

Strategies for improving the value chain of castor as an industrial raw material in Nigeria

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Abstract: Castor is possibly one of Nigeria's most under-appreciated assets. Its potential as an industrial raw material can be fully realized by a critical appraisal of its value chain. This article reviews castor value chain in Nigeria and identifies the constraints and strategies for improving its use as an industrial raw material. The strategies proposed can serve as a guide for castor value addition among operators and policy makers in a bid to maximize castor industrial potentials. A review of the uses of castor after value addition indicated that it can be used in over ten industries, namely; agriculture, food, paper, electronics and telecommunication, textile, pharmaceutical, cosmetic and perfume, paint, lubricant, plastic and rubber industries. Constraints such as insect and disease problems, weak input/service market, inadequate knowledge and skill, post-harvest losses and inadequate process technology serve as obstacles to successful value addition for castor. Strategies bordering on developing the input market, provision of quality seedlings and fertilizers, capacity development and development of farmers institutions were proposed to bridge the gaps, encourage value addition and ensure the development of castor as an industrial raw material. It is believed that if the recommendations are implemented, castor can attract up to 25 billion Naira (105,488,032 million dollars) to the Nigerian economy.

Keywords: value chain, castor, raw material, industrial crop, cash crop

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1 Introduction

Over the years, Nigeria has implemented a number of development programmes and agricultural development has always featured prominently (Onwualu, 2009). Although a number of agricultural development programmes have been implemented (including National Programme on Food Security (NPFS), Agricultural Development Programme (ADP), River Basin Development Authorities (RBDA), Commercial Agricultural Development Programme (CADP) Nigeria, still imports some basic food items such as rice, sugar, milk, wheat and most of the agro based industrial raw materials for the large scale industries in the agro-allied sector of the economy. In order to reverse this trend,

the Federal Government of Nigeria three years ago initiated the Agricultural Transformation Agenda (ATA) which is anchored on the value chain approach and supported by the Nigeria Incentive Based Agricultural Lending (NIRSAL) scheme of the Central Bank of Nigeria (CBN). The aim is to address the bottle necks in the value chain for selected industrial crops (Onwualu, 2012, 2014; Onwualu and Olife, 2013; Olife et al., 2013).

The Raw Materials Research and Development Council (RMRDC) is also implementing programmes aimed at developing local capacity and technology for value addition to the major industrial crops of Nigeria (Onwualu, 2014). One of the crops being addressed is castor. Castor is one of Nigeria's most under-utilized biological resources. Notwithstanding the fact that castor is one of the most versatile plants being used in over ten different industries, not much research has been done on improving its value chain and hence its use as

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an industrial raw material in Nigeria as compared to some other cash crops (Gana et al., 2013, Bello and Makanju, 2011, Momoh et al, 2012, Ogunniyi et al. 1998). Researchers have carried out critical appraisals of the value chain of some strategic crops such as Shea, Cashew and Potato in Nigeria (Olife, et. al., 2013a, 2013b; Ugonna, et al., 2013), but not much has been done on the value chain of castor in Nigeria.

Castor can serve as the starting material for producing a wide range of end-products owing to its unique chemical structure (Onwualu, 2014). The plant requires little fertilizer, pesticides, water, maintenance and other cultural inputs compared to most other cultivated crops.

Companies, entrepreneurs and governments are waking up to the potentials of castor bean, castor oil and castor oil derivatives. In the past few years, a number of countries which have little or no land under castor cultivation have started making serious exploratory efforts at growing castor. Companies are doing cutting edge researches on the use of castor to produce bio-plastics and biopolymers such as polyurethane, nylon and more (Zhang, 2013). Increased use of bio-lubricants and bio-grease has made castor oil emerge as a preferred feedstock (Narasimhan et. al., 2013).

The Economic Times in 2008 reported that Brazil with only about 7% share in global castor production is probably the world's largest exporter in value added castor products. It also reported that \$1,000 worth in tonnes of castor as a commodity can fetch up to 40% more money at the first level of value addition, about 350% at the second level and more than 800-900% worth of money at the third level of value addition. These economic advantages and the diverse industrial uses make studies on this plant and development of strategies for improving its value chain in Nigeria a necessity. Identifying challenges in the various components of the value chain for a crop can help in addressing the issues.

The objectives of this paper therefore are to take an incisive look at the castor plant, considering the challenges to improving its value chain in Nigeria and suggesting strategies for improving the value chain for castor in Nigeria. This will aid the development of intervention programmes towards developing enterprises for producing different industrial raw materials for the crop.

2 CASTOR AS AN INDUSTRIAL CROP

2.1 The castor crop

The Castor bean plant (*Ricinus communis*) belongs to the family Euphorbiaceae, the spurge family. It is a short-lived perennial, which grows into a tree of eight to ten meters in height. There are annual dwarf types of 0.6 m-1.2m in height. The leaves are large, usually 2 cm-5 cm wide or wider, alternate and palmately divided into 5-10 lobes. The leaves of different varieties may be green, purple or red (Figure 1). The stems may also be green or red (Onwualu, 2012).



