suitable and lead to squashing of produce at the bottom, abrasion and squashing through movement and vibration during the journey. Stackable plastic crates have been advocated and at times used in the past. This can lead to a significant reduction in fruit splitting or being damaged during transit. The result is a significant increase in the proportion of good quality fruit (this is further analysed in detail).

3.2.3 Handling and preparation of product for market

Currently the only washing and grading of produce in preparation for marketing to the consumer is done by retailers at markets in the south (Mile-12); prior to this stage and attempt to improve the grading, hygiene and appearance is fruitless because of the 3 day trip from the north and because of the conditions at Mile-12.

Currently the only way to overcome this is to by-pass the market conditions at Mile-12 while ensuring the conditions of transport are as good as possible.

The most appropriate stage to wash and prepare produce for sale is when produce transported in larger volumes is split into consumer size packages. Not only can appropriate packaging be used but produce must be handled for the final time. In theory this value-adding can be done at any stage from the farm to the retailer. However, intermediate logistics (farm to retailer) must not in any way down-grade the product; obviously this will negate the value-adding activities and make the product less competitive.

4 Analysis and Comparison of Interventions

4.1 Analysis of intervention value chains

4.1.1 First option from above (2 a).

The current markets (e.g. Mile-12) would be by-passed if:

- pack shed facilities were established in the north for cleaning and grading produce together with improved transport vehicles and plastic crates (or cartons requested by the market), and
- sales were made direct to wholesalers in the south.

Investment

Investment needed in this option:

- pack shed facilities established in the north for cleaning and grading produce,
- together with improved transport vehicles, and
- plastic crates (or cartons requested by the market),
- (with sales made direct to wholesalers in the south, as far as possible).

Feasibility

Quantities:

- The packing centre already designed will process 189 tons per day or 28,350 tons in a season (150 days). This is about 6% of annual production moved from the north to the south and a relatively large volume.
- The potential market for this would be through Best Foods in particular. Assuming they sourced all tomatoes through this channel they may absorb 29 tons per day by June 2014 (maximum potential). Other direct outlets (supermarkets) have established sources and may purchase some but in small quantities. A liberal assumption would be that 35 tons per day could be sold directly with the remainder, 154 tons (80%), having to be sold through traditional markets (Mile 12). This largely negates the value of washing, grading and packing in the north.

Costs:

- The capital cost together with the operating costs would have to be borne by the wholesaler purchasing the produce from the farmer. Although the capital cost is not great but there are operating costs.
- The question is whether this is an attractive investment considering much of the value adding activity will be lost when selling at Mile 12.
- Also the management of the facility would be difficult with the main business centred in the south (wholesaling).
- Any other investors (e.g. farmers) would face similar marketing issues affecting returns.

Summary

Constraints to this option are:

- the potential loss in the value-added exercise once the produce is at Mile 12,
- management of the facility by investors (likely to be the wholesaler in the south).

Pursuing this option is **inadvisable** because it would be difficult to sustain interest in a packing centre which is providing few, if any benefits to parties, involved.

4.1.2 Second option from above (2 b).

This option involves using plastic crates to transport the tomatoes from the north to the specific wholesaler in the south (e.g. Best Foods, etc). The product could then be washed, graded and re-packed in the south (by the wholesaler).

Investment

Investment needed in this option:

- improved transport vehicles are assumed ,
- use of plastic crates to transport to the south,
- cleaning, grading and re-packing, done in the south.

Feasibility

Quantities:

- The amount to be transported would be what the bulk market (wholesaler) required; that is, 29 tons by start of the season in 2014 (September). This is equivalent to two trucks; thus, to start, one truck would be used (as a pilot project in early 2014).

Costs:

- It is assumed that the wholesaler would invest the plastic crates, and cleaning and grading facilities at the bulk market (if not already in place).
- Cost of improvement (insulation) in the trucks would be at the expense of the owner and charged in the cost of transport.

Viability

- It is assumed that the proportion of poor quality grades is reduced by 80% (through use of crates and up-graded transport); this is based on studies of the effects of crates during transport of produce by Fernando, 2006 (16).
- With the reduction in intermediate actors in the value chain margins to the farmer are increased significantly; similarly margins on the bulk marketing-retailing business are good.

Table 6: Summary over 5 years of margins and other parameters in the direct marketing value chain (see annexure for analysis details).

Intervention Option (2 b)

Direct sales to wholesaler in south (e.g. Best Foods, Lagos)

i) 2013-2014 PILOT PROJECT

actor	net margin, N/kg	trucks /day	tons / day	net margin, N/day	tons / season (150 days)	net margin, N/season	combined income, N/season		numbers	
farmers	70	1	16	1,120,000	2,400	168,000,000		>=	343	farmers
wholesale (selling to retailers); 50%	32	1	16	513,960	1,200	77,094,000			16	employees
wholesale & retail (self-owned retail outlet); 50%	130	1	16	2,075,754	1,200	311,363,091	388,457,091		16	employees

ii) 2014-2015 EXPANSION

actor	net margin, N/kg	trucks /day	tons / day	net margin, N/day	tons / season (150 days)	net margin, N/season	combined income, N/season		numbers	
farmers	70	3	48	3,360,000	7,200	504,000,000		>=	1,029	farmers
wholesale (selling to retailers); 50%	32	3	48	1,541,880	3,600	231,282,000			48	employees
wholesale & retail (self-owned retail outlet); 50%	130	3	48	6,227,262	3,600	934,089,273	1,165,371,273		48	employees

iii) 2015-2016

actor	net margin, N/kg	trucks /day	tons / day	net margin, N/day	tons / season (150 days)	net margin, N/season	combined income, N/season		numbers	
farmers	70	6	96	6,720,000	14,400	1,008,000,000		>=	2,057	farmers
wholesale (selling to retailers); 50%	32	6	96	3,083,760	7,200	462,564,000			96	employees
wholesale & retail (self-owned retail outlet); 50%	130	6	96	12,454,524	7,200	1,868,178,545	2,330,742,545		96	employees

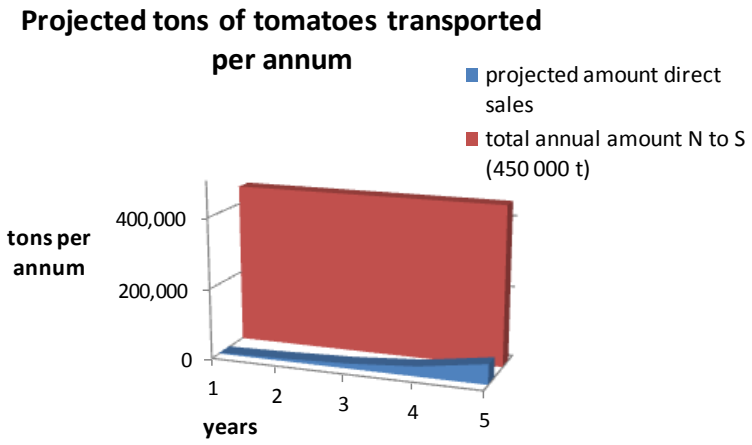
iv) 2016-2017

actor	net margin, N/kg	trucks /day	tons / day	net margin, N/day	tons / season (150 days)	net margin, N/season	combined income, N/season		numbers	
farmers	70	12	192	13,440,000	28,800	2,016,000,000		>=	4,114	farmers
wholesale (selling to retailers); 50%	32	12	192	6,167,520	14,400	925,128,000			192	employees
wholesale & retail (self-owned retail outlet); 50%	130	12	192	24,909,047	14,400	3,736,357,091	4,661,485,091		192	employees

v) 2017-2018

actor	net margin, N/kg	trucks /day	tons / day	net margin, N/day	tons / season (150 days)	net margin, N/season	combined income, N/season		numbers	
farmers	70	24	384	26,880,000	57,600	4,032,000,000		>=	8,229	farmers
wholesale (selling to retailers); 50%	32	24	384	12,335,040	28,800	1,850,256,000			384	employees
wholesale & retail (self-owned retail outlet); 50%	130	24	384	49,818,095	28,800	7,472,714,182	9,322,970,182		384	employees

Graph 10



4.1.3 Third option from above (3 a).

The third main intervention option is to use plastic crates to transport the produce to the established markets (e.g. Mile 12). This will be analysed using two variations to enable evaluation of the effects of up-grading transport vehicles.

- The first intervention is to analyse the use of plastic crates only (with some modification of current transporting conditions, such as covering the top of the produce with a tarpaulin during the trip).

Investment

Investment in the plastic crates is needed at a cost of N 950 each. The dealers are buying baskets at present and it is apparent (shown below) that they would benefit directly by using crates; that is, before any benefits from trading a higher proportion of better quality tomatoes is realised.

Feasibility

There a number of companies able to produce the plastic crates; some are receptive to participating in the intervention (e.g. Celplus).

