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Review of Cassava Bread Value Chain Issues for Actualization of the 40% Cassava Bread Production in Nigeria

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Author's contribution

This whole work was carried out by author EIO.

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ABSTRACT

Aims: Due to the combined effect of urbanization, increased population and changes in lifestyle, bread consumption in Nigeria has increased considerably. Nigeria has over the years been dependent on foreign nations, particularly the US for the importation of wheat, which has been detrimental on Nigeria's economy causing depletion of foreign reserve, trade imbalance and fueling food import dependency and unemployment. Hence, in 2012, Nigeria released cassava-wheat bread policy mandating flour mills to partially substitute imported wheat with cassava up to 40% in spite of limited success of earlier released wheat policies involving the partial substitution of wheat with 5-10% cassava flour. The aim of this study is to review the value chain issues for the actualization of the 40% cassava bread production policy in Nigeria.
Study Design: Secondary data followed by in-depth analysis.
Place and Duration of Study: Nigeria and July – December 2013.
Methodology: This study relied on secondary data followed by in-depth analysis to present the challenges facing players (farmers, importers, processors, millers, and bakers) in cassava bread value chain and how the challenges could be tackled for the success of the 40% cassava policy.
Results: The study found that implementation of the policy would alter the cassava value chain in the country. The flour mills have enough capacity (7mt/ annum milling capacity), but the high quality cassava flour (HQCF) processors would not be able to supply the 1.2mt of HQCF in the short-term.

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Conclusion: Using 40% cassava bread would require the use of bread improvers such as enzymes, chemicals, hydrocolloids and gums, emulsifiers, lipids and proteins. The bakers and flour mills would need to retrofit their machines to permit the use of cassava flour and bread improvers with the initial expense.

Keywords: Bread improvers; cassava value chain; composite flour; food policy.

1. INTRODUCTION

Nigeria is the largest producer of cassava in the world. In 2006, the country produced 45.72 million tonnes of cassava tubers from 3.81 million hectares of farmland [1]. The yield of cassava doubled from 11t/ha in 2002 to 25t/ha in 2006 [1]. Cassava is a major staple to over 600 million people in Africa [2]. Cassava is considered as the third most important crop in Nigeria after rice and maize [3,4]. Cassava is mostly utilized for human consumption, with little left for industrial processing. Bokanga [5] estimated that about 90% of the cassava produced in Africa is used for human food, while the remainder is used mostly as animal feed and only very little is used in industrial processing. In Nigeria, 84% of the 34 million tonnes of cassava produced in 2001 was consumed as food while the remaining 16% was utilized as industrial materials. Breakdown of industrial utilization of cassava showed that 10% was used as chips for animal feed, 5% was processed into syrup concentrates for soft drinks and less than 1% was processed into high quality cassava flour used in bakery, biscuits and confectionary, dextrin pre-gelled starch for adhesives, starch and hydrolysates for pharmaceuticals, and seasonings [6]. UNIDO/FGN [7] reported that 90% of cassava produced in Nigeria was used as food, while only 5–10% was utilized as industrial material for animal feed. The report also estimated that about 10% of Nigeria's industrial demand consisted of high quality cassava flour (HQCF) used in the production of biscuits and confectionaries, dextrin pre-gelled starch for adhesives, starch and hydrolysates for pharmaceutical products and as seasonings.

Nigeria has comparative advantage in the cultivation of cassava. Cassava grows well under tropical conditions. Cassava is drought tolerant, requires limited land for cultivation and grows well in poor soils [8]. Due to urbanization, increased wealth and changes in lifestyle, bread and other bakery products' consumption in Nigeria is increasing. Unlike cassava, wheat does not grow well under tropical conditions like in Nigeria. Hence, Nigeria depends on foreign countries for the importation of wheat. The country currently imports wheat worth N635 billion ($4.2 billion) annually, thus depleting its foreign reserves and worsening the rate of unemployment [9].

China is the largest producer of wheat in the world, producing 93 million tonnes in 2005/2006 out of the total world production of 615.2 million tonnes. However, USA is the largest exporter of wheat in the world followed by Australia and Canada. In 2005/2006, USA exported 25.9 million tonnes, Australia 16.5 million tonnes, while Canada exported 15.5 million tonnes out of the world total of 108.2 million tonnes. For about 5 years, from 2001-2006, wheat export averaged 108 million tonnes per year. Of this, USA, Australia and Canada accounted for 27%, 15% and 14% respectively [10]. Until 2011, Nigeria was the leading importer of US wheat and still remains the most consistent and loyal customers [11]. Nigeria imports over 90% of her wheat from the USA [12].

