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Ensuring Sustainable Development in Cassava Value Chain and Value Addition in Nigeria

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ABSTRACT

This work is positioned to review sustainable development framework in Cassava value chain and value addition in Nigeria. It takes a crucial look at Sustainable Development Goals, Cassava Potentials and Policy Initiatives, Cassava Value Chain and Value Addition. Contemporary rural and urban food system in Nigeria is grappling with the critical challenges of climate change, rapid industrialization and urbanization that take over designated farmland with attendant waste problems, slum menace and youth restiveness, banditry; armed conflict scenario and poor or lack of master plan for emerging agro-economies to ensure sustainable development in Nigeria's cassava system. The introduction of high yielding, early bulking varieties tolerant to the cassava mosaic disease and cassava bacterial blight, produced at the International Institute for Tropical Agriculture and the establishment of small-scale processing facilities are appreciable systematic interventions. Hence, this study supports the assertion that for efficient cassava value chain development, raw materials, technologies, financing, institutional support and technical and administrative human resource are essentials.

Keywords: *Cassava, sustainable develpment, cassava value chain, value addition*

INTRODUCTION

Cassava is a multipurpose staple crop which has been accepted to be palatable food among cultures and social divides in Nigeria, as it is the mostly eaten food despite different methods of production. In order to meet the needs of the growing urban population that is increasingly shopping in formal outlets such as supermarkets, traditional products such as fufu and gari are subjecting to innovative packaging and are being sold at more remunerative prices (Otekunrin and Sawicka, 2019). However, poor packaging and inconsistent quality limit Nigeria's participation in lucrative export markets. Where garri has been packaged well and is of good quality, it finds a ready market in large supermarkets patronized

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by middle class Nigerians. Otekunrin and Sawicka (2019) further posit that there have also been innovations around using cassava peels for animal feed; new products are also being introduced which provide increased convenience (for example, gari/sugar/peanut all-in-one pack), and offer new tastes (such as, fruited gari). In Nigeria, cassava is widely cultivated and it plays a crucial role in the food system of both rural and urban economy owing to its capability to thrive under unfavourable weather and marginal soil conditions and also its tolerance to drought (Ezedinma, Kormawa, Manyong and Dixon 2007; Otekunrin 2011; Awoyemi, Odozi, Atekunrin and Ehirim 2015).

According to Udemezue, Chinaka and Okoye (2019), cassava value chain is an instrument for economic growth and food security in Nigeria. According to Coulibaly, Arinloye, Faye and Abdoulaye (2014), for efficient cassava value chain development, raw materials, technologies, financing, institutional support and technical and administrative human resource are essentials. Cassava value chains provide comprehensive information on the cassava production and processing as a guide for future and investment in the sector (Udemezue, Chinaka and Okoye, 2019). There are employment generations at the various levels of cassava value chain and understanding how employment is distributed along cassava value chain provides the necessary start to determine opportunities for employment creation (Olukunle, 2013). Udemezue, Chinaka and Okoye (2019) observe that in cassava value chain, individual actor participated in number of different value chains at the same time such that a cassava farmer may be involved in various agricultural crops and several handcraft activities as a means of income diversification.

However, the quest for nations to evolve agricultural developmental strategies that would stand the test of time in this era of population explosion (especially in the third world), rapid urbanization and industrialization against the backdrop of declining natural resources and environmental degradation led to the resolution by the world leaders to evolve the theory of sustainable development. Sustainable development is believed to permeate every facet of human endeavour because of its concern for the ecosystems and continuity of production at all time. Sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs (United Nations General Assembly, 1987). This concept of conserving resources for future generations is one of the major features that distinguish sustainable development policy from traditional environmental policy, which also seeks to internalize the externalities of environmental degradation (Emas, 2015). The overall goal of sustainable development, according to Emas

(2015), is the long-term stability of the economy and environment; this is only achievable through the integration and acknowledgement of economic, environmental, and social concerns throughout the decision making process. Given this background, this paper therefore reviews the sustainable development framework in cassava value chain and value addition in Nigeria. Hence, the study takes a crucial look at sustainable development goals, cassava potentials and policy initiatives, cassava value chain and value addition.

