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Review

Exploring Investment Potential in Tomato Processing Industries in Kano, Northern Nigeria

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This review delves into tomato processing into different products using tomato paste as a base. It discussed tomato production in Nigeria and the glut that's a regular phenomenon during tomato seasons. Again, it talks about the wastages that occur because of the glut and also because of the inherent nature of tomato which predisposes it to perish after harvest when left in its natural state. Also, it discusses the necessary steps to undertake in production of processed tomato, advantages and disadvantages of processed tomato, and gave in-depth step by step processing procedures for the production of different tomato products. Furthermore, it dwelled on issues relating to packaging of finished tomato products, packaging development consideration, types of packaging, production capacity, marketing of tomato products, requirements for setting up a small scale processing centre, analysis of investment in tomato paste processing, hygiene in tomato processing, and product registration. Conclusively, it maintained that establishing tomato processing centres by investors would help create wealth and employment and in the long run help nip tomato wastages in Nigeria in the bud.

Keywords: Tomato, Wastages, Packages, small scale, Tomato paste.

INTRODUCTION

Raw materials are the backbone of agro-industrial organizations (UNIDO, 2007). It accounts for about 10% of the total cost of production depending on the enterprise. Two major processing methods of tomato which yield a variety of products are the drying (dehydration) and wet milling. Products of drying include dried tomato slices and powered tomato whereas wet milling results in Tomato Paste, Tomato jam, juice etc. Fruits and vegetable wastages in Nigeria is high with annual tomatoes loss at an alarming rate of 40 -50% due to poor processing and preservation culture (Okunoya, 1996). Tomato is one of the major vegetable crops produced in Nigeria, being highly perishable in nature; it has a limited shelf life. It creates glut during it short production season and become very scarce and expensive during it off season, its short life and inadequate processing and preservation leads to loss of revenue to the farmers. United state is the second largest producer of tomatoes after China and yet in the US, Processed tomato accounted for 89% of all tomatoes produced in 2008 yielding more than $2billion in annual farm cash receipt. Nigeria is second largest producer of tomato in Africa second only to Egypt and 13th in the world. Nigeria produces 6 million tonnes of tomato annually prior to 1990(Erinle, 1989). However, the scale of tomato production in 2008- 2009 season is estimated to be between 1 – 2million tonnes (UNCTAD, 2012). This short fall necessitated the importation of processed tomato worth ₦11.7billion ($75.5million) yearly; this makes Nigeria one of the primary importers of tomato globally.

Different raw materials are available in different agro-ecological zones of the country; this is due to the fact that different crops require different climatic conditions for its optimum production. Kano falls under the agro-ecological zone for tomato production, hence the call for investment to tap into the opportunities available in processing of tomatoes which will reduce the annual wastage in the region to the barest minimum. The

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need to preserve the product for home use (inclusion in stews, soups, curries etc) out of season or to add value for extra income. Also, the demand for this product is increasing everyday in all parts of the country (it is one of the consumer goods in every home, hotels and restaurants being used almost on daily basis) apart from the local markets; investors can also export. Traditionally, the most important methods used are concentration (to a paste or purée) and drying either fruit pieces or to a powder (Dale et al, 1982). Proper processing and packaging methods of tomato with emphasis on hygiene makes the product more appealing hence commanding more market value. Tomato being a seasonal crop sells between ₦450 to ₦1200 in it season and between ₦3000 to ₦7000 at off season. This huge price differential makes it glaring that there will be huge return on investment in this sector.

Necessary Steps to Undertake in Production of Processed Tomato (weighing)

Selection of raw materials for processing*:* Fresh, matured and uncontaminated tomatoes are used for processing. Especially without infected bruises, mould and must be of high quality (good specie). According to United States Department of Agriculture (USDA)(2011) Roma VF (and UTC Tomato) verity have been identified to be the best for processing into paste because they are fleshy and have relatively low water content.