Figure 1 Picture of castor plant
(Source: Armstrong, 2000)

2.2 Castor production outputs

Between the years 2000 to 2009, India was responsible for 54.0% and China for 23.4% of the castor seed produced in the world. Brazil ranked the third in world castor production (11.9%) followed by Mozambique (4.3%), Paraguay (1.1%), and Thailand (1.0%). Other countries producing minor quantities of castor are Cambodia, Colombia, Ecuador, Ethiopia, Haiti, Indonesia, Kenya, Madagascar, Pakistan, Peru, Philippines, Russia, South Africa, Syria, Tanzania,

Uganda, and Vietnam (FAO, 2011), as is shown in Table 1.

In Nigeria, the grinding operation was identified as the most critical operation in feed milling and it is responsible for the high energy consumption, relatively high amount of waste and dust generation. Based on the

In Nigeria, castor bean is cultivated on over 6,000 ha

results gathered from the study, Table 5 shows the problems identified in the small scale feed mills alongside possible solutions. This paper reveals the problematic areas in small scale feed milling requiring further qualitative evaluation.

Kogi, Ebonyi, Kwara, Zamfara and FCT are the

Table 1 Production of castor seed in the main producing countries, 2000 to 2009

Country	Year									
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	'1000 t of castor seed									
India	882.8	652.7	428.0	796.7	793.4	990.7	762.0	1053.0	1171.0	1098.0
China	300.0	260.0	265.0	258.0	250.0	220.0	200.0	170.0	190.0	190.0
Brazil	100.7	99.9	170.9	83.7	138.7	168.8	95.0	98.1	122.1	91.1
Mozambique	26.0	31.0	35.7	40.9	44.9	49.0	49.6	54.5	52.1	37.5
Paraguay	11.1	12.7	7.0	9.7	10.8	11.5	10.5	10.5	13.0	13.0
Thailand	8.6	9.0	9.7	9.7	9.8	10.6	10.9	11.0	11.3	10.8
Other countries	42.2	43.9	42.9	43.0	40.1	39.7	37.8	38.9	41.3	41.2
Total	1371.4	1109.2	959.2	1241.7	1287.8	1490.3	1165.8	1436.0	1600.8	1481.6

Note: †Source: [FAO \(2011\)](#)

across most of the states. The crop grows in the wild even where it is not cultivated. Table 2 shows the quantity of Castor imported into Nigeria as estimated by FAO (2013). Benue, Gombe, Yobe, Cross Rivers,

promising producers where the bulk of the hectares are cultivated. The output is estimated at 12,000 t. See Table 3 please.

Table 2 Hectarage yield per ha of holding and availability of castor bean in Nigeria

S/N	State	Hectarage	Yield/Ha (t)	Output (t)	Type of Holding
1	Abia	1.1	2.6	3.3	Small
2	Abuja FCT	17	3.00	51.0	Large
4	Bauchi	0.5	0.5	0.5	Small
5	Benue	323	1.66	534.7	Small and Large
7	Ebonyi	62.5	0.58	36.1	Large
8	Gombe	156	2.13	333	Small
9	Kogi	86	0.48	41	Medium and Large
10	Kwara	50	-	1,100	Large
11	Plateau	0.5	1.0	0.5	Small
12	Yobe	45	0.20	9.0	Medium and large
13	Zamfara	33	1.4	46.5	Small and medium

Note: Source: RMRDC 2005 Survey on Selected Agro- raw materials

Table 3 Output of castor beans in some major producing states in Nigeria (t)

State	2001	2002	2003	2004	2005
Cross river	145	295	332	231	16
Ebonyi	10.5	11.8	9.7	12	15
Total	155.5	306.8	341.7	243	31

Note: Source: RMRDC 2005 Survey on Selected Agro- raw materials

The following areas have been identified to have potentials to grow castor bean both for domestic consumption and export purposes: Benue, Taraba, Kogi, Kwara, Yobe, FCT, Cross Rivers, Ebonyi, Enugu, Gombe, Zamfara, Kaduna, Plateau, Abia, Bauchi, Osun.

Production of castor beans is still low but has started to grow due to the promotional effort of RMRDC by providing planting materials and creating awareness. However, more has to be done in the areas of marketing the produce after production.

Considering the number of pharmaceutical, cosmetic and paint industries in Nigeria, who meet these castor oil requirements by importation, the local demand for castor bean and its processed products is huge. The national production estimates cannot satisfy local requirements in addition to export. It could therefore be said that potential domestic markets are available for castor bean in Nigeria. Figure 2 shows castor import quantity (t) from 1998-2010 as estimated by FAO (2013).