Fig. 1: The pillars of the sustainable development and their common zones
Source: Ecolan Environmental Engineering and Consultancy (2007)

Sustainable Development Goals

The World Commission on Environment and Development through the Brundtland Report characterized sustainable development in terms of pursuing those paths of the economic, social and political progress that meet 'the needs of the present without compromising the ability of future generations to meet their own 'needs' within the carrying capacity of the supporting ecosystems (WCED, 1987). According to the WCED (1987) report, the definition of sustainable development contains two key concepts:

i 'The concept of 'needs', in particular the essential needs of the world's poor, to which overriding priority should be given; and

ii The idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs".

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Other critical objectives of the report for environment and development policies include:

- Reviving growth and changing in quality;
- Meeting essential needs for jobs, food, energy, water and sanitation;
- Ensuring a sustainable level of populations;
- Conserving and enhancing the resource base;
- Re-orientating technology and managing risk; and
- Merging environment and economics in decision-making.

Sustainability must address social, environmental, and economic concerns (UNEP, 1995). The economic aspects addressed must take into account the value of the natural systems of the site (Stavins, Wagner and Wagner, 2003). Following the expiration of the implementation timeline of the Millennium Development Goals (MDGs), which came to an end in 2015, the United Nations in collaboration with the Heads of States and Governments of 193 Member Nations, launched the Sustainable Development Goals (SDGs) as a New Development Agenda. This Agenda, also known as Agenda 2030, is framed into 17 Goals, 169 Targets and 230 Indicators (United Nation General Assembly, 2015). The goals, according to United Nation General Assembly (2015), are outlined as follows:

1. End poverty in all its forms everywhere.
2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture.
3. Ensure healthy lives and promote well-being for all at all ages.
4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.
5. Achieve gender equality and empower all women and girls.
6. Ensure availability and sustainable management of water and sanitation for all.
7. Ensure access to affordable, reliable, sustainable and modern energy for all.
8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.
9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.
10. Reduce inequality within and among countries.
11. Make cities and human settlements inclusive, safe, resilient and sustainable.
12. Ensure sustainable consumption and production patterns.
13. Take urgent action to combat climate change and its impacts.

14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development.
15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.
16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.
17. Strengthen the means of implementation and revitalize the global partnership for sustainable development.

With regard to sustainable agricultural production within the context of SDG, goals: 1, 2. 3, 5, 8, 9, 10, 12 and 17 are quite instructive to this end.

Cassava: Untapped Goldmine

Cassava is the most commonly cultivated root crop in the tropical region and a crop that persistently contribute to food security because it has the ability to store its matured edible roots in the ground for more than two years (Saranraj, Behera and Ray, 2019). According to Liu Q., Liu J., Zhang and He (2014), cassava is an important staple food widely cultivated in Africa for both consumption and industrial uses. It is useful in the production of native and modified starches. It is estimated that more than 90% of cassava production is processed into food Nweke, Spencer and Lynam 2002; Phillips, Taylor, Sanni and Akoroda 2004). It is also useful in the paint, pharmaceutical and sweetener industries (Adetunji, 2011).

According to Otekunrin and Sawicka (2019), a significant industrial demand exists for cassava, as substitution for imported raw materials and semi-finished products. There is no State in Nigeria that Cassava is not essentially cultivated. However, Anambra, Benue, Cross-River, Delta, Edo, Enugu, Imo, Kogi, Ogun, Ondo, and Taraba, States (FGN 2006; Wossen *et al* 2017) are known as the major cassava producing State. The IITA data as captured by Azogu *et al.*, (2005) show that Benue, Nasarawa, Plateau, Niger, Kogi, Taraba, and Kwara States produce the largest quantity (about 29%) of cassava in Nigeria. A mono-modal rainfall pattern (better than the southern States), makes the north-central zone the best area to source cassava used for livestock feed and to locate pilot plants for cassava chips or pellets. The southern area of Kaduna State and the northern parts of Oyo, Ekiti, Ondo, Enugu, Ebonyi, Edo, and Cross Rivers States are also conducive for cassava chips production. According to Adetunji (2011), Nigerian cassava-based industrial products are just a fraction of imports, and the growth potential is huge.