Wheat importation has detrimental effect on the Nigerian economy causing trade imbalance, foreign reserve depletion and unemployment. In order to reduce the detrimental effects of wheat importation on developing countries, the Food and Agricultural Organization (FAO) commissioned studies on composite flour (wheat flour mixed with other locally available flour). The success of the FAO studies spurred research in the area of composite and alternative flour for bread making. Also, due to the increased incidence of coeliac diseases, gluten-free bread is being promoted [13-15]. Several authors have reported that cassava bread can be produced to the tone of 10–20% cassava flour inclusion without any noticeable detrimental effect on the final bread [16-19,20,21]. Over the years, successive government have enacted wheat control policies ranging from complete ban in 1987-1991, 5% cassava inclusion (2007–2010) and 10% cassava inclusion (1979–1983 and 1999–2007). All these efforts seem to require more understanding and strategizing for more success. The government of President Jonathan started implementing 40% cassava-wheat bread policy with effect from 1 July 2012. Hence, the aim of this study is to present strategies for the actualization of the 40% cassava bread policy. The study focused on the major players in the cassava-bread production and related value chain in Nigeria.

2. MATERIALS AND METHODS

This study relied on secondary data followed by in-depth analysis to present the challenges facing players (farmers, importers, processors, millers and bakers) in the cassava bread value chain and how the challenges could be tackled for the success of the 40% cassava bread policy.

3. RESULTS AND DISCUSSION

3.1 Nigerian Cassava Bread Policy 2012 and Incentives

Nigeria has committed to the inclusion of 40% cassava in composite flour with effect from 15 July 2012. The policy provided for a changeover period of 18 months for flour miller and bakers to switch to composite flour. Some potential benefits of the policy includes savings of the Nigeria's foreign exchange earnings of ₦ 254 billion per annum, reduction in the severity of coeliac disease via gluten dilution, utilization of locally available crops, thus eliminating glut, creation of massive employment in both farm operation and flour milling leading to an improved source of income and livelihood. Incentives of the policy include;

- Waivers on the importation of bread improvers, cassava processing and flour milling equipment.
- 12% tax reduction on cassava flour utilization for flour millers.
- Provision of free starter packs of composite flours and bread improvers for 100 kg of bread for smallholder bakers.
- Provision of 100kg fertilizer at 50% discount and 15 bundles of improved cassava varieties for free to smallholders cassava farmers.
- Additional 65% duty on wheat flour importation to the initial 35% duty (total duty
- 100%) and 15% duty to the initial 5% duty on wheat grain (total duty 20%).
- Creation of cassava bread development fund to be funded by the excess money
- realized from the importation of wheat, which shall be used for training, research,
- development and demonstration
- Training of about 400,000 master bakers in Nigeria
- Provision of loans to cassava processors for the purchase of equipment

- Ban on the importation of cassava flour

3.2 Implementation of Cassava-Bread Policy

Implementation of the 40% cassava inclusion in bread policy in Nigeria creates new opportunities and challenges. Enhancement of the opportunities while mitigating the challenges of the policy is crucial to the success of the cassava-bread policy. Implementation of the policy can alter the cassava value chain in Nigeria. For instance, 84–90% of cassava produced in Nigeria being processed for human food, with 70% processed into garri [7]. Forty percent (40%) cassava inclusion in bread would ordinarily alter this pattern, which could threaten food security as per availability of cassava for gari production. Further, it is not certain that garri consumers will switch to bread, simply because the bread contains 40% cassava. Implementation of the 40% cassava bread policy could create a demand of 1.2 million tonnes of high quality cassava flour, HQCF [22]), which translates to a demand for 4.8 million tonnes of cassava tubers/annum, implying that over 10% of the 45.72 million tonnes of cassava produced in 2006 will be used for HQCF production, thus leaving 90% for other uses. Meanwhile, the country also planned to produce vehicle fuel ethanol [23] and cooking fuel ethanol [24] from cassava feedstock. The 'cassakero' project, which involved the production of 3.75 billion litres of cooking fuel ethanol from cassava [23], will require over 20 million tonnes of cassava per annum. Also, if one half of the 1.3 billion litres of ethanol required to implement the E10 (10% ethanol in gasoline) policy is obtained from cassava tubers, it would require additional 3.6 million tonnes of cassava per annum. Hence, in total, the cassava bread, automotive ethanol and cooking ethanol fuel would require 28.4 million tonnes of cassava, accounting for 62% of the annum total cassava production in the country. Thus, considerable expansion of production of cassava would be required to sustain demands for cassava, particularly without dislocation to food security in terms of availability and price of garri