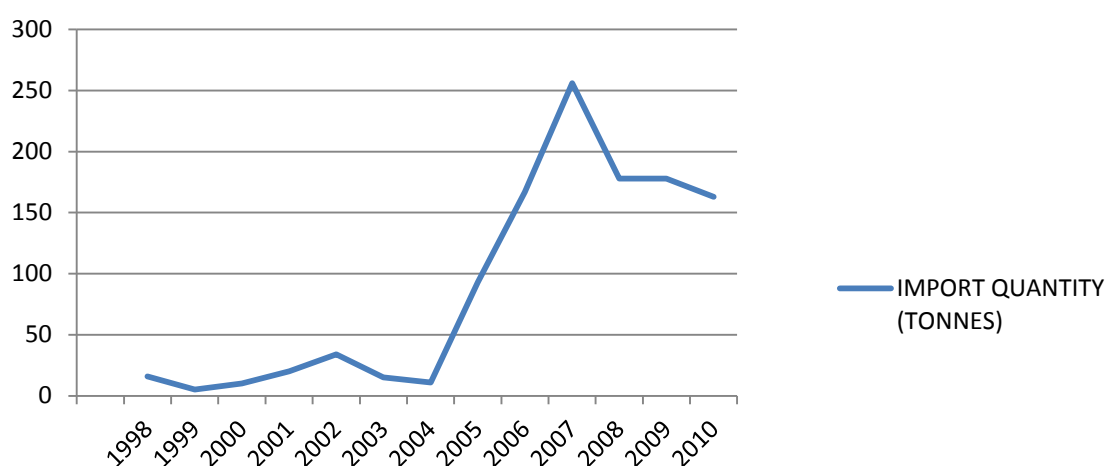


Figure 2 Graph showing castor import quantity (t) from 1998-2010

2.3 Economic uses of castor

Castor seed and its derivatives, when processed can be used to produce many secondary and advanced materials that can be used by many industries (Gana et al, 2013; Bello, 2011). Castor seed contains some 30% oil and up to 40% protein. The seed is grown typically for the oil, which has many industrial uses. Valuable products can be formed from triglycerides by sequential hydrolysis: diacylglycerols (diglycerides), monoacylglycerols (monoglycerides), (free) fatty acids plus glycerol. The basic industrial oleochemical compounds derived from triglycerides are used directly or as intermediates. These include: fatty acids, fatty acid methyl esters (FAME), fatty alcohols, fatty amines; and glycerols. Further reactions yield a series of alcohols and their derivatives: alcohol ethoxylates

alcohol sulfates, alcohol ether sulfates, aliphatic linear chain hydrocarbons, quarternary ammonium substances. Fatty alcohols and their derivatives can be used as surfactants, emulsifiers, detergents, cosmetics, lubricants, fire-extinguishing foams, plasticisers, heat stabilizers and UV absorbers (Diosady, 2011).

Narasimhan, et al. (2013) stated that castor oil is unique in having high concentrations of ricinoleic acid. High ricinoleic oil has many of the same industrial uses as mineral oils but it is readily bio-degradable. Its high ricinoleic acid content allows its ready derivatization through the OH group. Castor oil can be used as lubricants (hydraulic and brake fluids, dielectric fluids), feedstock for industrial processes (Nylon 11, Adhesives, Detergents) and as Fuels (biodiesel) (Gana et al., 2013).

Oleochemical production from any fat/oil results in glycerol. Biodiesel (a core product from castor) also results in huge volumes of glycerol. Glycerol is a tribasic alcohol, also commonly called glycerin or glycerine, it is a sugar alcohol, and is sweet-tasting and

of low toxicity. It is a colourless, odorless, viscous liquid; glycerol is one of the major raw materials for the manufacture of polyols for flexible foams, and to a lesser extent rigid polyurethane foams (Ogunniyi et. al., 1998). Other industrial uses of castor are shown in Table 4.

Table 4 Existing industries and applications for castor oil and castor oil derivatives