Viability

- A direct comparison between the cost of using a basket with using a plastic crate is shown below.
- It is apparent that using crates is 13% cheaper (per kilogram of tomatoes transported), assuming a life-span on the crates of 18 months.
- However there are more tomatoes transported in baskets in a single truck. This are 18 tons compared with 16 tons of tomatoes in crates, and this will affect returns which is apparent from the comparative margin analysis.
- In this respect, it is assumed that there is a 50% reduction in poor grades (grade 3 = poor; grade 4 = very poor; grade 5 = bad). This obviously results in an increase in good grades (grade 2 = average; grade 1 = good).
- Prices are assumed to remain stable; the quality remains the same, only the quantity of better grades (grade 1 and 2) increases.

Table 7: Direct financial comparison of the current use of raffia baskets with the use of plastic crates for transporting tomatoes.

Plastic crates:-		**remarks**
Cost per crate	950	
Life span, months	18	bottling companies estimate a life span of 1 to 1.5 years on similar crates
Capacity, kg	20	
Size: crates /truck x9 layers high	800	x9 layers results in crates 20cm above top of truck
Weight / truck, tons	16	
Trip turn around, days	6	minimum period
Trips per 18 months	91	
cost crates/ truck load	760,000	
interest 12%; over 18 months	136,800	
total	896,800	
cost per trip south/ truck	9,837	
Return trip cost north/ crate	100	negotiated cost to return x1 crate
cost per trip south/ crate	12	
Total cost per trip return/ crate	**112**	
Cost all crates on truck / trip	89,837	
Cost truck / trip /ton	**5,615**	
Cost truck / trip /kg	**5.61**	

Raffia Baskets:		**remarks**
Cost / new basket	300	
Re-used /basket	100	
weighted cost; new & reused	260	
Life span,trips	1.2	20% returned north
Basket capacity, kg	40	
Baskets / truck	450	
Weight / truck, tons	18	
Total cost per trip south/truck	117,000	
Total cost per trip / basket	**260**	
(after 20% re-use)		
Cost truck / trip	117,000	
Cost truck / trip /ton	**6,500**	
Cost truck / trip /kg	**6.50**	

Table 8: Summary of margins and other parameters of the value chain using plastic crates (only), years 1 to 3; see Annexure for detailed value chain analysis.

Intervention Option (3 a)

Introduction of plastic crates only

i) 2013-2014 PILOT PROJECT

actor	comparison of returns: net margin, N/kg; crates	comparison of returns: net margin, N/kg; baskets	trucks /week*	tons / week	number of crates; return trip 6 days (1 week)	net margin, N/ week	tons / season (22 weeks)	net margin, N/season	%age of total tons moved north to south	number of individuals	remark
farmers	25	16	12	192		4,800,000	4,224	105,600,000	0.9	603	* 2 trucks x3 times week from Kaduna & Kano; 12 trips /week
dealers	46	36	12	192	9,600	8,863,200	4,224	194,990,400	0.9	60	- dealers require 12 truck loads of crates = 12 x 800 = 9600 crates; - 30 dealers per location (x2
wholesalers	29	18	12	192		5,568,000	4,224	122,496,000	0.9	92	- 23 wholesalers purchase per truck arrival; 23 x 4 trucks/ delivery to market = 92
retailers	70	36	12	192		13,440,000	4,224	295,680,000	0.9	368	- 4 retailers purchase from each wholesaler

ii) 2014-2015 EXPANSION

actor	comparison of returns: net margin, N/kg; crates	comparison of returns: net margin, N/kg; baskets	trucks /week*	tons / week	number of crates; return trip 6 days (1 week)	net margin, N/ week	tons / season (22 weeks)	net margin, N/season	%age of total tons moved north to south	number of individuals	remark
farmers	25	16	36	576		14,400,000	12,672	316,800,000	2.8	1810	* 2 trucks x3 week from Kaduna & Kano; 12 trips /week
dealers	46	36	36	576	28,800	26,589,600	12,672	584,971,200	2.8	90	- dealers require 12 truck loads of crates = 12 x 800 = 9600 crates; - 30 dealers per location (x3 locations)
wholesalers	29	18	36	576		16,704,000	12,672	367,488,000	2.8	276	- 23 wholesalers purchase per truck arrival; 23 x 4 trucks/ delivery to market = 92
retailers	70	36	36	576		40,320,000	12,672	887,040,000	2.8	1104	- 4 retailers purchase from each wholesaler

iii) 2015-2016

actor	comparison of returns: net margin, N/kg; crates	comparison of returns: net margin, N/kg; baskets	trucks /week*	tons / week	number of crates; return trip 6 days (1 week)	net margin, N/ week	tons / season (22 weeks)	net margin, N/season	%age of total tons moved north to south	number of individuals	remark
farmers	25	16	72	1,152		28,800,000	25,344	633,600,000	5.6	3621	* 2 trucks x3 week from Kaduna & Kano; 12 trips /week
dealers	46	36	72	1,152	57,600	53,179,200	25,344	1,169,942,400	5.6	120	- dealers require 12 truck loads of crates = 12 x 800 = 9600 crates; - 30 dealers per location
wholesalers	29	18	72	1,152		33,408,000	25,344	734,976,000	5.6	552	- 23 wholesalers purchase per truck arrival; 23 x 4 trucks/ delivery to market = 92
retailers	70	36	72	1,152		80,640,000	25,344	1,774,080,000	5.6	2208	- 4 retailers purchase from each wholesaler

Table 8, continued: Summary of margins and other parameters of the value chain using plastic crates (only), years 4 and 5; see Annexure for detailed value chain analysis.

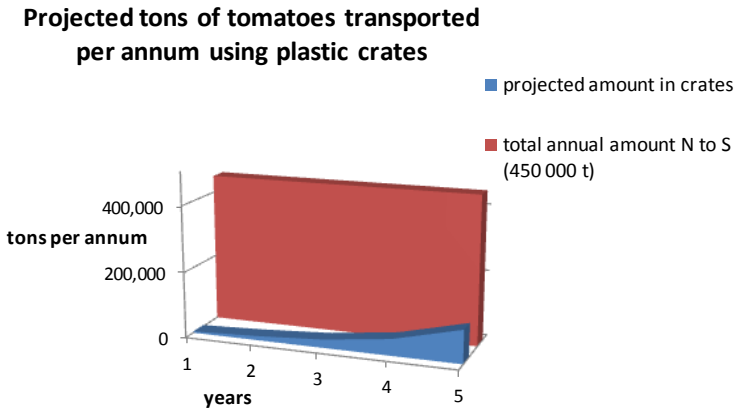
iv) 2016-2017

actor	comparison of returns: net margin, N/kg; crates	comparison of returns: net margin, N/kg; baskets	trucks /week*	tons / week	number of crates; return trip 6 days (1 week)	net margin, N/ week	tons / season (22 weeks)	net margin, N/season	%age of total tons moved north to south	number of individuals	remark
farmers	25	16	144	2,304		57,600,000	50,688	1,267,200,000	11.3	7241	* 2 trucks x3 week from Kaduna & Kano; 12 trips /week
dealers	46	36	144	2,304	115,200	106,358,400	50,688	2,339,884,800	11.3	150	- dealers require 12 truck loads of crates = 12 x 800 = 9600 crates; - 30 dealers per location
wholesalers	29	18	144	2,304		66,816,000	50,688	1,469,952,000	11.3	1104	- 23 wholesalers purchase per truck arrival; 23 x 4 trucks/ delivery to market = 92
retailers	70	36	144	2,304		161,280,000	50,688	3,548,160,000	11.3	4416	- 4 retailers purchase from each wholesaler

v) 2017-2018

actor	comparison of returns: net margin, N/kg; crates	comparison of returns: net margin, N/kg; baskets	trucks /week*	tons / week	number of crates; return trip 6 days (1 week)	net margin, N/ week	tons / season (22 weeks)	net margin, N/season	%age of total tons moved north to south	number of individuals	remark
farmers	25	16	288	4,608		115,200,000	101,376	2,534,400,000	22.5	14482	* 2 trucks x3 week from Kaduna & Kano; 12 trips /week
dealers	46	36	288	4,608	230,400	212,716,800	101,376	4,679,769,600	22.5	180	- dealers require 12 truck loads of crates = 12 x 800 = 9600 crates; - 30 dealers per location
wholesalers	29	18	288	4,608		133,632,000	101,376	2,939,904,000	22.5	2208	- 23 wholesalers purchase per truck arrival; 23 x 4 trucks/ delivery to market = 92
retailers	70	36	288	4,608		322,560,000	101,376	7,096,320,000	22.5	8832	- 4 retailers purchase from each wholesaler

Graph 11.



A 50% reduction in poorer qualities within the volumes of this intervention is assumed.