Handling: All raw food and materials should be handled with care in order to avoid bruises and damages. Foods should be kept off the ground and protected from insects. Raw materials should be kept cool by storing them away from sunlight. Bruised but not infected tomatoes can also be processed but putting in mind that bruises encourage infestation

Weighing**:** Correct weighing of raw materials and ingredients is critical in processing. This step together with adequate mixing of ingredients has the most important effect on both quality of the product and uniformity of the batches of products.

Sorting*:* Food is sorted by maturity and colour. Sorting should be done as early as possible by picking to remove any mouldy or rotten tomato.

Cleaning: Washing in clean portable water.

Blanching: known as pre-heat treatment before processing. In case of tomatoes for example, put the tomatoes in boiled water for 5 minutes and thoroughly covered and removed from the water after the said time and cool immediately by pouring cold water. This process helps to de skin, de-seed and to remove offensive odour.

Pasteurization: This is also known as post-heat treatment. Processed foods can be pasteurized in their bottles using hot water. It is important to note that the product and the water shall maintain the same temperature at all times, otherwise the bottles will burst. The filled bottles with their lids closed are placed in a larger pan of water with water heated to boiling point. This could be done for at least 45 minutes for tomato paste. The time of pasteurization varies from one product to another; Pasteurization is used to preserve acidic foods such as bottled fruit juice for several months. It preserves foods by destroying enzymes and microorganisms, but the mild heating causes few changes to the eating quality or, and nutritional value of food.

Preservatives (chemical)*:* They prevent the growth of micro organisms and help preserve food. They are many types of chemical preservatives that are used in food processing. For example, sodium benzoate, sodium metabisulphite, sulphur dioxide, Sodium chloride (common salt), citric acid etc. For example sulphur dioxide is more effective against moulds or bacteria than yeasts and has the additional advantage of slowing down browning or darkening of some of some products. As a general rule, if a product is to be opened (i.e. if pasteurized) and used up at once, a chemical preservative should not be necessary. If a product is opened, part used and resealed, the use of a preservative can be considered.

Advantages of Tomato Processing

According to Goldberg (2011) the following reasons amongst others are some of the advantages why food is processed:

- Protection against spoilage
- Long shelf life
- Add value
- Availability
- Easy transportation
- Profitability
- Lower of season cost
- Easy to store
- convenience
- safety

Disadvantages of Processed Tomato

- Reduction of nutritional value
- Reduction of taste
- Change of colour
- Change in texture
- Restriction in use

Materials required for primary processing: grinding machine, filter, thermometer, Refractometer, pH meter or papers, tables, knives, vessel, pots, heat source, water source etc

METHODS OF PROCESSING

- Dehydration
- Chemical preservation
- Pasteurization(heat treatment)

This paper will lay emphases on wet milling of tomato i.e. the Processing of tomato into Paste, Jam and juice etc using pasteurization.

TOMATO PASTE PRODUCTION

Process Flow Chart	Note
Mature, ripe tomato	Ripped
↓	
Sorting	By colour, maturity and blemishes Remove any mouldy or rotten tomatoes
↓	
Washing	In clean portable water, drain to eliminate water
↓	
Blanch and grind	In boiled water for 5mins and grind using grinding machine
↓	
Boil and Mix with lemon	Boil for 20-25mins. Add lemon if PH is above 4.0; add until PH falls below 4.0
↓	
Filtering	Separate juice using white cotton sack; hang for one hour to drain water
↓	
Heating	Heating must be done slowly with constant stirring to prevent the pulp from burning until 30% solids is obtained to get concentrate
↓	
Sterilization of containers	Using hot water
↓	
Hot fill	Into sterilized bottles and cans air tight
↓	
Pasteurization	For 45mins
↓	
Cool	At room temperature
↓	
oughly clean bottles of dirt	With clean water
↓	
Label	Put Informative label
↓	
Package and Store	Pack and stored in a cool, dry place away from sunlight until it is marketed
↓	
Marketing	Preferably during the off-season