Industry	Application for castor oil and castor oil derivatives
LUBRICANTS	<ul style="list-style-type: none"> • Hydraulic fluids • Heavy duty automotive • Greases • Fuel additives • Corrosion inhibitors • Lubricating grease • Aircraft lubricants • Jet engine lubricants • Racing car lubricants
Textile chemicals	<ul style="list-style-type: none"> • Textile finishing materials • Dyeing aids • Nylon, synthetic fibers & resins • Synthetic detergents • Surfactants, pigment wetting agents
Paints, inks & additives	<ul style="list-style-type: none"> • Inks • Plasticizer for Coatings • Varnishes • Lacquers
Electronics and telecommunications	<ul style="list-style-type: none"> • Polymers for Electronics & Telecommunications • Polyurethanes • Insulation Materials
Paper	<ul style="list-style-type: none"> • Flypapers • Defoamer • Water Proofing Additive
Food	<ul style="list-style-type: none"> • Surfactants • Viscosity Reducing Additives • Flavourings • Food Packaging
Cosmetics and perfumeries	<ul style="list-style-type: none"> • Polishes • Emulsifiers • Deodorants • Lipsticks • Hair Tonics • Shampoos
Agriculture Pharmaceuticals	<ul style="list-style-type: none"> • Organic fertilisers • Emulsifiers • Encapsulants • Expectorant • Laxatives & Purgative • Antihelmintic • Antidandruff • Cathartic • Emollient
Plastics and rubber	<ul style="list-style-type: none"> • Polyamide 11 (nylon 11) • Plastic films • Adhesives • Coupling agents • Polyols • Synthetic resins • Plasticizers

Source: Narasimhan et al. (2013)

Glycerol is used to produce nitroglycerin, an essential heart medication, but also an essential ingredient of dynamite, smokeless gunpowder and other explosives.

With the high price of crude oil, and legislative support, tryglyceride oils and therefore castor oil-based biodiesel could be competitive and economically lucrative (Diosady, 2011). Some oleochemical derivatives of castor oil require relatively simple methods for their production, while higher generation derivatives such as sebacic acid or salts of ricinoleic and undecylenic acid require more sophisticated production methods.

So far in Nigeria, most of the use of castor is in cooking where it is used as a spice. Only a few industries are currently extracting the crude castor oil for export. However, studies in Nigeria have shown that castor oil has antimicrobial activity, purgative, anti-inflammatory, labour-inducing ability and has been used to treat gall bladder problem, abscesses, headaches, appendicitis, epilepsy, hemorrhoids, constipation, diarrhea, skin diseases, etc (Momoh et al. 2012; Odugbemi, 2006).

Castor has also been shown to be a good alternative for production of biodiesel (Bello and Makanju, 2011). Opportunities also exist for downstream industries to refine the oil into different products as is shown in Table 4. These will create wealth and employment in Nigeria through the emergence of small and medium enterprises involved in the processing activities as has been shown for other industrial crops (Ugonna et al., 2013; Olife et al., 2013ab).

2.4 Economic analysis of castor development

From the economic point of view, the vast arable land, ideal climate and abundant quantities of castor growing in the wild and in farms around the country, present rare opportunities for consolidated socio-economic development. Aggressive value addition to castor will not only lead to increased

utilization and development, but also create wealth and foreign exchange earnings for the nation. In effect, castor, one of the nation's natural resources holds a vantage position for the development of the nation's resources. In an era where government is directing her attention towards diversification of the economy, targeted investment in castor value chain development will contribute to sustain the micro-economic indices, real GDP growth rates, and employment trend. Other areas where the economic factors may influence, include exports which would attract hard currencies and encourage foreign direct investment.

3 Castor value chain in Nigeria

3.1 Concept of value chain for crops

The study of value chains comprises of two key concepts: value and chain. The term value is synonymous to "value added" in the value chain as it characterizes the incremental value of a resultant product produced from processing of a product. Price of the resultant product shows its incremental value. The term chain refers to a supply chain indicating the process and the actors involved in the life cycle (from conception to disposal) of a product (Hawkes and Ruel, 2011). Kaplinsky and Morris (2001) defines value chain as study of the "full range of activities which are required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers, and final disposal after use".

The success or failure of a value chain intervention depends principally on the partnerships that are built between actors and support providers that participate in a particular chain (Lundy et al., 2004). Earlier studies have shown that the current Agricultural Transformation Agenda of the Nigerian government is hinged on an improved value chain (Onwualu and Olife, 2013).

3.2 Component of castor value chain in Nigeria

Figure 3 and Figure 4 show castor value chain with emphasis on different products as obtained in different countries, especially the developed countries (SBC, 2011). The figures show that for the components of the

value chain from production (cultivation) to processing and consumption modern technologies are applied, resulting in high quality products for industrial and domestic use.