4.1.4 Fourth option from above (3 b).

a. This option would include the up-grading of transport trucks to have an insulated back (and refurbished refrigeration unit), together with the use of plastic crates.

Investment

- Investment in the plastic crates is needed at a cost of N 950 each. The dealers are buying baskets at present and it is apparent (shown below) that they would benefit directly by using crates; that is, before any benefits from trading a higher proportion of better quality tomatoes is realised.
- Furthermore up-grading of transport trucks is assumed (x12 wheeler, maximum capacity 30 tons). The cost of this is calculated below using refurbished insulated back and refrigeration unit.

Table 9:.Estimated costs of up-grading vehicles with insulated backs and cooling units.

Vehicle up-grading

			remarks
1)	**Refurbished insulated body, 30 ton**		
	capital costs	1,050,000	
	interest @ 12% over 6 months (one season)	126,000	
	total	1,176,000	
	trips in 150 days	25	6 days turnaround
	cost per trip,	**47,040**	repayment of capital and interest over 6 months
2)	**Thermo King SEII refrigeration unit**		
	capital cost, refurbished	800,000	
	interest @ 12% over 6 months (one season)	96,000	
	total	896,000	
	trips in 150 days	25	6 days turnaround
	cost per trip,	**35,840**	repayment of capital and interest over 6 months
	Total cost for insulated body & refrige unit / trip	**82,880**	repayment of capital and interest over 6 months

Feasibility

There a number of companies able to produce the plastic crates; some are receptive to participating in the intervention (e.g. Celplus).

The feasibility and interest of truck owner's up-grading trucks has not been checked.

Viability

- A direct comparison between the cost of using a basket with using a plastic crate is shown below.
- It is apparent that using crates is 13% cheaper (per kilogram of tomatoes transported), assuming a life-span on the crates of 18 months.
- Cost of up-grading vehicles (repayment and interest) is repaid over one season (6 months).
- It is assumed that there is an 80% reduction in poor grades (grade 3 = poor; grade 4 = very poor; grade 5 = bad) with use of both crates and up-graded transport.
- Prices are assumed to remain stable for all grades; improved returns are a consequence of a greater proportion of good quality grades.

Table 10: Summary of margins and other parameters of the value chain using plastic crates and up-graded transport, years 1 to 3; see Annexure for detailed value chain analysis.

Intervention Option (3 b)

Introduction of plastic crates and up-graded transport

i) 2013-2014 **PILOT PROJECT**

actor	comparison of returns: net margin, N/kg; crates	comparison of returns: net margin, N/kg; baskets	trucks /week*	tons / week	number of crates; return trip 6 days (1 week)	net margin, N/ week	tons / season (22 weeks)	net margin, N/season	%age of total tons moved north to south	number of individuals	remark
farmers	28	16	12	192		5,280,000	4,224	116,160,000	0.9	603	* 2 trucks x3 week from Kaduna & Kano; 12 trips /week
dealers	50	36	12	192	9,600	9,508,320	4,224	209,183,040	0.9	60	- dealers require 12 truck loads of crates = 12 x 800 = 9600 crates; - 30 dealers per location (x2 locations); - dealers using up-graded transport (insulated - cooled)
wholesalers	32	18	12	192		6,048,000	4,224	133,056,000	0.9	92	- 23 wholesalers purchase per truck arrival; 23 x 4 trucks/ delivery to market = 92
retailers	91	36	12	192		17,529,600	4,224	385,651,200	0.9	368	- 4 retailers purchase from each wholesaler

ii) 2014-2015 **EXPANSION**

actor	comparison of returns: net margin, N/kg; crates	comparison of returns: net margin, N/kg; baskets	trucks /week*	tons / week	number of crates; return trip 6 days (1 week)	net margin, N/ week	tons / season (22 weeks)	net margin, N/season	%age of total tons moved north to south	number of individuals	remark
farmers	28	16	36	576		15,840,000	12,672	348,480,000	2.8	1810	* 2 trucks x3 week from Kaduna & Kano; 12 trips /week
dealers	50	36	36	576	28,800	28,524,960	12,672	627,549,120	2.8	90	- dealers require 12 truck loads of crates = 12 x 800 = 9600 crates; - 30 dealers per location (x2 locations); - dealers using up-graded transport (insulated - cooled)
wholesalers	32	18	36	576		18,144,000	12,672	399,168,000	2.8	276	- 23 wholesalers purchase per truck arrival; 23 x 4 trucks/ delivery to market = 92
retailers	91	36	36	576		52,588,800	12,672	1,156,953,600	2.8	1104	- 4 retailers purchase from each wholesaler

iii) 2015-2016

actor	comparison of returns: net margin, N/kg; crates	comparison of returns: net margin, N/kg; baskets	trucks /week*	tons / week	number of crates; return trip 6 days (1 week)	net margin, N/ week	tons / season (22 weeks)	net margin, N/season	%age of total tons moved north to south	number of individuals	remark
farmers	28	16	72	1,152		31,680,000	25,344	696,960,000	5.6	3621	* 2 trucks x3 week from Kaduna & Kano; 12 trips /week
dealers	50	36	72	1,152	57,600	57,049,920	25,344	1,255,098,240	5.6	120	- dealers require 12 truck loads of crates = 12 x 800 = 9600 crates; - 30 dealers per location (x2 locations); - dealers using up-graded transport (insulated - cooled)
wholesalers	32	18	72	1,152		36,288,000	25,344	798,336,000	5.6	552	- 23 wholesalers purchase per truck arrival; 23 x 4 trucks/ delivery to market = 92
retailers	91	36	72	1,152		105,177,600	25,344	2,313,907,200	5.6	2208	- 4 retailers purchase from each wholesaler

Table 10, continued: Summary of margins and other parameters of the value chain using plastic crates and up-graded transport, years 4 and 5; see Annexure for detailed value chain analysis.

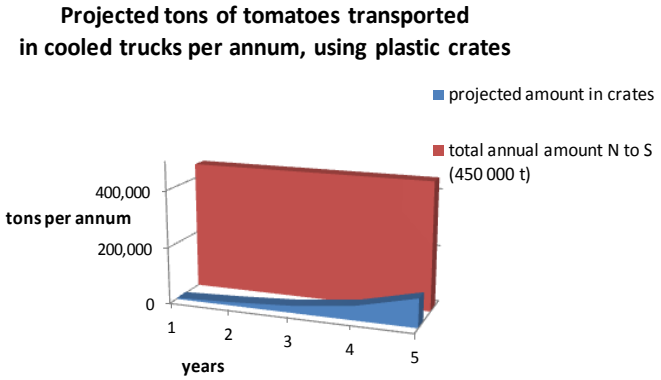
iv) 2016-2017

actor	comparison of returns: net margin, N/kg; crates	comparison of returns: net margin, N/kg; baskets	trucks /week*	tons / week	number of crates; return trip 6 days (1 week)	net margin, N/ week	tons / season (22 weeks)	net margin, N/season	%age of total tons moved north to south	number of individuals	remark
farmers	28	16	144	2,304		63,360,000	50,688	1,393,920,000	11.3	7241	* 2 trucks x3 week from Kaduna & Kano; 12 trips /week
dealers	50	36	144	2,304	115,200	114,099,840	50,688	2,510,196,480	11.3	150	- dealers require 12 truck loads of crates = 12 x 800 = 9600 crates; - 30 dealers per location (x2 locations); - dealers using up-graded transport (insulated - cooled)
wholesalers	32	18	144	2,304		72,576,000	50,688	1,596,672,000	11.3	1104	- 23 wholesalers purchase per truck arrival; 23 x 4 trucks/ delivery to market = 92
retailers	91	36	144	2,304		210,355,200	50,688	4,627,814,400	11.3	4416	- 4 retailers purchase from each wholesaler

v) 2017-2018

actor	comparison of returns: net margin, N/kg; crates	comparison of returns: net margin, N/kg; baskets	trucks /week*	tons / week	number of crates; return trip 6 days (1 week)	net margin, N/ week	tons / season (22 weeks)	net margin, N/season	%age of total tons moved north to south	number of individuals	remark
farmers	28	16	288	4,608		126,720,000	101,376	2,787,840,000	22.5	14482	* 2 trucks x3 week from Kaduna & Kano; 12 trips /week
dealers	50	36	288	4,608	230,400	228,199,680	101,376	5,020,392,960	22.5	180	- dealers require 12 truck loads of crates = 12 x 800 = 9600 crates; - 30 dealers per location (x2 locations); - dealers using up-graded transport (insulated - cooled)
wholesalers	32	18	288	4,608		145,152,000	101,376	3,193,344,000	22.5	2208	- 23 wholesalers purchase per truck arrival; 23 x 4 trucks/ delivery to market = 92
retailers	91	36	288	4,608		420,710,400	101,376	9,255,628,800	22.5	8832	- 4 retailers purchase from each wholesaler

Graph 12



Volumes transported would remain the same as using crates alone (in graph above); proportion of good quality fruit would however increase (80% reduction of poorer quality assumed).