TOMATO JAM PRODUCTION

Process Flow Chart	Note
Mature, ripe tomato	Ripped
↓	
Sorting	By colour, maturity and blemishes Remove any mouldy or rotten tomatoes
↓	
Washing	In clean portable water, drain to eliminate water
↓	
Blanching	In boiled water for 5mins
↓	
De-skin and weigh	Separating the skin from the seed and weigh
↓	
Mash	Turing the tomato into slurry using grinding machine
↓	
Boiling	Add 3/4sugar per 1kg &Lemon. Until you achieve the desired thickness
↓	
Cooling	Until the temperature is at ambient
↓	
Sterilization of containers	Using hot water
↓	
Filling	Bottle the jam and seal (air tight)
↓	
Pasteurization	Product is boiled at 90^0C for 10mins
↓	
Cooling	Cooled over night and was the bottle
↓	
Labelling	Informative and attractive label about the product
↓	
Storage	Packed and stored until it is marketed
↓	
Marketing	Targeting whole sellers

TOMATO JUICE PRODUCTION

Process Flow Chart	Note
Mature, ripe tomato	Discard mouldy or unripe
↓	
Washing	With clean potable water
↓	
Blanching	In hot water bath (90^0C) for 5- 10mins
↓	
Grinding	Turning the tomatoes in pulp using grinding machine
↓	
Filtering	To get the juice
↓	
Stabilizer	Add sugar
↓	
Sterilization of containers	Using hot water
↓	
Filling	Bottle the juice
↓	
Pasteurization	For 10mins
↓	
Labelling	Informative and attractive label about the product
↓	
Storage	Packed and stored until it is marketed
↓	
Marketing	Targeting whole sellers

DRIED TOMATO PRODUCTION

Process Flow Chart	Note
Mature, ripe tomato	Not over ripped and un-bruised
↓	
Sorting	By colour, maturity and blemishes
↓	
Washing	In clean portable water
↓	
Slicing	Quarterly
↓	
Salting	Help to drain and maintain colour after drying
↓	
Spreading and draining	Spread on the drying tray for 30mins to drain properly before loading
↓	
Loading in dryer	After firing the dryer and draining the tomatoes for 30mins
↓	
Grinding	Optional; if you want it in powered form
↓	
Packaging and sealing	In slices or powdered form
↓	
Storage	Arrange in carton in a cool dry place until marketing
↓	
Marketing	Preferably during off-season

REQUIREMENTS FOR SMALL SCALE (COTTAGE) TOMATO PROCESSING CENTRE

S/n	Materials	Quantity	Cost (₦)
1	Grinding Mill (Stainless steel)	1	170,000
2	Big Bowl	10	15,000
3	Small bowl	10	5,000
4	Big Pot	10	80,000
5	Packaging (Bottles, stickers and cartons)		170,000(monthly)
6	Table (Stainless steel covered)	2	30,000
7	Stool	4	6,000
8	Hand gloves	1 packet	500
9	Building (4 rooms with a toilet)	-	1,500,000
10	Personnel Requirement	12	240,000(monthly)
11	Water source	-	-
12	Logistics	-	60,000
13	Tomatoes	300basket	360,000(monthly)
14	Transportation		30,000(monthly)
15	Sieves	12	8,000
16	Scale	2	5,000
17	Screw Press	1	15,000
18	Gas cylinder/Burner	2	50,000
19	Gas		24,000(monthly)
20	Stirrer	12	8,000
21	Drum	2	6,000
22	Company Registration		85,000
		Total	**2,867,500**

Note: The cost of water was excluded and without the building cost, the total cost estimate will be ₦1, 367,500. The estimate in the table above is a rough estimate.