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Basically, Cassava has played a remarkable role in the crop sub-sector of agriculture in Nigeria; it has grown from minor crop to a major crop that accounts for between 40-50% of all calories consumed in Southern and Central Nigeria (Adebayo, 2005). FAO (2019) posits that Nigeria remained the highest producer of cassava in the world with about 59 million tonnes in 2017. Cassava is the chief source of dietary food energy for the majority of the people living in the lowland tropics, and much of the sub-humid tropics of West and Central Africa (Tsegia and Kormawa, 2002 cited in Ogundipe, Oyelade and Farounbi, 2013). Adetunji (2011) captures that cassava production in Nigeria is increasing at 3% every year but Nigeria continues to import starch, flour, sweeteners that can be made from cassava. In Nigeria, cassava is the source of livelihood for farmers and countless processors and traders as a cash crop and source of livestock feed (Wossen *et al,* 2017).

Policy Initiatives and Interventions on Cassava

Several Scholars have opined that in Nigeria, achieving food security requires new and productive investments, innovations, and policy actions in agriculture since it is the predominant sector on which the majority of food insecure households directly depend for their livelihood (Koundouri, Nauges and Tzouvelekas, 2006; Alene, Manyong, Tollens and Abele, 2007. 2007; Alene and Coulibaly 2009; Alene 2010; Dercon and Christiaensen 2011; Suri 2011; Alene et al. 2012). Nevertheless, with cassava viewed as a food security crop and poorly commercialized, there has been minimal development along the Cassava Value Chain. Systematic interventions in the cassava sector began in the early 1980s with the introduction of high yielding, early bulking varieties tolerant to the cassava mosaic disease (CMD) and cassava bacterial blight (CBB), produced at the International Institute for Tropical Agriculture (IITA) in the 70s', and the establishment of small-scale processing facilities (Adetunji, 2011). These two key interventions increased profit margin for producers and processors alike and drove down prices of cassava food products for the rural and urban consumer (Adetunji, 2011). One particular intervention in this regard is the widespread dissemination of new varieties as cassava is the most important food crop in the country (Abdoulaye et al. 2014). "The cassava transformation", as the rapid increase in production and marketing has been termed, spun an entire food industry and transformed the crop from a rural subsistence crop to a cash crop and urban staple food (Nweke, Spencer and Lynam, 2002).

The second wave of cassava transformation began with the Presidential Initiative on Cassava, started in 2003 (Adetunji, 2011). (Adetunji, 2011) further

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opines that the initiative sought to position cassava as a commodity crop and foreign exchange earner, beyond its traditional role as food crop. A number of projects were embarked upon to build flour and sweetener processing factories in the country. According to Adetunji (2011), increased productivity of cassava by small scale farmers in Nigeria was addressed via the production and dissemination of over 100 million bundles of certified stock of improved cassava varieties over a period of three years, and a fast-track farmer participatory selection of new varieties (Nweke, Spencer and Lynam 2002).

According to Adetunji (2011), multiplication centres were established across the country to facilitate farmers' access to improved cassava varieties. Local fabricators were trained by the National Centre for Agricultural Mechanization (NCAM) and other relevant agencies to build and sell thousands of gratings, dewatering and drying machines. Six farm-gate primary processing Centers for training of extension workers and farmers in production of cassava flour, chips and pellets were established; State extension personnel were also trained in improved production technologies (Adetunji, 2011). The Nigerian cassava system, characterized by small-scale farmers/holdings cultivating less than 2 hectares of cassava (average of 0.5 ha), is subsistent in nature, primarily cultivated for the traditional food market, and not oriented to the industrial market. Any surplus cassava is either processed on the farm, or sold to local processors.