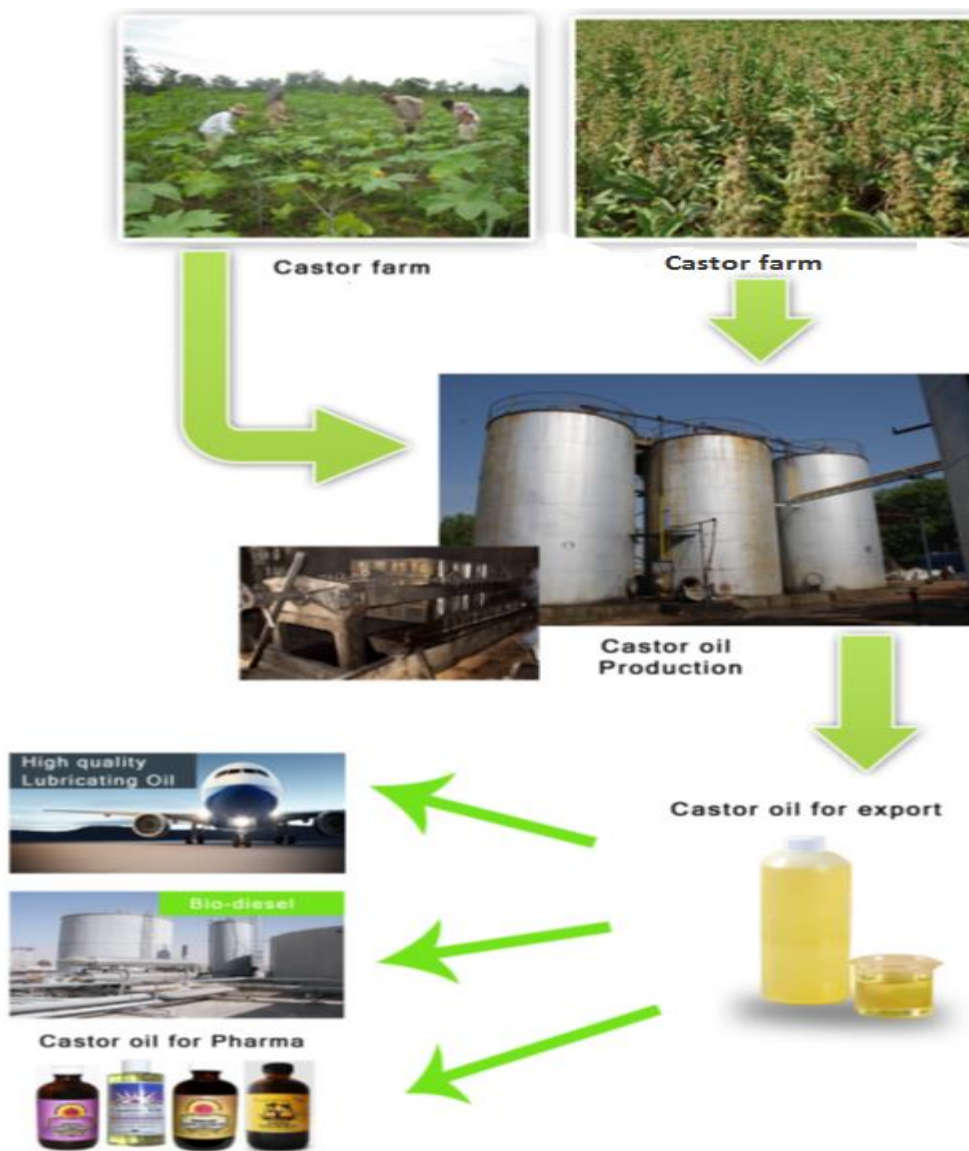


Figure 3 Castor value chain in the developed world
Source: RMRDC, 2005

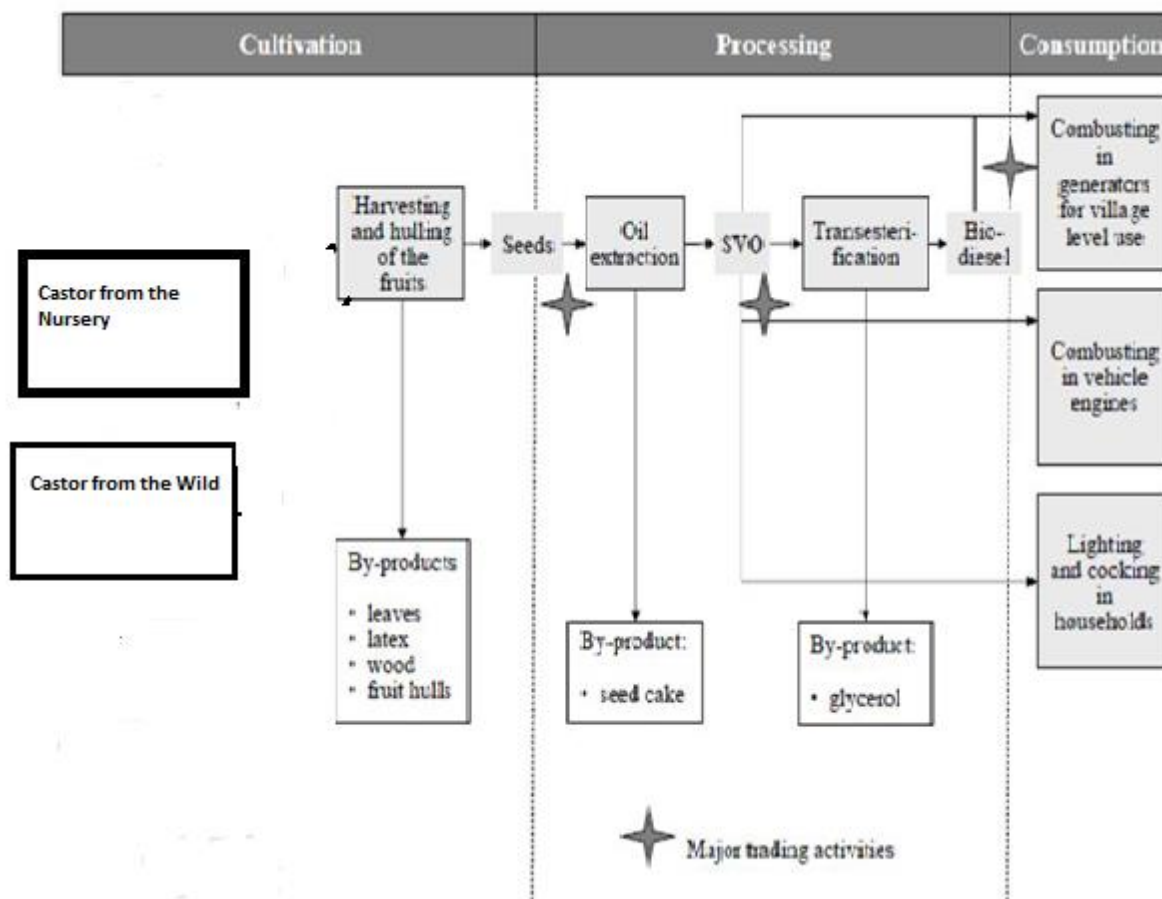


Figure 4 Castor value chain showing major trading points
 Source: dspace.cigilibrary.org

The castor value chain in Nigeria is comprised of six principal players: input suppliers who supply the farmer with planting materials and technology; the farmers, who perform all the production and harvesting functions; the processors, who buy castor seeds to extract the oil; the marketers and exporters, who buy and sell castor seed, oil and cake and end users (Figure 5). Castor seeds are cultivated on over 6000 hectares across most of the states. The crop also grows in the wild. States such as Benue, Cross River, Ebonyi, FCT, Gombe, Kogi, Kwara,

Yobe and Zamfara are locations where castor is cultivated. Varieties used for production include the local, Brazilian, wild local, Kabba local and the Aruna 48 variety. Most of the growers however collect their seeds from the wild in Nigeria. Growers carry out castor production manually with the use of hoe and cutlass while a few use mechanical equipment (RMRDC, 2005). Harvesting and on-farm processing, handling and packaging are done manually.



Figure 5 Castor value chain in Nigeria

Processing of castor in Nigeria is still at the rudimentary stage as many processors still use the traditional extraction process. The oil extraction process in Nigeria still involves cracking and decortication using stones, pulverizing using grinding stones and oil extraction by squeezing of ground seeds in cloth. The alternative to this method for castor oil extraction is by boiling the crushed seeds in water and skimming off the floating oil. There are a few castor crude oil processing plants in the country.

Castor bean marketing is still being done locally by women in rural markets for domestic consumption in Kogi, Kwara and Enugu states. However the rapid sales in these areas indicate the silent but lucrative nature of this business and the presence of potential domestic markets.