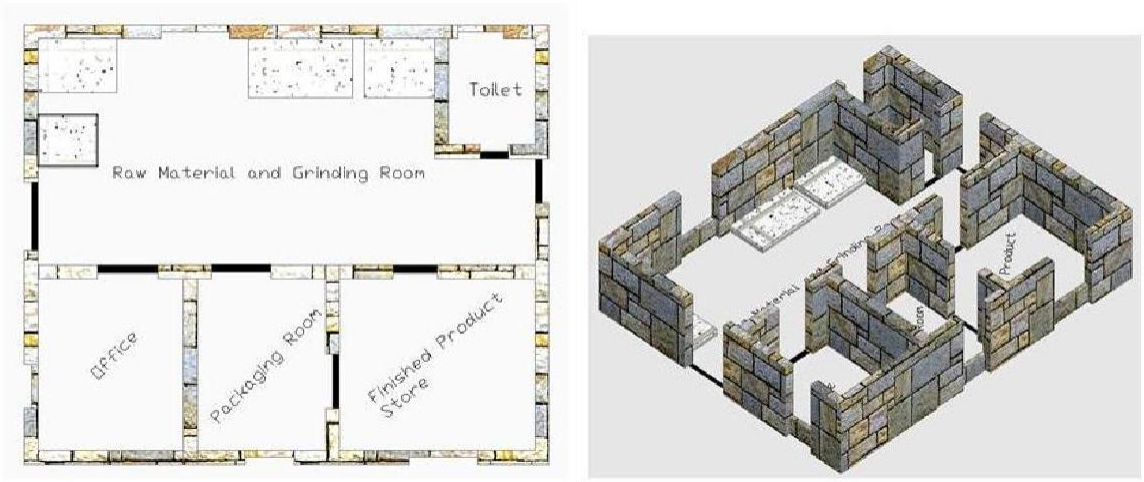

Figure 1: 4 rooms and a toilet building for a small scale Tomato Processing centre

Packaging

Packaging is one of the most efficient ways to tell a product's story; the information of the package is the only massage that stays with the product all the way from the producer to the consumers. Packaging agricultural produce means wrapping or containing it in some form of material that will protect it during storage, transport, or and distribution (Fellows, 2011). A well designed graphics and clear information on a quality packaging material can make a strong connection and creates a brand identity. The main aim of packaging is to keep food in good condition until it is sold, or consumed (FAO, 1992). Packaging materials protects

the product by providing tampering resistance and special physical, chemical and biological needs. It also shows the nutritional information on the food being consumed. A proper, standardized package of standard weight and suitable quality will create a better consumer appeal and a higher return to the processor.

Why Packaging and Labelling

Packaging is a means of providing the correct environmental conditions for food during the length of time it is stored and or distributed to consumers; a good package according to Ackerman (1997) has to perform the following functions among others*:*

1. For physical protection: The production enclosed in the package may require protection from mechanical shock, vibration, compression, temperature etc.
2. Barrier Protection: It is a bars oxygen, water, vapour, dust; it keeps product clean, fresh, sterile and safe for the intended shelf life.
3. Containment: small objects are typically grouped in one package for reason of efficiency. For example, a single box of 50 ticks of matches requires less physical handling than 50 single sticks. Liquids, powders and granular materials need containment.
4. Information Transmission: Package and labels communicate information such as; how to use, ingredients, name of producer, production site, production date, expiry date, net weight, how to dispose package or product etc.
5. Marketing: The packaging and label is use to encourage potential buyers to purchase the product
6. Security: Packaging can play an important role in reducing tampering risk in shipment, and reduce the risk of pilferage
7. Convenience: Package can have features that add convenience in distribution, handling, stacking, display, sale and disposal.
8. Portion control: Single serving or single dosage packaging has a precise amount of contents to control usage. Bulk commodities such as sugar can be divided into packages that are more of a suitable size for house hold.

Packaging Development Consideration

Package design and development are often thought of as an integral part of the new product development process, it must be linked closely with the product to be packaged, need of consumer, and requirement of product preservation and protection, distribution, as well as needs of the retailers and the environment (Earle and Earle, 2000). Some products like food require packaging materials that are considered safe when in contact with food; the food is safe to be consumed after being in contact with the packaging material. Packaging, labelling, distribution and sale need to be validated to comply with regulations having the well being of the end users in mind.

Tomato paste, jam, puree, juice and syrup are packed in bottle and jars. Glass containers have some advantages over metal containers because they are reusable and airtight-closing is relatively easy; a lid for the jar and cap for the bottle.

It is advised that a professional graphic art designer be employed in designing of your labels and on your packaging material to ensure a qualitative and beautiful packaging for your product.