3.3 Production of Cassava in Nigeria

The production of cassava in Nigeria is dependent on rainfall, manual planting and without the use of agrochemicals, hence yield is low ranging from 11 tonnes/ha for local varieties to 25 tonnes/ ha for improved varieties. Both the areas and yield of cassava would have to increase considerably for the country to be able to meet up with the multifunctional use of cassava tubers. Otherwise, this could affect the production and consumption of garri, the main food that 70% of Nigerian cassava is currently processed into. The government will need to encourage irrigation, the use of agrochemicals and increase the acreage of land dedicated to cassava. Despite the availability of improved varieties, some farmers are still planting local varieties with reduced yield. Farmers are also constrained with lack of funds. Some of the farmers are unable to access loans from the National Agricultural Cooperative and Rural Development Bank (NACRDB), whereas those that got the loan are unable to redeem or service the loans. Most of the rural farmers are small scale, and are unable to increase their production considerably in the short term. The farmers are at the bottom of the cassava flour value chain; hence the 40% cassava inclusion policy for bread would depend on attention paid to the challenges pertaining to farmers' operations. Fortunately, few large scale cassava farms are emerging in the country. Sanni et al. [1] reported that large scale cassava farms (>1000ha) have started including Obasanjo farms, Nigeria Starch Mills, Zimbabwean farmers and Ekha Agro Farms.

3.4 Cassava Processing into HQCF

Next in the cassava flour value chains are the processors, who convert cassava tubers to HQCF. Like farming, cassava processing is mostly carried out by smallholders using flash dryers. These processors were unable to supply the 250,000–300,000 tonnes required for 10% cassava flour inclusion policy [11]. They had several challenges (Table 1) that must be addressed before they can supply enough HQCF to meet the 40% cassava bread policy. Olanrewaju [25] reported that there are about 156 small-scale HQCF processing plants in Nigeria. Sawyerr [26] reported that majority of the HQCF processors are small-scale producing less than 5 tonnes daily, with only a few medium scale processors, producing 5–30 metric tonnes daily. However, a large scale HQCF processing factory owned by Thai Farmers Ltd. is able to produce 60 metric tonnes HQCF per day and employ about 1000 cassava farmers and spending about One million Naira (₦1m) (US $1 = ₦ 160) daily for the purchase of cassava tubers from farmers. Another large scale HQCF processor in the country is DADCO producing 60 MT/day HQCF.

3.5 Wheat Flour Importation and Flour Mills

Implementation of the 40% cassava flour inclusion in bread policy could have detrimental effects on wheat flour importers, who will have to reduce wheat imports by 40% and pay higher levies (100% duty on wheat flour or 20% duty on wheat grain). Although, genuine importers will have to compete with smugglers for the supply of wheat to the reduced wheat market, the reduction in wheat import into Nigeria could save the country about ₦354 billion annually, but could affect trade relationship with the US. The us has reduced their demand for Nigeria oil perhaps in retaliation for the reduced importation of wheat by Nigeria. Also, the role of the flour mills is central to the actualization of the 40% cassava flour inclusion in bread policy. Traditionally, imported wheat pass through flour mills and bakeries, which are tied together by the flour traders and linked to the consumers by bread vendors [27]. But with the advent of the cassava bread policy, this pattern will change. Flour mills now have to deal with HQCF processors and importers of flour improvers (Table 2) in addition to bakers and wheat importers (Fig. 1). Table 1 shows challenges of flour millers and possible solution options.