4.2 Comparison of intervention options

As shown in the table below, margins are increased by use of crates and further by up-graded insulated and cooled transport. This is obviously through reduction of damage during transport and prevention of internal degradation through the effects of cooling (assumptions of reduction in poor quality are, however, tenuous and must be investigated as soon as possible).

Direct sales to bulk markets in the south avoid intermediate actors and financial margins are shared between fewer actors. Of significance is the significant increase in farmer's net margins.

Table 11

Comparison between interventions of net margins (N/kg and as %age of all costs) per actor in the value chain

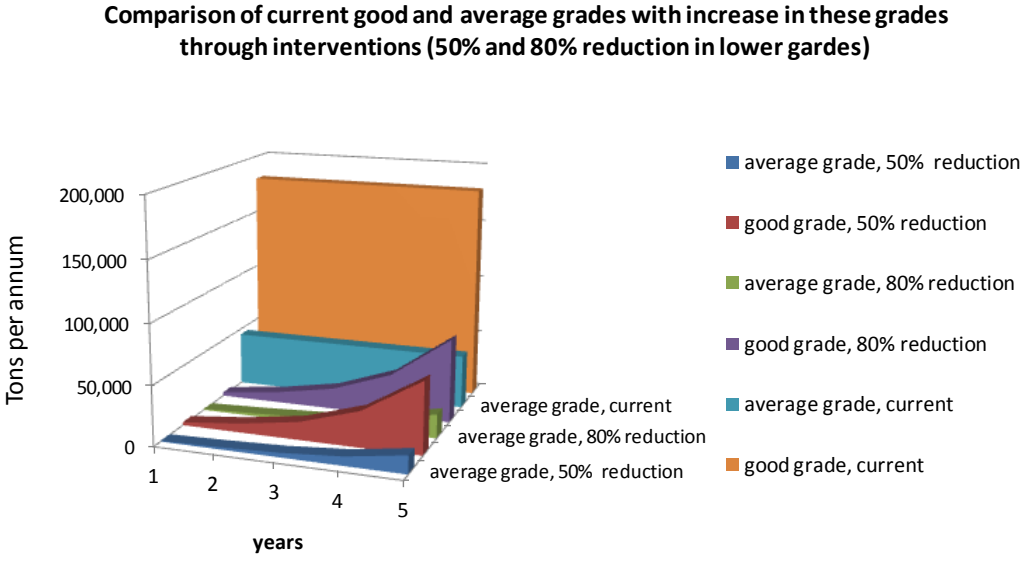
Option:			3 a		3 b		2 b		
actor	current: using baskets	%	using plastic crates only	%	using crates & upgraded transport	%	direct sales: farmer to wholesaler/retailer		%
farmer	**16**	41	**25**	63	**28**	69	**70**		175
dealer	**36**	38	**46**	47	**50**	47			
wholesaler	**18**	13	**29**	20	**32**	20	32	#	29
retailer	**36**	23	**70**	28	**91**	33	**129**		48

this margin applies when sales are made to other retailers and not to self-owned retail outlets

Comparison of better quality fruit (average and good grades) at their current levels with the potential increase in these grades resulting from the interventions are shown below (i.e. that is, a reduction in poorer grades of either 50% or 80%).

Although a small proportion of the total good quality in the first few years, the proportion of good quality increases to over 25% in the fourth and fifth years. This increase in supply could influence prices resulting in lower prices for these grades; on the other hand, improving economic conditions for the population as a whole could ensure demand remains strong and prices stable.

Graph 13



5 Impact Analysis of Interventions

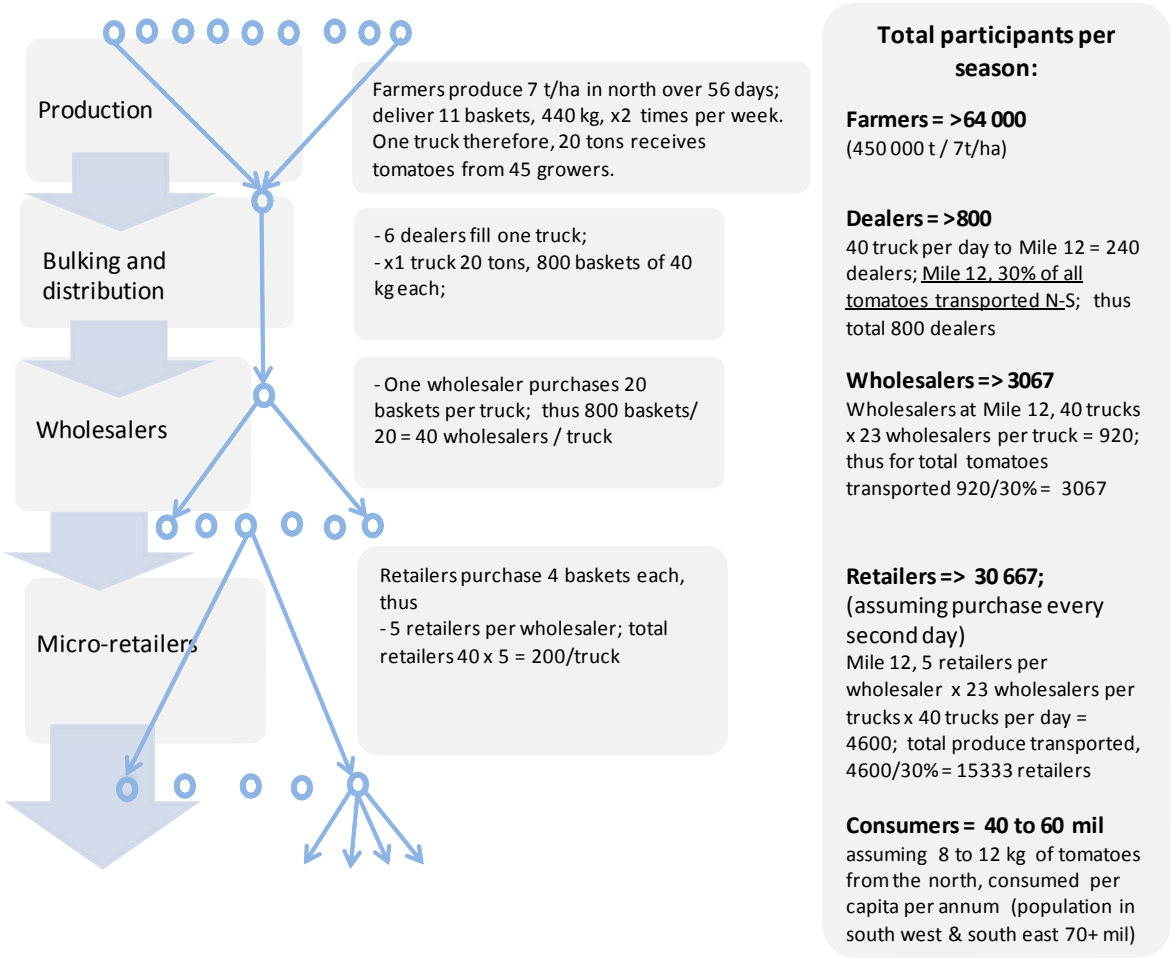
5.1 Impact analysis on number of actors

The number of actors at each stage of the value chain is estimated and shown graphically in the figure below (this is also detailed in the "Assumptions" in the Annexure), detailing the number of individuals at each stage of the value chain.

This serves as the baseline for calculating the impact interventions may have on the current system. This is quantified in terms of number of individuals and in financial terms.

Figure 11

Estimated number of participants in the distribution chain of tomatoes grown in the north and sold in the south



The development of the direct sales to wholesalers in the south (bulk marketers) is based on current estimates and the desired rate of expansion of Best Foods. However this distribution chain does not have to be limited to one business outlet and alternative markets could be secured (e.g. Shoprite would be open to discussing receipt through this channel). A doubling of the through-put after the pilot project, would result in the involvement of 9 099 individuals after 5 years.

The two options for the adoption of plastic crates for transporting tomatoes to current markets in the south are not exclusive. That is, plastic crates would be introduced and up-graded transport used if possible and attractive to vehicle owners.

A doubling in the number of plastic crates being used annually is assumed (after the pilot project period). This will involve 25 702 individuals after 5 years, as shown below.

Table 12.