Types of Packaging

Packaging are categorised by their layer or function hence, we have:

i. Primary Packaging: This is the material that first covers the product and holds it, this is usually the package that is in direct contact with the content

ii. Secondary packaging: This packaging is outside the primary packing, it is often used to group primary packages together.

iii. Tertiary packaging: This is used for bulk handling and for ware house storage and ship transport

Production Capacity

Tomato processing plant could be operated on small, medium or large scale depending on the availability of raw material and availability of fund for the investor.

- For medium to large scale production, it is advised that investor should have an understanding with large farm(s).
- For small scale processing plant, it is advised that the investor liaise with small farmers around the plant for steady supply of tomato at a reasonable price. This arrangement will make it easier for the processor to get fresh and qualitative supply and also make marketing/selling easy for the farmers

This paper is focusing on small scale processing (cottage industry) which is relatively easy to start up considering the capital involved in large and medium scale processing industries.

A small scale processing centre that can process an average of ten baskets a day will by the end of a month have processed an average of 300 baskets. Putting in mind that tomato is a seasonal crop, production should be planned to cover the seasonal period when the crop is cheap. Marketing will majorly occur during the off season.

Establishing reasonable numbers of small scale processing centres will in a long way reduce wastages of tomato usually experienced during it season and also improve the bargaining power of tomato farmers as there will be more demand for their produce.

Marketing of Tomato Paste

Nigeria is a major consumer of tomato paste of which only between 20-30 percent is produced domestically; however, 25-50 percent of the input for this domestic

paste is imported from China (CBN, 2011). This leaves the market for domestically produced tomato paste underserved. The country has a huge market for tomato paste; the size of the Nigerian market for tomato paste is about 200,000 tonnes per annum and this goes up if the West African market is included i.e. the size of the market rise to around 400,000 tonnes per annum.

Consumer will buy more if the price is relatively low but may be willing to pay a higher price if product is of good quality. It is advisable for producers of tomato paste to control sale of the product when tomato is in season but rather intensify production. The ability to produce and stock pile can help to minimize seasonal fluctuation by placing on the market only amount of produce sufficient to maintain a given price. It is therefore important to know 'when' and 'what amount' to produce and sell at any given time bearing the mind the market price. A producer must have access to information on market and price.

Potential Market for Tomato Paste includes:

- Hotels
- Restaurants
- Caterers
- Supermarkets
- School (Boarding houses)
- Market Wholesalers

It should be noted that marketing of the product should not be limited to one state or region alone as the demand for the product is nationwide. A simple analysis on profitability of investment in small scale tomato processing plant is explained below;

One Month Analysis

***Fixed investment*:** Building, machineries and other equipments ---------- **= ₦ 1,933,000**
***Working capital*:** Salaries, Raw materials, packaging materials and other Utilities---------- - **= ₦ 934,500**
***Total Investment*---------- =₦ 2,867,500**

Plant output estimate

- If 10basket is processed per day, 300 baskets will be processed in a month
- If 14.70kg of paste is derived from one basket then **4410kg of paste will be processed monthly**

Estimate market value of product (Monthly)

- If 0.98kg is to be sold for ₦ 450
- Total monthly production of 4410kg will worth ----------**₦ 2,025,000**

Six Month Analysis

Fixed investment ---------- **=₦ 1,933,000**
Working capital (6 x monthly working capital)
---------- **=₦ 5,607,000**
Total investment ---------- **=₦ 7,540,000**

Plant output estimate: Total production in 6months =6 x 4410 ---------- = **26460kg**

Estimate market value of product (6 months)

- Total 6(six) month Production of 26460kg will worth---------- **₦ 12,150,000**

This project is considered feasible because the raw materials, man power, and machines required to setup this processing centre are available locally in abundance. With the estimate personnel requirement of 12 people, going into a venture like this will help generate employment thereby reducing youth unemployment in the state and other core tomato producing states.