Table 1: Estimated demand of cassava in the industrial and export markets, acreage required and estimated number of jobs created (assumes one direct job per hectare for production and one direct job in the processing and other downstream sectors).

Value-Added Chain	**Estimated Demand**	**Fresh root equivalent to meet estimated demand (metric tons)**	**Acreage required (25ton/ha)**	**Number of Job created (one direct job on farm per ha and one off-farm)**
Starch	230,000 tons	1,150,000	46,000	92,000
Flour	250,000 tons	1,000,000	40,400	80,000
*Sweeteners	190,000 tons	950,000	38,000	76,000
Dried chips for export and animal feed	900,000 tons	3,360,000	134,400	268,560
**Fuel Ethanol (E-10)	0.5 billion liters	3,571,428	142,857	285,714
High quality garri for export and supermarkets	455,000 tons	2,730,000	109,200	218,400
Total		**12,758,429**	**510,337**	**1,020,674**

*Assumes 50% replacement of imported sugar in the Sweetener industry
**Assumes 50% from cassava as feedstock
Source: Adetunji, Adewale (2011). Action Plan for a Cassava Transformation in Nigeria.

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Cassava Value Chain and Value Addition

Value Chain can be defined as an organized system of exchange from production to consumption, aimed at increasing value and competitiveness. It is also an alliance of enterprises, working vertically to achieve greater market access. Value Chains encompass the full range of activities and services required to bring a product and/or service from its production/conception to its end use. These include the final markets into which a product or service is sold (local, national, regional or global). Actors in the value chain are driven by incentives namely, profit, prices, commissions or some other extrinsic factors. It is the incentive in the value chain that encourages private sector investments and oils the wheel of progress for an industry. For the success in global markets, Value Chains must move a product from production to the consumer more efficiently, with better quality and/or in a unique variation different to Value Chains in competing countries. The competitiveness of the Nigerian cassava industry therefore depends on its ability to develop, and to maintain an edge over market rivals (EFDI-Technoserve, 2005, Sanni, 2005).

Value addition is competitiveness created at different stages and by different actors throughout the value chain in terms of derivatives produced at the end of the value chain. Value added may be related to quality, costs, delivery times, delivery flexibility, innovativeness etc. The size of value added is decided by the end-customer's willingness to pay (EFDI-Technoserve, 2005, Sanni, 2005). Cassava value chains are characterized by a lack of market information flow; economies of scale in cassava processing are restricted by the unreliable supply of cassava from farmers, seasonal glut, financing difficulties, and inferior infrastructure; and transport is the most costly link in the value chain due to poor road conditions (McNulty and Oparinde, 2015). In pursuance of the total transformation of Nigeria's cassava sub-sector in order to attract competitiveness advantages both home and in the international markets, cassava products which include; starch, sweeteners, Ethanol, HQCF, and dried Chips adopt highly improved production and processing technologies and connect an effective link between producers and processors into efficient value-added chain (Otekunrin and Sawicka, 2019).

Cassava value chain can be of the major engine for economic growth and poverty reduction in Nigeria if the potentials are properly harnessed. Cassava value chain has the capacity to create new jobs and generate increased income and employment in the economy if properly harnessed Udemezue, Chinaka and Okoye (2019). According to Adetuji (2011), implementation of the value-added

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chain activities will be driven by the private sector with support from the public sector. A Cassava Market and Trade Development Corporation (CMTDC) will be established as the primary vehicle for implementation of value-added chain activities (Adetuji, 2011). Primary activities of CMTDC are market development, including advocacy with potential users of cassava-based products and policy makers, to ensure reliable demand. From the public sector, the Federal, State, Local governments, and NGOs will organize and train farmers in modern production methods, and disseminate to them improved varieties and inputs required to grow them. Cassava value chain comprises input suppliers, farmer's/ farmers' cooperatives, processors, traders, collectors, intermediate and final consumers within and outside the region (Udemezue, Chinaka and Okoye, 2019).