Some of the failures of previous attempts at producing cassava bread is linked to flour mills; including reluctance to use HQCF [28], lack of willingness to comply with government policy [28,29,30] and poor quality of the composite flour because of the presence of sand, odour and colour problems and shorter shelf life [7,31,32] and the flour mills were not designed to mill cassava [33]. Except the flour mills are encouraged to change their perception on the use of HQCF, the 40% composite cassava wheat (CCW) policy could similarly fail. At 10% cassava inclusion, bread of acceptable quality can be produced without any need for additives. But at increasing level of wheat substitution, wheat gluten is diluted. Although, the quality of bread would ordinarily be affected adversely, other additives can be added that would supplement for decreased gluten. Several bread improvers have been identified for this purpose including enzymes, hydrocolloids and gums, emulsifiers, lipids, proteins and flour from other carbohydrate sources such as grains, legumes and oil seeds of local origin (Table 2). The Nigerian government also requires wheat to be fortified with vitamin A [12,34]. Implementation of the policy could create new business opportunities in the importation and possibly domestic production of bread improvers in the future.

Table 1. Overcoming the challenges of HQCF processors

Challenges of HQCF processors (references)	Possible solution
Policy inconsistencies i.e. lack of continuity by successive government [9,26]	The Nigerian Government should be consistent with their policies
Lack of enabling policy environment [28]	The cassava bread policy should be fully implemented including the deployment of cassava bread development fund
Unreliable supply of HQCF [7, 26, 28,29]	HQCF supply chains should be reinforced by enabling capacity for reliable supply of HQCF
Lack of willingness by the flour millers to comply with government policy [28,30]	Erring companies should be sanctioned
Lack of knowledge on the advantages of cassava wheat composite bread [28]	cassava bread development fund for the training of personnel (the government have started training of millers and bakers)
Presence of impurities such as sand [7]	cassava bread development fund for the training of personnel
Foul odour, and colour problems [7]	cassava bread development fund for the training of personnel
Shorter product shelf life [7]	Creation of awareness of cassava bread development fund for the training of personnel
Supply of partially fermented cassava flour resulting in poor product quality [7, 30]	Encourage mechanization of HQCF production.
Low wheat prices relative to HQCF [31]	Use price control strategies to make cassava flour more competitive
High cost of HQCF production (fuel, transportation cost, lab our) [15, 32]	Training of cassava flour processors on cost reduction strategies. Installation of fuel-efficient flash dryers
Low demand of HQCF and lack of market access [15,32]	HQCF supply chains should be reinforced. Strict implementation of the policy could strengthen demand and market access
Lack of working capital [15,32]	deployment of cassava bread development fund
Dependence on weather for drying [15,32]	Encourage mechanization of HQCF production
Weak supply lines of HQCF [30]	HQCF supply chains should be reinforced
Strong consumer preference for 100% wheat bread [30]	Public enlightenment campaigns (the government have started campaigns)
Frequent breakdown of processing equipment (Rohi Biotechnologies Ltd, personal communication)	Installation of fuel-efficient and rugged flash dryers
Fuel inefficient flash dryers (Rohi Biotechnologies Ltd, personal communication)	Installation of fuel-efficient and rugged flash dryers
Flour mills not designed to mill HQCF [33]	Retrofit and modify mills or request for the supply of cassava flour instead of chips or pellets