Annual change in number of actors in the value chain, in each intervention

	current total	year 1	2	3	4	5
1) direct to wholesaler in south (2 b)						
* farmers	64,000	343	1,029	2,057	4,114	8,229
employees: bulk/distribute		38	114	228	456	912
employees: wholesale		16	48	96	192	384
employees: retail		16	48	96	192	384
* total of wholesale & retail activities		70	210	420	840	1,680
* total		413	1,239	2,477	4,954	9,909
2) use of plastic crates only (3 a)						
farmers	64,000	603	1,810	7,241	7,241	14,482
dealers	800	60	90	120	150	180
wholesalers	3,067	92	276	552	1,104	2,208
retailers	30,667	368	1,104	2,208	4,416	8,832
		1,123	3,280	10,121	12,911	25,702
3) use of crates & transport up-grade (3 b)						
farmers	64,000	603	1,810	3,621	7,241	14,482
dealers	800	60	90	120	150	180
wholesalers	3,067	92	276	552	1,104	2,208
retailers	30,667	368	1,104	2,208	4,416	8,832
		1,123	3,280	6,501	12,911	25,702

5.2 Impact on value of tomatoes traded

Analysis of the current value chain estimates the net margins per actor in the chain. This can then be compared net margins from analysis of the intervention value chains.

This is shown below in terms of annual percentage increases in net margins for each actor. It must be noted that this is based on the following estimates .and assumptions

- Estimated average prices are used; these are constant for each grade of tomato irrespective of the intervention activity.
- The changes that the interventions effect are a reduction in poorer grades; this is assumed to be either a 50% or 80% reduction (as initially described).

Once interventions are implemented these value chain analysis models can be used to monitor actual performance (i.e. actual prices and actual proportions of each quality grade).

Table 13: The annual net margins for each actor in the value chain, together with potential increases in these margins, for each intervention option, compared with the current system.

		N / year / actor			
		farmers	dealers	wholesalers	retailers
current system	net margin / actor	113,750	2,549,360	814,957	407,478

	farmers	employees: bulk/distribute	employees: wholesale & retail (1:1)
1) direct to wholesaler in south (2 b)			
net margin / actor	490,000		5,527,958
increase on current system	376,250		1,756,164
% improvement on current	331		

	farmers	dealers	wholesalers	retailers
2) use of plastic crates only (3 a)				
net margin / actor	175,000	3,249,840	1,331,478	803,478
increase on current system	61,250	700,480	516,522	396,000
% improvement on current	54	27	63	97

	farmers	dealers	wholesalers	retailers
3) use of crates & transport up-grade (3 b)				
net margin / actor	192,500	3,486,384	1,446,261	1,047,965
increase on current system	78,750	937,024	631,304	640,487
% improvement on current	69	37	77	157

The potential financial impact of the interventions is shown in the table below in pounds sterling. Of significance is the good potential return to the farmers selling directly to wholesalers (and similarly to the wholesale-retail businesses). However, the number of individuals involved in the direct marketing system is about 40% of those in the other supply chains.

Table 14

Cumulative increase in value of tomatoes traded in each intervention by each actor, compared with current system

	GBP				
year	1	2	3	4	5
1) direct to wholesaler in south (2 b)					
farmers	496,154	1,488,462	2,976,923	5,953,846	11,907,692
total of wholesale & retail activities	472,813	1,418,440	2,836,880	5,673,760	11,347,519
	968,967	2,906,901	5,813,803	11,627,606	23,255,211
2) use of plastic crates only (3 a)					
farmers	142,154	426,462	1,705,846	1,705,846	3,411,692
dealers	161,649	242,474	323,298	404,123	484,948
wholesalers	182,769	548,308	1,096,615	2,193,231	4,386,462
retailers	560,492	1,681,477	3,362,954	6,725,908	13,451,815
	1,047,065	2,898,720	6,488,714	11,029,108	21,734,917
3) use of crates & transport up-grade (3 b)					
farmers	182,769	548,308	1,096,615	2,193,231	4,386,462
dealers	216,236	324,354	432,473	540,591	648,709
wholesalers	223,385	670,154	1,340,308	2,680,615	5,361,231
retailers	906,535	2,719,606	5,439,212	10,878,425	21,756,849
	1,528,926	4,262,422	8,308,608	16,292,862	32,153,250

6 Evaluation of Interventions

6.1 Direct sales to wholesalers-retailers

Farmers sell produce to wholesalers in the south who may sell to retailers or sell produce through their own retail outlets. This model is being used by Best Foods and is similar to the supply chain of Shoprite supermarkets.

6.1.1 Strengths

The business model is very efficient and beneficial to farmers. There are two financial transactions (produce bought from farmers and sold to consumers) in the supply chain and returns, most importantly, to farmers are not diluted by intermediate trading.

Linkages between the farmer, wholesaler-retailer and consumer are very strong. The markets (wholesaler) require consistent supply and predictable quality. To achieve this contracts are often made with farmers, technical support is given to farmers and good prices are paid if farmers ensure this supply and quality.

Feedback from the market to farmers, in terms of prices and quality, is essential and beneficial to both parties. As mentioned, this ensures good returns to farmers (as can be seen in the previous table).

6.1.2 Weaknesses

The supply chain is controlled by the wholesaler-retailer business. This means that:

- All individuals in the supply chain are dependent on the single wholesale-retail business; any collapse of the business will affect all farmers and employees,
- The wholesale-retail business can dominate the supply chain and margins could become skewed to their own benefit. For this reason it is important that there is competition and other wholesaler-retailers providing the same service. Furthermore farmers should not agree to any very restrictive (exclusive) long-term contracts.

From the intervention viewpoint there are fewer individuals are affected by the changes; that is, a number of actors within the current value chain could be affected. It is estimated that after 5 years this could be at least 90 dealers, 1000 wholesalers and 4 500 retailers.

6.1.3 Risks

Securing supply would need to be ensured. There needs to be full willing cooperation from farmers who are open to new technical information and changes to ensure that quality and yields are improved (through technical support).

The logistics involved in moving supply from the north to the south will always be difficult.

- Collection of produce requires a structured system; this needs to be over a number of areas so that production is spread during the season. On the other hand, for collection and truck loading clusters of farmers would be more suitable.
- The responsibility of transporting produce from north to south must be clearly defined. Relying on the current transport system would be a high risk with frequent delays and breakdowns.

The business model provides strong linkages on the one hand, but on the other it can be dominated by the bulk marketer (wholesaler). This can be a risk if farmers are dealing with a single wholesaler-retailer. Once this supply chain becomes more established and accepted by the farmers, alternative wholesalers-retailers will be available to the farmer and the risk reduced.

Acceptance of a new marketing system depends on various factors, including business incentives, past experiences, social issues and social pressures. On the one hand, incentives for farmers to adopt the direct selling channel are obvious and have been adopted by some farmers already dealing with supermarkets (e.g. Fresh-Mark, the buying company for Shoprite). On the other hand, as already mentioned a number of

dealers, wholesalers and retailers could be affected through the system by-passing them. The dealers have a strong association (FFVDAN), dominate the current system and obviously have much influence on players both upstream and downstream in the supply chain. Through their power pressure could be brought to bear on farmers not to participate initially or to withdraw at a later stage. This would obviously be a risk to the initiation and establishment of this intervention but how real this risk is, is not clear (without further investigation).

6.2 Introduction of plastic crates

Stackable plastic crates, that could be re-used, would be introduced with the aim of reducing the considerable damage that is done to tomatoes loaded in baskets in trucks. Currently baskets are bought by dealers for each trip to the south and not returned (about 20% are repaired and returned by basket dealers, and sold at a reduced price).

6.2.1 Strengths

The use of plastic crates has immediate financial benefits for the dealers, being cheaper to use than baskets. This is assuming the crates last for 18 months (if looked after they could last longer).

Furthermore the crates would improve the proportion of good quality fruit and thus their net margins when trading between the farmer and the wholesalers.

6.2.2 Weaknesses

The establishment of a strong relationship between the dealers and suppliers of the plastic crates is needed; once use of crates expands supply of crates must be assured.

The use of plastic crates could affect women basket makers. By the fifth year of use of crates, 5 000 or more women basket makers could have their source of income removed. This is a significant number and approximately 25% of all basket makers; alternative sources of income must be identified for them.

6.2.3 Risks

As mentioned, the supply of crates must be well assured into the future for the intervention to succeed. Introduction of other companies will provide stability in this respect. In the past it has been shown that crates have not been used because they were not readily available (91% of respondents; 17).

The life-span of the crate must be assured. If they do not last 18 months on average, the financial benefits and incentive to the dealers will be reduced and become less attractive to them. In this respect the monthly the estimated monthly cost to the dealers would ensure that they own them after 18 months (a “hire-to-buy” model). This would provide an additional incentive for them to look after the crates and ensure they last beyond the 18 months (from which time there is no costs involved in their use except the return trip from south to north). The life-span of crates depends on these factors.

- Loss or theft of crates.
- The treatment and handling of crates must be such that they will last the 18 months.
- The risk of mis-handling and treatment of crates is a management issue but could be an issue in some instances.

Financing of the plastic crates needs clarification; initially, in the pilot project, it is proposed that this will be borne by the crate manufacturers.