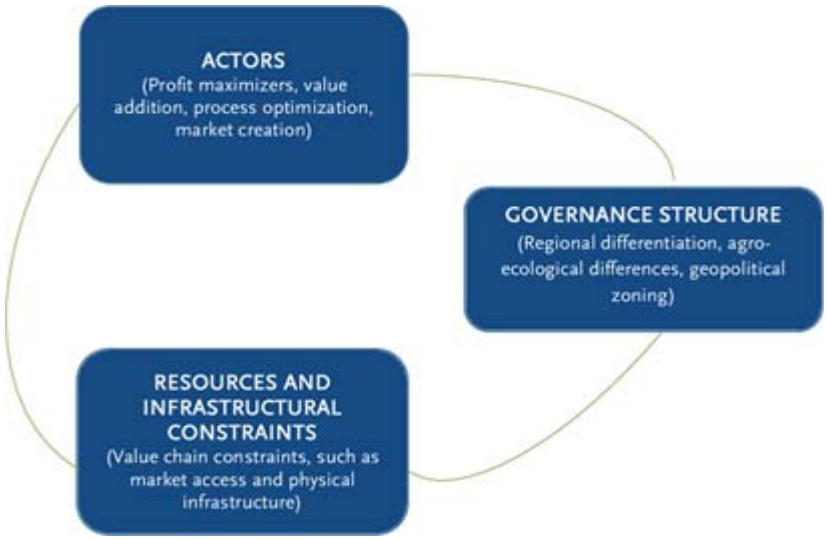

Figure 2: Framework for Reviewing the Cassava Value Chain in Nigeria
Adopted from: McNulty E. and Oparinde A. (2015).

Opportunities for a company to add value depend on a number of factors, such as market characteristics (size and diversity of markets) and technological capabilities of the actors. Moreover, market information on product and process requirements is key to being able to produce the right value for the right market. In this respect, finding value adding opportunities is not only related to the relaxation of market access constraints in existing markets but also to finding opportunities in new markets and in setting up new market channels to address these markets (EFDI-Technoserve, 2005, Sanni, 2005). Cassava, in its processed form, is a reliable and convenient source of food for millions of rural and urban dwellers in Nigeria. It is estimated that more than 90% of cassava production is

processed into food (Nweke, Spencer and Lynam, 2002; Philip *et al*., 2004). But a significant industrial demand exists for cassava, primarily as substitution for imported raw materials and semi-finished products. According to Otekunrin and Sawicka (2019), there is a potential demand of 250,000 ton/year in the High Quality Cassava Flour (HQCF), primarily from 10% replacement in bread flour and for use in bouillon, noodles, and the adhesive industry (dextrins); a demand equivalent of 1.15 million tons of fresh roots. Similarly, demand for native and modified starches exceeds 230,000 tons/year in the food, paint, and pharmaceutical industries, another million tons of fresh roots. In the sweetener industry, an annual demand of 150,000 tons exists for high fructose syrup, as part of replacement for imported sugar, and 40,000 tons/year for glucose (40,000ton/year); this requires an additional 950,000 tons of fresh roots.

Table 2: Characteristics of cassava production in Nigeria

Cassava production ('000t)	36,804
Cassava harvested area ('000ha)	3,126
Cassava Yields (t/ha) 2009	11.7
Utilization –	
Garri	60%
Fufu	20%
Lafun	10%
Tapioca -	5%
Starch- native	3%
Animal feed	2%
Farm Size (ha/Farm)	1-2
Cassava area (Ha/farm)	0.5-1
Crop System (%)	
- monocrop	10
-intercrop	90
Time of Planting	April - June
Land Preparation	Manual/tractor
Weed control	Manual
Fertilization	
-organic	none
-chemical	very little
Labor costs (US$/day)	3-4
Production costs (US$/ha)	450-900
Production costs (US$/t fresh roots)	37.99

Sources: FAOSTAT 2009; IITA cassava handbook; Adetunji, Adewale (2011). Action Plan for a Cassava Transformation in Nigeria.