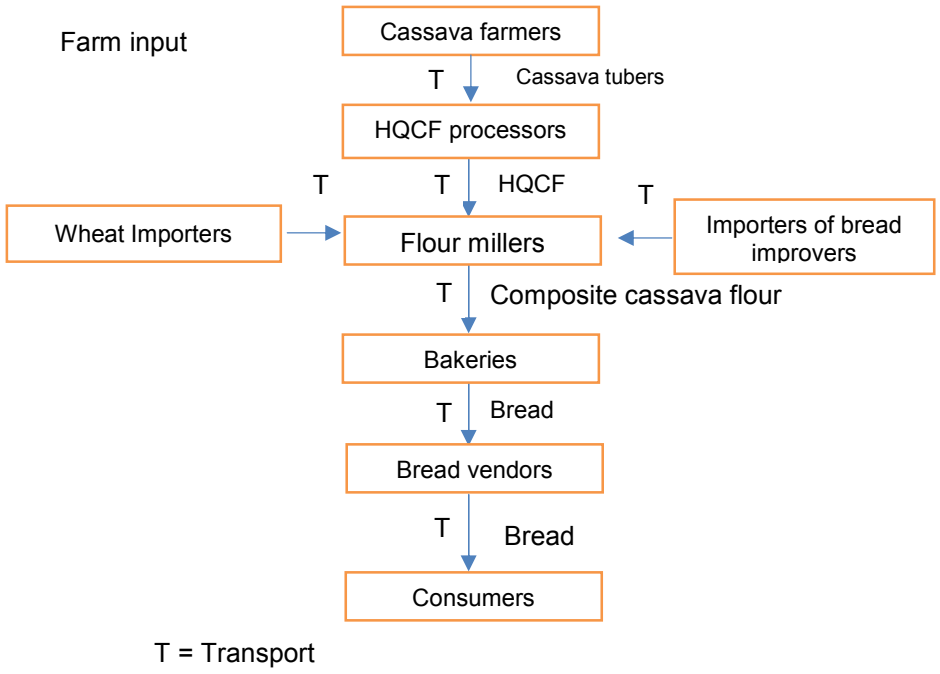

Fig. 1. Cassava-Wheat bread value chain

Table 2. Improvers required for 40% CCW bread

Types	Examples
Enzymes	Lipase, amylase, hemicellulase, cellulase, glucanase, xylanases
Hydrocolloid and gums	Xanthan gum, guar gum, carrageenan, agar, carboxyl methyl cellulose
Emulsifiers	Glyceryl monostearate, sodium lauryl lactylate, Sodium stearoyl lactylate (SSL), caseinate, lecithin
Lipids	Margarine, vegetable oil
Animal proteins	Egg, milk
Oil seeds / proteins	Soya, peanut, cowpea, Bambara groundnut
Chemicals	Acids (ascorbic acid, lactic and acetic acids), oxidizing agents (potassium bromate, calcium peroxide), reducing agents (sorbic acid, sodium dioxide, sodium metabisulphate)
Vitamins	Vitamin A, vitamin C

3.6 Technology Implications and Challenges of HQCF Milling

Technological implications of the policy have to be considered. There are over 22 flour mills spread across the country with combine capacity of 22,500 tonnes/day (Table 3), which translated to 7 million tonnes per annum (using 313 working days in a year, excluding days set aside for maintenance). In addition, Apapa Mills and Honeywell Flour mills, Lagos, have wheat storage facilities of 191,000 and 42,500mt/annum respectively. It has been variously reported that Nigeria's overall milling capacity ranged from 6.2–6.6 mt/annum with 52–60% capacity utilization [12,34]. Most of the mills are designed to mill imported wheat only, except a few like the Northern Nigeria mill, which have installed a 200 tonnes/day maize milling plant [27]. None of the flour mills have installed cassava milling plants and have presented a great challenge to milling of cassava chips and grits. Nicely et al. [12] reported that there is no existing technology to process the 1.2mt HQCF required by the mills to fully comply with the 40% CCW bread policy and as at now, the millers can only handle about 30,000 metric tonnes of HQCF. Fortunately, the Federal Government of Nigeria have facilitated the importation and installation of 18 large scale HQCF plants from China (to be installed within 24 months) with a combined capacity of 1.3mt of HQCF/year [25,35]. The government also planned to facilitate the importation of 200 compact mills, which will decentralize private sector milling of wheat and mixing and production of premix composite cassava flour [25]. As part of the new cassava bread policy, the government have also reduced to zero percent (0%) i.e. it has completely waive import duty on all agricultural and bread processing equipment [36].

The millers also have other challenges. Apart from Dangote's mills that are recently installed, all the other mills are relatively old, some established in 1960s, 1970s and 1980s. Many of the flour mills are also contending with power supply challenges. A few of the mills have installed large scale self-generated power plants e.g. Apapa mills (60MW) and Honey Well mills (21MW). Some of the flour mills such as Mix and Bake located in the oil rich Niger Delta have begun extension of gas supply pipeline to their factory for independent Electricity generation. Many of the flour mills are located in coastal towns and ports such as Lagos, Calabar, Warri, Port Harcourt, Sapele in order to facilitate wheat importation. Such locations, which were strategic for wheat may be far from HQCF supply sources.