The logistics of the use of plastic crates must be well defined. It is possible for the manufacturers to mark crates; this will essential to establish ownership and assist with their return. Furthermore it will assist with dealer’s delivery to specific wholesalers in the south; at present baskets are marked so that wholesalers can identify product being sent to them from other product on the truck. Furthermore, the system for returning crates must be efficient and under the control of the dealers agent who travels with the truck. There is a high risk to the success of the intervention if this crate-return system breaks down; dealers will quickly return to the known system of using baskets.

The business model main weakness is that financial benefits are not passed back to the farmer. However this does not appear a major threat or risk to the success of the intervention.

Whether plastic crates would be accepted in the supply chain raises many questions.

- They have been introduced in the past without sustained success; 21% of farmers have used them and 91% say they would use them if available (3).
- However the main problems with their use were the expensive price, they are not a unit of measurement and they were not readily available. Respondents to these questions were both farmers and tomato traders. Any new intervention must introduce plastic crates to the system through the dealers; they have the greatest influence in the system and the ability to ensure that crates are constantly cared for (through their agents travelling on the trucks to and from the south).
- It is critical to obtain the support and cooperation of the dealers with the introduction of crates. As already mentioned, they can be shown that there is a direct financial benefit to using crates (each trip is cheaper than using baskets which are not returned). If the benefits to them are obvious, they will have a vested interest in ensuring it works.

6.3 Introduction of crates and up-graded transport

This intervention is merely a variation on the introduction of plastic crates (and not a separate proposal).

The post-harvest care of fruit and vegetables ideally requires cooling so that the rate of respiration in the fruit is reduced and internal breakdown of tissue is slowed down extending the shelf-life of the product. This not only avoids the problem of having to discard rotting fruit but also means that fruit is more durable and resistant to bruising and damage. Thus not only is cooled transport important but also cooled storage areas are needed at reception points.

Once market areas become better established with covered off-loading, loading and handling areas, it would be possible to established cool rooms for temporary storage of product if needed.

6.3.1 Risks

If truck owners do upgrade their vehicles it will be necessary for them to increase freight rates. These are paid by dealers and they will need to convinced that potential better grades of tomatoes will more than justify them paying higher freight rates. This incentive for dealers will be difficult to demonstrate and similarly it may be difficult to convince truck owners that dealers would support them. This presents a definite risk to any plans for truck up-grading under the current system. On the other hand, the transport of produce from the north to Fresh-Mark is often done in cooled vehicles and benefits are apparent to farmers involved; it is just a matter of time for this to be more widely accepted.

6.4 Ranking of risks

The risks described above are ranked in the table below, from 5 (high risk) to 0 (no risk). These estimates merely provide:

- a ranking of priorities where attention must be focused in order to ensure the establishment and long term sustained success of the interventions,
- an estimate of the overall risk associated with the introduction of the intervention; for example from the rankings, it is likely that it will be difficult to convince owners to up-grade vehicles and to convince dealers to pay higher freight rates.

Table 15.

Ranking of risks associated with interventions

5	**high risk**
0	**low risk**

Direct selling to wholsale-retailers

1	Supply of produce from farmers	3
2	**Logistics, farm to market**	**4**
3	Business model stability	3
4	Acceptance, farmers	2
	average intervention risk	3

Introduction of plastic crates

1	Supply of crates	2
2	**Life-span of crates**	**4**
3	**Logistic of crate-use**	**4**
4	Business model stability	3
5	Acceptance, various actors	2
	average intervention risk	3

Up-grading of vehicles

1	**Acceptance, vehicle owners**	**4**
2	**Acceptance, higher freight rates to dealers**	**4**
	average intervention risk	**4**

7 Research

To more accurately compare the current situation with proposed changes, certain activities need to be investigated in more detail.

Also background and best practices involved in fresh produce handling in the supply chain from farm to consumer must be clearly understood to ensure practical and feasible interventions are introduced which have a good probability of sustained success.

7.1 Information research:

7.1.1 Transport

Crates

Information on the use of plastic crates to transport produce to the south needs further investigation:

- Losses in quantity within each grade needs to be quantified for crates at the top, middle and bottom layers in the truck.
- This must be compared with tomato quality losses in similar layers of baskets.
- Note that it is necessary to sample grade tomatoes before leaving so losses can be exactly quantified.

Temperature

Digital temperature probes (used for continuous monitoring of fresh produce in transit) must be used at each level in both the baskets and crates (USB loggers can download continuous temperature graphs onto computers). For each load there should x3 in crates and x3 in baskets (for both Kaduna and Kano).

Trucks

More accurate information is needed on the frequency of delays (as a percentage of trips). Also the average length of delays (hours or days) needs to be known. The cause of potential delays must be identified:

- Stoppages by authorities (state) and their predictability,
- Mechanical breakdowns.

7.1.2 Markets:

The Lagos State Ministry of Agricultures policy on fresh produce markets, especially Mile-12, needs to be more clearly understood, both for the short-term and the long-term. Also the opinion and policies of the local authorities must be similarly understood.

Notices served on the market are generally for upgrading certain aspects, but what action is taken is not clear.

7.2 Capacity building

It is critical that the management and direction of horticultural interventions, particularly because produce is perishable, are done with good understanding of post-harvest technical issues and a similar understanding of best practices, their inter-dependence and relative importance in the supply and distribution chain. This will enable a realistic perspective to be applied to any changes proposed while keeping feasible and viable long-term goals the focal point.

In this respect it is essential that the intervention manager (R. Ogundele) has exposure to tomato (and other products) value chains outside those encounter in Nigeria. This will be invaluable for him when championing the cause for improvement particularly with authorities involved in policy guidance.

This could be arranged through a short visit to South Africa which could provide a view of small-scale producers, wholesalers and retailers involvement in the value chain, together with their involvement in marketing and purchasing from the large municipal fresh produce markets.

Annex 1: supporting data

Assumptions

Assumptions

			estimated averages	remarks
		units		
Financial exchange:				
	United States Dollar	Naira	160	
	Pounds Sterling, GBP	Naira	260	
Production:				
	yield national	ton/ha	5.9	
	yield, north	ton/ha	7.0	more favourable conditions; less rain and disease, slower ripening
	farm size	ha	1	
	basket capacity	kg	40	
	baskets reqd. / farmer	no.	22	
Collection centre:				
farmer delivery:	x2 / week, for 8 wks	tons	7.0	
(to collection centre)	baskets / delivery	no.	11	
truck capacity:	baskets / truck	no.	450	
	tomatoes / truck	tons	18	
	farmers / truck	no.	41	
aggregator commission (% of price to farmer):		%	10	
Dealers:				
	dealers / truck	no.	6	
	basket (40kg) cost	N	300	
	loading cost/truck (x12 loaders)	N	12,000	
	off-loading (x10 loaders)	N	10,000	
	banking agent comm.	%	3	
	dealers comm. (% of price to wholesaler)	%	10	
Transport:				
	truck size	wheels	12	
	rates	N/km	200	
	Kaduna -> Lagos, trip	N/km	150,000	
Wholesalers:				
ave. baskets purchased / truck		baskets	20	
wholesalers purchasing / truck		no.	23	
Retailers:				
ave. baskets purchased / wholesaler		no.	4	
ave. retailers purchasing / wholesaler		no.	5	
ave. retailers / truck		no.	115	
Consumer sales:				
quality grade: current grades				
1	good	%	40	from:
2	average	%	10	Tomato Market System Analysis, 2013 GEMS4 Study (19)
3	poor	%	20	
4	very poor	%	10	
5	bad	%	20	
quality grade: 50% reduction in grades 3,4,5				
1	good	%	60	- Studies show that plastic crates can reduce poor
2	average	%	15	quality grades from 50 to 80%; Fernando, 2006 (16)
3	poor	%	10	- Research needed for local data
4	very poor	%	5	
5	bad	%	10	
quality grade: 80% reduction in grades 3,4,5				
1	good	%	70	(see above)
2	average	%	20	
3	poor	%	4	
4	very poor	%	2	
5	bad	%	4	