Figure 5 also shows other stakeholders in the value chain to include research institutes, commodity associations and financial institutions. The main

commodity association is the castor growers, processors and marketers association. Financial institutions include Bank of Agriculture, Bank of Industry and other commercial banks. Research institutes include the Cereal Research Institute in Badeggi which has done a lot of work in developing technologies for the different components of the value chain and Raw Materials Research and Development Council.

The Raw Materials Research and Development Council (RMRDC) started a promotion exercise to stimulate and encourage increased production of the crop by distributing seeds which included a variety from Brazil. RMRDC also engaged in research based collaborations with the University of Agriculture Makurdi, on the development of improved seeds to boost Castor Production. The Council then went on to establish a pilot plant at Kaduna with a 45 metric ton per hour capacity. It also encouraged a private processor who now owns a plant in Abuja (RMRDC, 2005).

Production is still low and processing still backward but with promotional activities by RMRDC and other government agencies, geared towards creating awareness, providing planting materials and modern process technology there are signs of growth in this sector (Onwualu, 2012).

3.3 Constraints of castor value chain development in Nigeria

Based on interaction and survey of various operators in the value chain in Nigeria, the following were identified as constraints; weak input/service market, inadequate knowledge and skills, **lack of access to and high cost of transportation**, post-harvest losses, **lack of proper storage, marketing information, limited access to credit facilities and** process technology challenges. The relative weight of each of the constraints is shown in Table 6.