Note that the floor and the walls of the building should be tiled and if the walls are not tiled it must be painted using oil-base paint. It is also important to build the facility in such a way encourages easy cleaning; running tap water and PVC drain outlet system is important to encourage frequent washing of the facility. The entire compound/environment of the building must be fumigated and the certification of fumigation collected, this is also a prerequisite for registration.

Hygiene in Food Processing

A high standard of hygiene in food processing is a prerequisite for safe food production (Lelieveld et al, 2003). Food contamination is a serious health problem. It can cause severe illness and even death. It can seriously damage the reputation of a business, the reputation of the food industry, and the jobs of many workers. Sources of contamination includes; physical, chemical and microbiological contaminant and as a person who handles food you have an important responsibility to handle food safely to protect other people from getting sick, your reputation in the food industry and your business. A tomato processing plant should have a running tap water and functional toilet facility. Hygienic plant design consider the following; The factory site, the factory building, the interior of the building; walls, ceilings, floors, drainage, services, internal barriers separating manufacturing processes. Airborne contaminants such as dust, engine fuse etc should also be control. Note that persons with highly contagious diseases like tuberculosis and hepatitis-C should not work in a food processing centre.

Personal Hygiene

An important way to prevent food contamination is to maintain a high standard of personal hygiene and cleanliness (Harrell, 2009). Even healthy people carry food contaminating bacteria on their bodies, by touching parts of the body, such as your nose, mouth, hair, or your clothes you can spread germs from your hands to the food. Good personal hygiene also makes good business sense. It is very important to train your staffs on hygiene and you have a monitoring system in place to check the activities of each employee. The knowledge of the operational standard of the regulating body is also important has not to working below expected hygiene standard.

Washing of hands thoroughly is a good way to reduce the chance of contaminating food product. Wash your hands with soap and warm water and don't forget the backs of your hands, wrists, between your fingers and under your fingernails. Thoroughly dry your hands immediately after you wash them. Always dry your hands with a clean towel or disposable paper towel, not on your clothes. Wash your hands after; using the toilet, handling raw food, blowing your nose, handling garbage, touching your ears, nose, mouth or other body parts, handling animals, etc. If you are wearing disposable gloves change them regularly, in the same way you would wash your hands regularly if you are not wearing gloves.

Registration

There are three types of registration that will be necessary to start-up the processing centre before products can be rolled out into the market.

1. NAFDAC Registration: You have to register your product with NAFDAC to have your NAFDAC registration number. It is therefore important to get to know NAFDAC's rules and regulations to hasten your registration process. Some of the information that NAFDAC will be concern about include the constituent/ingredient of the product, method of production, hygiene, competency/qualification of your personnel, quality of your facility and equipments etc.
2. CAC Registration: It is important to register your business name with the corporate affairs Commission (CAC) to operate using that name without fear of duplicity. You need to be sure you are not using another business name and no other business can use yours, this is important for banking and declaimers' purposes. CAC has presence in every state of the federation.
3. Trade Mark Registration: It is also important to register your trade mark with the Federal Ministry of Trade to have a national right. Registration at the state level limit you right only to the state which is subject to national registration. The registration of trade mark process is administered by the Registrar of Trade Marks (RTM) at the Trade Mark Registry Abuja, under the Federal Ministry of Trade. Although this registration does not stop production taking off but it is also important for declaimers' purposes.

CONCLUSION

From the foregoing, it is logical to maintain that establishing small scale (cottage industries) tomato processing centre(s) would help nip tomato wastages in Nigeria in the bud. Processing of tomato into paste and concomitant products is very important since these products can be kept for several months without spoilage; which will check glut and under-pricing, excessive price fluctuation and wastages. Essentially, this venture will not only be advantageous to the farmers, processors and balance of payment of the country, it will also help create the much needed jobs which have often proof elusive in many quarters. With the total investment estimate of a small scale processing centre being ₦7,540,000 with an estimate return of ₦12,150,000 for a 6 (six) month's production year, It shows that there is high return on investment in this enterprise and is worth giving a try. There is absolutely no doubt that private driven tomato processing in Kano and its environs will be a money spinner for investors because potential rewards are high as pointed out.

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