Assumptions

estimated averages				remarks
Total tomato production:				
Total national production		tons	1,700,000	
Total tomatoes move North to South		tons	450,000	
Proportion moved north - south		%	26	
Transport period, 6 to 7 months (season)		days	150 - 180	
Equivalent trucks, x12 wheeler, during season		no.	25,000	
Equivalent trucks / day		no.	140	
Mile-12 statistics:				
Trucks to Mile-12 / day		no.	40	
Proportion to Mile-12		%	30	
Tomatoes sold / year		tons	130,000	
Gross turnover all produce / day (estimate)		N mil.	500	
Assume 25% tomatoes during year		N mil./day	125	
Ave. Sales price / basket N 6500; 450 baskets/ truck then trucks / day (*cross check*)		no. +-	43	
Markets:				
Traditional (informal systems):				
micro-retailers (hawkers, stree traders, etc)		% >	98	
Small formal:				
convenience shops		% >=	0	
Larger formal:				
super-markets:				
tons/ store /wk		tons	0.5	e.g. Shoprite, 1.5 to 2 tones/wk (x4 stores Lagos)
x11 stores in Nigeria; tons /wk		tons	5.5	Shoprite x11 stores in Nigeria
tons /year		tons	300	
20 chains in Nigeria		tons	6,000	x20 supermarket chains in Nigeria; assuming equal size
as proportion of total production		%	0.35	
estimated total,		% <	1	
other: online, direct delivery, fresh markets		% <	0.5	
Baskets:				
Equivalent trucks, x12 wheeler, during season		no.	25,000	
Ave. 450 baskets per truck		no.	11,250,000	
Cost / new basket		N	300	
Re-used /basket		N	100	
weighted cost; new & reused		N	260	
Life span,trips		trips	1.2	
Basket capacity, kg		kg	40	
Baskets / truck		no.	450	
Weight / truck, tons		tons	18	
Total cost per trip south/truck		N	117,000	
Total cost per trip / basket (after 20% re-use)		N	260	
Cost truck / trip		N	117,000	
Cost truck / trip /ton		N	6,500	
Cost truck / trip /kg		N	6.50	
Actual required; 80%		no.	9,000,000	repaired and returned to north, 20%
Required by farmers		no.	1,408,000	64 000 farmers; 22 per season (assuming 6 month life)
Value basket making industry; @ N150 to basket maker		N	1,561,200,000	
Value of basket trading (maker to farmer)		no.	1,561,200,000	
Women basket makers		no.	20,816	assuming 500 made by each during season
Income per person per season		no.	75,000	
i) Women potentially affected by use of crates:				Total affected i) + ii):
	year 1	1 %	195	306
	year 2	3 %	586	919
	year 3	6 %	1,172	1,838
	year 4	11 %	2,345	3,677
	year 5	23 %	4,689	7,354
ii) Women potentially affected by use of crates in direct sales option:				
	year 1	1 %	111	
	year 2	2 %	333	
	year 3	3 %	666	
	year 4	6 %	1,332	
	year 5	13 %	2,664	

Assumptions

		estimated averages	remarks
Plastic crates:-			
Cost per crate	N	950	
Life span, months	month	18	
Capacity, kg	kg	20	bottling companies estimate a life span of 1 to 1.5 years on similar crates
Size: crates /truck x9 layers high		800	x9 layers results in crates; 20cm above top of truck
Weight tomatoes / truck, tons	tons	16	
Trip turn around, days		6	minimum period
Trips per 18 months	no.	91	
cost crates/ truck load	N	760,000	
interest 12%; over 18 months	N	136,800	
total	N	896,800	
cost per trip south/ truck	N	9,837	
Return trip cost north/ crate	N	100	
cost per trip south/ crate	N	12	negotiated cost to return x1 crate
Total cost per trip return/ crate	N	112	
Cost all crates on truck / trip	N	89,837	
Cost truck / trip /ton	N	5,615	
Cost truck / trip /kg	N	5.61	

Production, population and consumption estimates

	population	% popn	tons produced	% produced	tons consumed	surplus/ deficit tons	% surplus/deficit
central	10 435 881	7.43	145 676	10.1	106 745	38 930	2.7
eastern	5 473 750	3.90	31 946	2.2	55 989	-24 043	-1.7
north-east	8 857 483	6.31	66 449	4.6	90 600	-24 152	-1.7
northern	40 568 513	28.89	715 599	49.8	414 962	300 638	20.9
south-east	41 763 944	29.74	245 348	17.1	427 189	-181 841	-12.7
south-west	33 320 551	23.73	231 292	16.1	340 825	-109 533	-7.6
total	140 420 122		1 436 310				
consumed kg/capita/year			10.2				

Region	State	Production, tons	
central	Niger	76 671	
	Plateau	51 114	
	Nasarawa	12 779	
	Abuja FCT	5 111	145 676
eastern	Adamawa	12 779	
	Taraba	19 168	31 946
north-east	Borno	38 336	
	Gombe	25 557	
	Yobe	2 556	66 449
northern	Kano	70 282	
	Kaduna	134 175	
	Katsina	121 396	
	Bauchi	38 336	
	Jigawa	230 014	
	Sokoto	70 282	
	Zamfara	12 779	
	Kebbi	38 336	715 599
south-east	Rivers	38 336	
	Benue	51 114	
	Anambra	25 557	
	Delta	2 556	
	Imo	1 278	
	Akwa Ibom	1 278	
	Kogi	44 725	
	Enugu	38 336	
	Cross River	38 336	
	Abia	1 278	
	Ebonyi	1 278	
	Bayelsa	1 278	245 348
south-west	Lagos	25 557	
	Oyo	83 061	
	Ogun	57 504	
	Ondo	12 779	
	Osun	12 779	
	Edo	25 557	
	Ekiti	12 779	
	Kwara	1 278	231 292
total		1 436 310	

Estimated from: FAO stats; 2010, and ref. 2.

Value chain analyses details

DIRECT BULK MARKET

actor	description	unit size	unit	N costs	N costs/kg	N selling price / crate	N income/kg	margins N/kg	margins %age	number players / employees
Note: Assumptions of finacial margins are based on wholesaler buying direct from farmer and selling: - within self-owned retail shop (vertically integrated), **or** - selling to other retailers.										
1 producer (grower)	numbers dependent on yield; 7 t/ha									343
expenses:										
growing costs	seedlings, fert., chemicals, labour (ref. 8); yield kg/ha = 7,000	1	ha	220,000	31					
marketing costs:										
transport	to collection centre (N 120/km); 500km 16 trips of 30km return over 8 weeks	500	km	60,000	9					
expenses total					40					
income (selling)	crate size, 20kg	20	kg			2,200	110			
nett margin								**70**	**175 %**	
2 wholesaler (bulking & distributing)										
expenses:										
buying price (cost of sales)		20	kg	2,200	110					
aggregating agent	co-ordinating farmers; sourcing supply & delivery	5	%	110	6					1
operating expenses:										
loading cost	N 12 000 per truck; crates =	800	1 truck	12,000	0.8					12
transporter fee	Kaduna - Lagos; refurbished insulated & refridge truck; crates =	800	1 truck	232,880	7					2
unloading cost	x10 people @ N 1000; crates =	800	1 truck	12,000	0.8					12
plastic crates	800 crates; @ crate/ trip =	112	1 truck	89,600	3					
re-load crates	x10 people @ N 1000; crates =	800	1 truck	10,000	0.3					10
transport controller	accompany vehicle; return	2	%	66	3					1
expenses total					**131**					**38**
wholesaler (marketing & selling to retailer)										
expenses:										
operating expenses:										
wash, grade & re-pack	x3 times pack centre costs / kg	1	kg	0.5	0.5					10
packaging expenses,	5 kg units; polystyrene containers	5	kg	10	2.0					
staff expenses, admin, etc	N 30 000 @ month, N 1500/day; 1 truck per day	1,500	6 no.	9,000	0.6					6
electricity/generator	N 1 300 /day	1,300	1 no.	1,300	0.1					
rental, Lagos authority	N 400,000/month; N 18 000/day	18,000	1 no.	18,000	1.1					
water	N 500 /day	500	1 no.	500	0.03					
expenses total					**3**					**16**
income (selling)	crate size, 20kg	20	kg			3,300	165			
nett margin								**32**	**29 %**	
gross margin								55	50 %	
3 retailer (selling to consumer)										
expenses:										
operating expenses:										
re-pack labour	x3 times pack centre costs / kg	1	kg	0.5	0.5					8
packaging	300 g punnets for of 20% produce	0.33	kg	5	4					
staff expenses, admin, etc	N 30 000 @ month, N 1500/day; 1 truck per day	1,500	6 no.	9,000	0.6					6
electricity/generator	N 1 300 /day	1,300	1 no.	1,300	0.1					
rental, Lagos authority	N 400,000/month; N 18 000/day	18,000	1 no.	18,000	1.1					
water	N 500 /day	500	1 no.	500	0.03					
transport local (if used)	N 0.5/km/kg; 10 km	0.5	10 km	5	0.5					2
expenses total					**7**					**16**
total expenses					**140**					

income (selling price)	**before quality improvement**					selling prices / 5kg	selling prices / kg	selling prices within 20 kg	weighted income/kg		
quality grade 1	good	%	40	8	kg	1,500	300	2,400	**200**		
2	average	%	10	2	kg	1,200	240	480			
3	poor	%	20	4	kg	800	160	640			
4	very poor	%	10	2	kg	600	120	240			
5	bad	%	20	4	kg	300	60	240			
	total			20	kg			4,000			
nett margin										**60**	**30 %**
gross margin										90	82 %

income (selling price)	**after: 80% reduction in grades 3,4, & 5**					selling prices / 5kg	selling prices / kg	selling prices within 20 kg	weighted income/kg		
quality grade 1	good	%	70	14	kg	1,500	300	4,200	269		
2	average	%	20	4	kg	1,200	240	960			
3	poor	%	4	1	kg	800	160	128			
4	very poor	%	2	0.4	kg	600	120	48			
	bad	%	4	1	kg	300	60	48			
				20	kg			5,384			
nett margin										**129**	**48 %**
gross margin										159	145 %