Table 6 Relative importance of the factors hindering the value chain development for castor in Nigeria

S/N	Attribute	Percentage, %
1	Weak input supply system	8.5
2	Inadequate skills (production, handling, marketing)	6.8
3	Poor transportation	9.1
4	Post-harvest losses	12.0
5	Poor storage facilities	8.2
6	Poor access to credit	25.3
7	Technology challenges	18.9
8	Poor marketing facilities	11.2

3.3.1 Weak input/supply systems

In general, the input supply system for agriculture in Nigeria is weak. This has contributed in no small way in making the farmer component of the castor value chain to be weak. Most of the castors grown in Nigeria are in the wild. The few farmers who cultivate the crops do so on small holdings (less than 0.1 ha) and so the crop is not grown on a commercial scale. As a result of this, the supply of inputs such as improved

seeds, fertilizer, herbicides, pest control chemicals are difficult to come by for the farmers since they cannot afford these inputs and the existing supply system is inefficient. Thus, most of the farmers rely on seed stock that are low yielding, do not use fertilizer and grow the crop using primitive tools. This does not encourage optimum yield per unit area, thereby making the cost of the seed to be uncompetitive in the market.

3.3.2 Inadequate knowledge and skills

For farmers to adopt modern methods, knowledge and skill in cultivating the crop, they need constant interaction with extension officers so that research findings from research institutes can be transferred to them. At present the extension system in the country is weak. In addition the relevant research institutes have not been coming up with cutting edge research results that can help the system. There is therefore a need for constant training and demonstration for farmers to upgrade their skills and knowledge in cultivating and handling the crop, as well as improving the extension system in the country.

3.3.3 Lack of access to and high cost of transportation

Production areas are not only small but highly scattered. Access to transport is featured as the major marketing constraint, because the rugged terrain between the farm and market place makes transporting product extremely difficult. The lack of link roads connecting production to markets is a major constrain. The cost of transport is significantly high and the quality of service is generally poor. Furthermore, the cost of carrying castor from farm to market is also very high. In most cases, up to one third of the retail price placed on castor as a commodity in the market is spent on transport. This may be attributed to the general poor nature of transport infrastructure in Nigeria.

3.3.4 Post-harvest losses

Post-harvest losses resulting from poor general management of the farm prior to harvest and later during post-harvest handling (including transport) can be as high as 30%. Harvesting techniques are generally

crude (manual), and consist of picking by hand. The pooling of the castor beans from far-flung areas and the transport of such produce on poor roads is challenging and results in substantial losses. Loss from these coupled with some being rejected for being of poor quality once it reaches the process plant or export point constitute major issues in the value chain.

3.3.5 Lack of proper storage

Lack of storage facilities is a problem at farms. Storage facilities are also lacking at the markets. Growers have to unload their castor in poorly protected open stalls in the market. Improvement in this situation is seen as one of the critical factors in the overall profitability of castor production and trading. An excessive supply of castor during the peak season could be stored, and when the market price increases the products could be sold at a relatively higher price. However this is not the case in Nigeria. Closely related to this is the poor packaging system available.

3.3.6 Marketing information

Marketing information is a powerful tool for helping producers and traders decide on whether to buy or sell goods. It includes prices in the destination markets and the cost of marketing margins. It also includes information that would affect supply and demand, such as weather conditions in the growing areas, and changing export market regulations or other conditions that might affect price and access to markets. This is a critical tool that is unavailable to operators in the Nigerian castor value chain. It must be noted however, that a few on-line marketing websites are springing up in Nigeria.

3.3.7 Limited access to credit facilities

Lack of working capital is one of the major constraints that has hampered the farming business, particularly for the farmers' marketing groups. There is a need to increase awareness about sources of agricultural loans and loan service delivery systems that will cater for the needs of farmers such as mobile banking and other schemes. In addition, operators of

the various components of the value chain need to be trained on how to access the loans that are available. Currently the government through the Central Bank of Nigeria (CBN), Bank of Industry (BOI), Bank of Agriculture (BOA), Nigerian Export Import Bank (NEXIM) and some commercial banks makes these loans available but small scale operators are finding it difficult to access the funds.

3.3.8 Process technology challenges

Process infrastructure is one of the key requirements in castor value chain in Nigeria. In most of the castor-growing areas, modern processing plants have not been established in sufficient numbers so far. The unavailability of processing capacity may then cause farmers to down-scale their production and this poses a threat to even the existing processing plants as sourcing raw materials is difficult. The cost of production of castor increases substantially if the units are run under low economies of scale. A number of other challenges affect this phase in addition to low capacity utilisation because of poor availability of feedstock for processing and low procurement pricing. These include; higher cost of trans-esterification of castor thereby leading to high castor oil prices, dispersed feedstock points that cumulates in higher transportation costs when gathering and shortage of feedstock due to inconsistent demand. Part of the problem is that most of the machines required are imported and therefore beyond reach. The need for local development and infrastructure for equipment fabrication cannot be over emphasized.