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Cassava in Nigeria is currently used for two main purposes. Cassava is regarded as an important staple food for human consumption and as secondary industrial material mainly used as animal feed (Ugwu, 1996). Garri, fufu and lafun (Cassafufu) is a widely consumed Nigerian food. An estimated 4.2 million tons were produced in 2009 (IITA, 1990). It is estimated that more than 90% of cassava production is processed into food (Nweke, Spencer and Lynam 2002; Phillips *et al* 2004) and only 5-10% as secondary industrial material (used mostly as animal feed). In the same vein, Otekunrin and Sawicka (2019) observe that about 90% of cassava is processed as food while not more than 10% is used for industrial production and less than 1% of cassava output is exported. However, 10% of the Nigeria's industrial demand consisting of High Quality Cassava Flour (HQCF) is used in biscuits and confectioneries, dextrin pre-gelled starch for adhesives, starch and hydrolysates for pharmaceutical products and as seasonings; 70% of cassava processed as human food is *gari*. Other common cassava products used as human foods are *lafun* and *fufu/Akpu* (Otekunrin and Sawicka, 2019). Processed products can be classified into primary and secondary products. The former, such as, *gari*, *fufu*, starch, chips, pellets are primary products which are obtained directly from raw cassava roots, while the latter are obtained from the further processing of primary products (for example, glucose syrup, dextrin, and adhesive are obtained from starch).

Table 3: Cassava Production in Nigeria (2007-2017)

Year	**Production (Tonnes)**	**Area Harvested (Ha)** **Yield (tons/ha)**
2007	43,410,000	3,875,00011.20
2008	44,582,000	3,778,000 11.80
2009	36.822,248	3,129,030 11.77
2010	42,533,180	3,481,900 12.22
2011	46,190,248	4,120,166 11.21
2012	50,950,292	6,401,996 7.96
2013	47,406,770	6,741,3007.03
2014	56,328,480	6,458,435 8.72
2015	57,643,271	6,216,434 9.27
2016	59,565,916	6,150,574 9.69
2017	59,485,947	6,792,349 8.76

Sources: Olutosin A Otekunrin and Barbara Sawicka (2019)**,** Food and Agriculture Organization of the United Nations (FAO). FAOSTAT Statistical Database, Statistical Division. Rome (2019).

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Production Process of Cassava Value Chain Addition

Primary Products from Cassava

Four primary industrial products from cassava stand out as important for Nigeria. These are (a) cassava flour, (b) crude ethanol, (c) native starch, and (d) animal feed/cassava chips and pellets. These products are commonly traded and showed the highest potential for growth in demand, and are associated with medium and large scale processing. In the domestic market, industrial cassava products compete with traditional cassava products, mainly gari. Furthermore, each of the main industrial products (cassava flour, chips for animal feed, chips for food grade, ethanol, and cassava starch) faces competition from (a) identical imported products, and (b) substitute products that are either being imported or locally produced. For domestic cassava flour, the main competitive product is wheat flour. For cassava chips/pellets, it is feed grains. For ethanol, it is ethanol from other sources, and for starch, it is corn/maize starch.

Figure 3: Fresh Cassava Value Chain in Nigeria
Adopted from: McNulty E. and Oparinde A. (2015).

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Secondary Products from Cassava

Cassava can be processed into various secondary products, including modified cassava starch, glucose syrup, extra neutral alcohol, noodle, bakery and confectionery industries, beef and textile. It is also industrially processed as a raw material in the coating of pharmaceutical products, the manufacture of glues and adhesives and oil drilling starch (EFDI-Techno Serve, 2005). Cassava based adhesives are of three main types:

i Liquid starch adhesives are supplied by the adhesives manufacturer in liquid form usually in plastic or lined metal drums, cans and bottles.

ii Pre-gel starch adhesives are produced in dry flakes and milled to specific particles sizes. They are packed in waterproof lined multi-wall paper bags/ sacks and are very suitable for export.

iii Dextrin based adhesives are delivered to consumers in liquid and dry forms depending on specification and requirement. The liquid dextrin adhesives are packed as the liquid starch adhesives, while the dry dextrin adhesives are packed as the milled pre-gel adhesives. Dry dextrin adhesives are very suitable for export as intermediate raw materials used especially in Europe and America by the food and industrial companies.