PLASTIC CRATES only

actor	description			unit size	unit	N costs	N costs/kg	N selling price / crate		N income/kg	margins N/kg	margins %age
Note: Assumptions of financial margins are based on current buying and selling prices; November 2013.												
1 producer (grower)												
expenses:												
growing costs	seedlings, fert., chemicals, labour (ref. 8);			1	ha	220,000	31					
	yield kg/ha =	7,000										
marketing costs:												
transport	to collection centre (N 120/km); 500km			500	km	60,000	9					
	16 trips of 30km return over 8 weeks											
expenses total							40					
income (selling)	crate size, 20kg			20	kg			1,300		65		
nett margin											25	63 %
2 dealer (bulk and distribute)												
expenses:												
buying price (cost of sales)				20	kg	1,300	65					
aggregating agent	10% farm price			10	%	130	7					
operating expenses:												
loading cost	N 12 000 per truck; crates =	800	1	truck		12,000	0.4					
transporter fee	Kaduna - Lagos N 150 000; crates =	800	1	truck		150,000	5					
unloading cost	x10 people @ N 1000; crates =	800	1	truck		10,000	0.3					
crates costs	800 crates; @ crate cost / trip =	112	800	N		89,600	3					
re-load crates	x10 people @ N 1000; crates =	800	1	truck		10,000	0.3					
marketing costs:												
admin.agent	3% wholesale price			3	%	87	4					
dealers agents fee	10% wholesale price			10	%	290	15					
expenses total							99					
income (selling price)				20	kg			2,900		145		
nett margin											46	47 %
gross margin											80	123 %
3 wholesaler												
expenses:												
buying price (cost of sales)				20	kg	2,900	145					
operating expenses:												
space rental fee	equivalent N 40/equiv. basket			40	kg	40	1					
expenses total							146					
income (selling price)				20	kg			3,500		175		
nett margin											29	20 %
gross margin											30	21 %
4 retailer												
expenses:												
buying price (cost of sales)				20	kg	3,500	175					
operating expenses:												
grading labour	own labour						0					
bowls	negligible						0					
space rental fee	equivalent N 40/basket			40	kg	40	1					
transport local (if used)	N 2/km/basket; 10 km			40	kg	20	1					
expenses total							177					
income (selling price)	**before quality improvement**						/ 5kg	/ kg	within 40 kg	weighted income/kg		
quality grade 1	good	40%	40	8	kg		1600	320	2,560	187		
2	average	10%	10	2	kg		1250	250	500			
3	poor	20%	20	4	kg		700	140	560			
4	very poor	10%	10	2	kg		200	40	80			
5	bad	20%	20	4	kg		50	10	40			
	total			20	kg				3,740			
nett margin											11	6 %
gross margin											12	7 %
							selling prices					
income (selling price)	**after: 50% reduction in grades 3,4, & 5**						/ 5kg	/ kg	within 20 kg	weighted income/kg		
quality grade 1	good	%	60	12	kg		1600	320	3,840	247		
2	average	%	15	3	kg		1250	250	750			
3	poor	%	10	2	kg		700	140	280			
4	very poor	%	5	1	kg		200	40	40			
	bad	%	10	2	kg		50	10	20			
				20	kg				4,930			
nett margin											70	28 %
gross margin											72	41 %

PLASTIC CRATES with TRANSPORT up-grade

actor	description		unit size	unit	N costs	N costs/kg	N selling price / crate	N income/kg	margins N/kg	margins %age
Note: Assumptions of financial margins are based on current buying and selling prices; November 2013.										
1 producer (grower)										
expenses:										
growing costs	seedlings, fert., chemicals, labour (ref. 8); yield kg/ha =	7,000	1	ha	220,000	31				
marketing costs:										
transport	to collection centre (N 120/km); 500km 16 trips of 30km return over 8 weeks		500	km	60,000	9				
expenses total						40				
income (selling)	crate size, 20kg		20	kg			1,350	68		
nett margin									28	69 %
2 dealer (bulk and distribute)										
expenses:										
buying price (cost of sales)			20	kg	1,350	68				
aggregating agent	10% farm price		10	%	135	7				
operating expenses:										
loading cost	N 12 000 per truck; crates =	800	1	truck	12,000	0.4				
transporter fee	Kaduna - Lagos; refurbished insulated & refridge truck; crates =	800	1	truck	232,880	7				
unloading cost	x10 people @ N 1000; crates =	800	1	truck	10,000	0.3				
crates costs	800 crates; @ crate cost / trip =	112	800	N	89,600	3				
re-load crates	x10 people @ N 1000; crates =	800	1	truck	10,000	0.3				
marketing costs:										
admin.agent	3% wholesale price		3	%	93	5				
dealers agents fee	10% wholesale price		10	%	310	16				
expenses total						105				
income (selling price)			20	kg			3,100	155		
nett margin									50	47 %
gross margin									88	130 %
3 wholesaler										
expenses:										
buying price (cost of sales)			20	kg	3,100	155				
operating expenses:										
space rental fee	equivalent N 40/equiv. basket		40	kg	40	1				
expenses total						156				
income (selling price)			20	kg			3,750	188		
nett margin									32	20 %
gross margin									33	21 %
4 retailer										
expenses:										
buying price (cost of sales)			20	kg	3,750	188				
operating expenses:										
grading labour	own labour					0				
bowls	negligible					0				
space rental fee	equivalent N 40/basket equiv.		40	kg	40	1				
transport local (if used)	N 2/km/basket; 10 km		20	kg	20	1				
expenses total						190				
							selling prices			
income (selling price)	**before quality improvement**						/ 5kg	/ kg	within 40 kg	weighted income/kg
quality grade 1	good	% 40	8	kg			1600	320	2,560	187
2	average	% 10	2	kg			1250	250	500	
3	poor	% 20	4	kg			700	140	560	
4	very poor	% 10	2	kg			200	40	80	
5	bad	% 20	4	kg			50	10	40	
	total		20	kg					3,740	
nett margin									-3	-1 %
gross margin									-1	0 %
							selling prices			
income (selling price)	**after: 80% reduction in grades 3,4, & 5**						/ 5kg	/ kg	within 20 kg	weighted income/kg
quality grade 1	good	% 70	14	kg			1600	320	4,480	281
2	average	% 20	4	kg			1250	250	1,000	
3	poor	% 4	1	kg			700	140	112	
4	very poor	% 2	0	kg			200	40	16	
	bad	% 4	1	kg			50	10	8	
			20	kg					5,616	
nett margin									91	33 %
gross margin									93	50 %

Packing centre costs

1 Packing Centre Investment

Capital costs

		no.	N		N	total	Dep. %	Depreciation per annum
Building	Water supply - borehole	1	250,000		250,000		5	12,500
	Generator set (borehole)	1	200,000		200,000		20	40,000
	Plastic water tanks 5 000 l	4	30,000		120,000		20	24,000
	Wood construction	100	1,200		120,000		33	39,600
	Side insulation	1	30,000		30,000		33	9,900
	Roof insulation	1	50,000		50,000		33	16,500
Equipment								
	Sorting tables	10	3,000		30,000		33	9,900
	Plastic drum for washing	10	5,000		50,000		20	10,000
	Replacment costs (dep. /annum)							162,400
Total Investment Costs						**850,000**		

Operating costs (6 months)

PPE materials	50	5,000		250,000		
Staff						
packers	30	15,000	6 months	2,700,000		
washers	20	7,500	6 months	900,000		
training costs	30	1,000		30,000		
Water	1	10,000		10,000		
Generator						
fuel	12	6,000		72,000		
maintenance	1	100,000	8 300/ month	100,000		
Replacment costs (dep. annual)				162,400		
Total operating costs per season					**4,224,400**	

Throughput:

kg tomatoes / day	210,000
kg, net 90%	189,000
tons tomatoes / season (150 days)	31,500
tons tomatoes / season 90% (150 days)	28,350
total no. crates required	56,700
crates / day	9,450
tons / day	189
no. lorries / day (16t)	12
operating months	6
operating days	150
return trip, days	6
crates / lorry	800
weight / crate, kg	20
wastage %	10
transported total, tons	28,350
packing centre operating cost per ton	**149**
operating cost / kg	**0.15**

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