4 Strategies for improving castor value chain

Interventions in the castor value chain in Nigeria are crucial. Co-ordinated efforts from government, research, extension, commodity association and development organisations are required. The following strategies are suggested for improving castor value chain in Nigeria.

4.1 Developing and strengthening of input market

This is a critical intervention that can result in increased access for farmers to farm inputs and services leading to higher profits. Both physical products such as planting materials (seed), irrigation, fertiliser, chemicals and packaging materials as well as market services such as pest management, technical information on farm management, storage, transportation and market information services need to be developed and strengthened to enhance the growth of the subsector. Government departments need to revisit the existing input delivery mechanism and explore alternative ways to provide these inputs and services. With their help, value chain operators can function on a more commercial basis and make sustainable profits. The current effort being made by the Federal Ministry of Agriculture and Rural Development tagged the “E-Wallet system” should be sustained and expanded to enable farmers to have access to inputs at the right time and cost.

Provision of quality seedlings is a key factor to ensure higher productivity. A vast majority of farmers cannot acquire good quality seedlings; they rely on their own seedlings grown locally without proper technical understanding or on those from the wild. It is therefore recommended that private nurseries need to be supported to function on a commercial basis to produce quality seedlings. It is also recommended that research into the development of high quality seedlings should be encouraged at the relevant research institute.

At present, fertilisers are also provided through government but many farmers do not apply chemical fertilisers on their agricultural crops; instead they prefer to use farmyard manure. This means that the customer base is very weak for private enterprises to sell fertilisers, and also that farmers who want to use fertilizers cannot get them at the right time. Hence, awareness needs to be created among growers about the positive effects of fertilisers on yield and quality. This will increase the demand leading to expansion of the customer base,

which will encourage the private sector to get into this business.

4.2 Transportation

Transportation in the country presents a major obstacle for marketing agricultural products. Though local roads connect many towns, the majority of villages still remain isolated without access to major markets. This is because, the movement of vehicles on village roads is very low and the quantity of agro-produce in many places is not even a full truckload. To address this issue, farmers need to be organised into groups/co-operatives/clusters so that they can amass a bulk quantity in one place, which will be attractive to transport companies. Alternatively, the establishment of supply chains that will buy the seeds off the farmers is recommended. Such chains will take care of transport and handling.

4.3 Raising awareness and capacity development

Inadequate knowledge and awareness is one of the critical constraints that results in low yield and high post-harvest losses. More efforts are needed toward capacity development in planting of good quality seedlings, use of appropriate amounts of fertiliser, control of diseases and pests, and improved harvesting and post-harvesting techniques (including sorting, grading, packing and arrangement for safe transportation).

4.4 Establishment of market information system

Market information system is a way of conveying a message to actors in the value chain. The system includes a channel of communication, a message or information (price, demand and supply situation) and a receiver (name and address of service providers and other value chain actors). RMRDC has already been working to establish the Raw Material Information System which would greatly fulfill this task. It is suggested that the MIS system should not only provide information on price but it should also provide information on critical current issues affecting the production and sale of castor, such as backlog of produce

at the market, the security situation and road conditions, pest infestation and measures to take, etc. Dissemination of market information through SMS can be an effective way to reach a large number of farmers at a low cost. This can be highly effective in remote areas. The national media can be used and a farmer's newsletter can be produced and distributed to farmers through Extension Offices to provide similar information and knowledge on a weekly basis.

4.5 Development of farmer institutions and clusters

There is a need to start up and strengthen existing farm clusters and extend assistance with material support. The established Castor Growers, Processors and Marketers Association of Nigeria (CASGPMAN) should also be strengthened. This will help farmers to get organised, share knowledge and information and become better entrepreneurs. The clusters could function as a part of a commercial business under joint profit-sharing mechanisms guided by a business contract, co-operation, and share-holding. This can be part of the current staple crop processing zones being promoted by the Federal Ministry of Agriculture and Rural Development. Such Clusters require support in the area of the business skill development, technology, marketing and finance. They also need capacity building to acquire the necessary skill required to access various funding windows from Bank of Agriculture (BOA), Bank of Industry (BOI) and other development finance institutions as well as foreign donor agencies.

5 Conclusions

Castor, upon value addition has the potential to contribute significantly to the industrial and economic development of Nigeria. Its wide range of industrial uses upon value addition makes it an ideal candidate for increased attention. Establishment of a functional market information system, capacity development and development of farmer institutions and clusters would help in the development of its value chain. Local fabrication of required process technology and its

subsequent maintenance needs to be encouraged as successful development of value added castor products would create massive opportunities for employment and wealth creation at all levels of the value chain. It is estimated that if the strategies suggested in the paper are adopted, Nigeria can earn up to 25 billion Naira (105,488,032 million dollars) annually from castor.

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