Most of the bakeries in Nigeria are small-scale with little or no temperature control [37] Most of these bakeries were designed to process wheat into flour for bread, and not composite flour. Nicely et al. [12] reported that Nigeria baker's machineries can only support wheat flour for bread making. Sabowale [33] reported that the Nigerian bakery is designed to make bread using wheat flour and that major changes would be required for them to bake CCW bread. The changes needed would involve structural and process equipment and training of personnel. These changes could be costly and time consuming and would therefore require planning. It is unlikely that the bakers will be able to embark on these changes in the short-term. The government has started training the entire 400,000 master baker across the country on the techniques of CCW bread making [25,28]. There are transporters and middlemen in between all the major stages in the CCW bread value chains. Due to the combined effects of bad roads and high cost of fuel, transportation typically adds about 20 - 25% to the cost of the goods at each stage.

Table 3. Installed flour milling capacity

Mills	Owners/ operators	Year commissioned	Installed capacity (MT/day)	Location
Apapa mills	Flour mills of Nigeria	Sept 1962	8000	Apapa, Lagos
Nigeria Eagle flour mills,		1980s	1000	Ibadan, Oyo state
Niger Mill Co. Ltd		1970s	750	Calabar
Northern Nigeria Flour mills, Kano		1970s	1200	Kano
Honey well flour mills	Honey well flour mills	1985	2610	Tin Can Island, Lagos
Bua flour mills	Bua Group	31 Aug. 2005	500	Tin Can Island, Lagos
Bua flour mills		Feb 2007	500	Kano
Dangote flour mills	Dangote Group	1999	1000	Apapa, Lagos
Dangote flour mills		2000	500	Kano
Dangote flour mills		2001	1500	Calabar
Dangote flour mills		2005	1000	Ilorin
Crown flour mills		1980s	220	Tin Can Island, Lagos
Ideal Flour Mills		1980s	300	Kaduna
Port Harcourt Flour Mills		1980s	600	Port Harcourt
Life Flour Mills		1980s	500	Sapele
Maiduguri mills		1980s	400	Maiduguri
West Africa Mills Ltd		1980s	400	onitsha
Enugu Flour Mills Ltd		1980s	200	Enugu
Manila Flour Mills Ltd		1980s	520	Owerri
Mix & Bake Flour Mills Ltd		1980s	300	Warri
Ruak Flour Mills Ltd		1980s	300	Kano
Gold Medal Products Ltd		1980s	200	Ewekoro
TOTAL			22500	

Source: Compiled from several sources including companies websites, newspapers reports, Andrae and Becmann [27]

4. CONCLUSION

Like in most countries, bread consumption has increased in Nigeria primarily due to urbanization, changes in lifestyle and increased affordability. However, the flour thought to be ideally suited for bread production is that from wheat, which do not do well under tropical climatic conditions as in Nigeria. Hence, the country had over the years been dependent on wheat importation mostly from the US. The continued importation of wheat had had negative impacts on the Nigeria economy causing trade imbalance, loss of foreign exchange and fueling food dependency and unemployment in Nigeria. Determined to reduce the impacts and encourage the use of local species, Nigeria government released cassava-wheat bread policy, which mandated flour mills to partially substitute imported wheat with locally

produced cassava up to 40%. At 10% inclusion, composite cassava-wheat bread can be produced without the need for additives or improvers. The Nigerian government had earlier implemented 5-10% cassava inclusion in bread policy that have not succeeded. Ordinarily, one would wonder why a government that could not yet work out 5-10% cassava inclusion would consider the implementation of 40%. At 40% inclusion, would require the use of bread improvers such as enzymes, chemicals, hydrocolloids and gums, emulsifiers, lipids and proteins. The bakers and flour mills would need to retrofit their machines to permit the use of cassava flour and bread improvers, which can be expensive. The flour mills have enough capacity (7 mt/ annum milling capacity), but the high quality cassava flour (HQCF) processors would not yet be able to supply the 1.2mt of HQCF. The implementation of the policy would alter the cassava value chain in the country. About 90% of cassava produced in Nigeria is processed into food. Hence the industrialization of the crop by this same government for the production of fuel ethanol, animal feed and bread making could threaten human food and nutrition. Thus, this paper have reviewed the challenges facing the players (farmers, importers, processors, millers, and bakers) in cassava bread value chain and considered how the challenges could be tackled for the success of the 40% cassava policy. In addition, bilateral interest with countries and due diplomacy would have to be brought to bear, especially to limit the impact of retaliatory action of affected counties especially the us that imports the bulk of Nigeria's Oil and whose export of wheat to Nigeria would have to reduce.

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COMPETING INTERESTS

Author has declared that no competing interests exist.

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