Cassava By-Products

Cassava by-products are widely used in most tropical areas for feeding pigs, cattle, sheep and poultry. Dried peel of cassava roots are fed to sheep and goats. Raw or boiled roots are mashed with protein concentrates such as maize, sorghum, groundnut, oil palm kernel meal and mineral salts and used for livestock feeding. Analytical tests have shown that cassava leaves have a protein content equivalent to that of *alfalfa* (17-20%) and can be used at 100 percent substitution to replace *alfalfa* as a protein rich source for animal feed (Onabolu, Abass and Bokanga, 1998). Cassava meal is the powdered residue of the chips and roots after processing is done to extract edible starch. However, small-scale farmers who produce their own feedstuffs ensure its continued use by blending it with other ingredients. The above list of cassava products indicates the large variety of intermediate and end products within the cassava industry.

High Quality Cassava Flour (HQCF)

Nigeria imports over one million tonnes of wheat annually. At 10% substitution of cassava flour in wheat flour and with the current national demand, 300,120,000 metric tonnes of HQCF (assuming the national demand for wheat flour is 1.2 million tonnes), is required (Ezedinma, *et al.*, 2005). IITA has confirmed that

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30% of the total wheat can be replaced by cassava flour in bread making, and 100% cassava flour is currently being used in pastries and confectioneries (Onabolu, Abass and Bokanga, 1998). However, with poor regulation and standardization, some bakeries have complained about some problems such as:

- Presence of impurities such as sand;
- Odour;
- Shorter product shelf life (e.g. biscuits);
- Brittleness;
- Gradual change of colour (biscuits turning pale);
- Unreliable supply;
- Poor final product quality in cases where the cassava flour had partially fermented.

The Ethanol Industry

Most of the ethanol consumed in Nigeria is imported. Her current annual demand for the industrial, pharmaceutical and beverage industries is estimated at 160 million liters, a figure however expected to rise exponentially to 900 million liters once the E10 policy on ethanol in fuel is fully implemented. Ethanol is produced by the fermentation of sugar related materials or starchy materials. Cassava stands as one of the richest fermentable substances for the production of crude alcohol/ethanol, with dry chips containing up to 80% of fermentable substances (starch and sugars).

Starch

The Nigerian demand for starch is estimated at 230,000 tonnes per year. Cassava starch is an important domestic and industrial raw material used in the manufacture of various products including food, adhesives, thickening agents, paper, and pharmaceuticals (IITA, 1990). It has many remarkable characteristics including high paste viscosity, high paste clarity and high freeze-thaw stability, which are advantageous to many industries.

Animal Feed/Chips/Pellets

Chips from peeled roots are used for human consumption and in animal feed industry and generally store better than flour (IITA, 1990). Chips are the most common form in which dried cassava roots are marketed. In Nigeria, cassava

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chips were processed into animal feed and some animal feed millers continued the practice until the late 90s when the price of cassava became too expensive vis-à-vis the price of maize.

CONCLUSION

This paper reviewed the sustainable development framework in cassava value chain and value addition in Nigeria. It crucial looked at sustainable development goals, cassava potentials and policy initiatives, cassava value chain and value addition as well as cassava production process. The importance of cassava in Nigeria agricultural mix was explored with consideration for value chain addition as a modern concept. The various derivative of cassava by-product was tabled so as to showcase the important of cassava as export earning crop within the context of sustainable development paradigm. Consequently, the introduction of high yielding, early bulking varieties tolerant to the cassava mosaic disease and cassava bacterial blight, produced at the International Institute for Tropical Agriculture (IITA) and the establishment of small-scale processing facilities are appreciable systematic interventions. The study, therefore, supports the assertion that for efficient cassava value chain development, raw materials, technologies, financing, institutional support and technical and administrative human resource are essentials.

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