

## **Small-scale food processing enterprises: measures for national development and addressing food security challenges in Nigeria.**

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**ABSTRACT :** *This article focuses on small-scale food processing enterprises (SSFPEs) as one of the important measures for national development and addressing food security challenges, particularly in Nigeria. The roles, challenges, prospects and measures of SSFPE's development in Nigeria were discussed. The need for food processing following the extent of food losses and wastages in Nigeria was emphasized. Efforts made at ensuring food security in developing countries, with particular reference to Nigeria were also discussed. The contributions of engineering in enhancing food processing and productivity in Nigeria in the areas of mechanization of food processing unit operations, development of new and existing technologies, design and development of machinery and systems for processing and preservation of different agricultural produce of high target were also discussed. This will facilitate the achievement of the technical roles of food processing. SSFPEs play important roles in the economy of a developing country, particularly in terms of employment creation, income generation, post-harvest losses reduction, food preservation, value addition, improvement of food safety and nutritional quality, increase in shelf-life of a product, and act as training grounds for entrepreneurs before they invest in large scale enterprises. SSFPEs in Nigeria are faced with significant challenges that compromise their ability to function and to contribute optimally to the economy. Financial constraints and lack of management skills are the major constraints, among others. The long-term effect in the economic and national development can be achieved through the development of small-scale food processing techniques, and these culminate to rapid food processing and industrialization. In view of this, it is recommended that governments and non-governmental organizations should encourage and facilitate the development of SSFPEs either by funding or regularly organizing seminars for potential small-scale food enterprises' operators on how to plan, organize, direct and control their businesses.*

**Keywords:** *Food losses, Food processing, Food security, National development, Small-scale enterprises*

### **I. Introduction**

Over 80% of Nigeria population engages in agricultural activities such as arable, pastoral, fish and plantation farming. However, about 90% of Nigerian farmers engage in subsistence agriculture without adequate capital to expand their farms and store their farm produce after harvest so that agro-processing industries could access them all year round [1]. Due to the dearth of infrastructural facilities such as good roads, processing and storage equipment as well as inadequate marketing information; huge quantities of these raw materials waste uncontrollably. An excess of 10 million tonnes of grain equivalent of food per annum conservatively estimated at over N825 billion was reported to be lost to spoilage and wastage occasioned by the lack of post harvest management [2, 3]. In Nigeria, the food processing sector is dominated by small and medium enterprises. Small-scale food processing enterprises (SSFPEs) have played a very important role in the development of the economy of most developed and developing countries of the world, particularly in terms of employment generation especially in the rural areas, better income distribution, reduction of post-harvest food losses and increasing food availability, and as a training ground for entrepreneurs before they invest in large scale enterprises [1, 4-6]. Also, SSFPEs have important linkages to related industries such as the manufacture of machinery, food packaging materials and suppliers of food ingredients. Food processing results in a high value food product, which represents the outcome of a sequential series of unit operations, activities and decisions. The process starts with the articulation of consumers' demand and leads to decisions by farmers to produce certain crops, rear certain livestock or catch certain particular fish. This is followed by a series of activities and operations to transform the crop or animal products in time and place to meet consumers' demand and value addition. Food processing is therefore the physical and economic bridge that links raw material production and

consumer food purchases [1, 7]. The long-term objective of Nigeria's economic and national development is a good balance between a strong industrial sector and a resilient agricultural sector. The development of small-scale rural agro-industry is seen as a strategic step towards achieving this goal. Besides creating new job opportunities, this strategy also encourages the export of goods other than petroleum, and enhances rural development [8].

This article focuses on SSFPEs as one of the important measures for national development, and addressing food security challenges, particularly in Nigeria at a time when the national government is making concerted efforts to diversify from a predominantly oil-based economy to agro-based economy. The specific objectives of this paper include the following: to identify the roles, challenges, measures and prospects of SSFPEs' development in Nigeria, and proffer lasting solutions to the constraints; to identify effective means of developing technological inputs and value addition strategies for promotion of food processing, to emphasize the need for food processing following the extent of food losses and wastages in Nigeria, and to investigate long term effects in the economic and national development that are achievable through development of efficient food processing technologies and systems. In the context of agriculture-driven development strategies for Nigeria, the development of a sustainable and vibrant food production/processing industries to conserve and convert enhanced agricultural outputs into maximized value-added products for global markets occupies a critical tactical niche.

## **II. Concept and practice of small-scale food processing enterprises**

There is no unique or universally accepted definition of small and medium enterprises (SMEs) since the classification of businesses into small and large scale is a subjective judgment [9]. Egbugu [10] noted that definitions of SMEs vary both between countries and between continents. The major criteria used in the definitions according to Carpenter [11] could include various combinations of the following: number of employees, financial strength, sales value, relative size, initial capital outlay and types of industry. Fatai [12] however, stressed the indicators prominent in most definitions namely, size of capital investment (fixed assets), value of annual turnover (gross output) and number of paid employees. In countries like the United States of America, Britain and Canada, SMEs are defined in terms of annual turnover and number of paid employees. In Nigeria, the definition of SMEs varies from time to time and according to institutions. According to Umar [13], SMEs has been defined by the Nigerian Government using various criteria such as investment in machinery, equipment, working capital and turnover; and that the Federal Ministry of Industry, under whose jurisdiction the micro and small scale enterprises are, has adopted a somewhat flexible definition especially as to the values of installed fixed cost. Amongst several definitions provided by the Government and its attendant agency, the National Council on Industry defined small scale enterprise as an industry whose total project cost excluding cost of land and including working capital does not exceed N5m (i.e. US\$500,000). SMEs, therefore is any business enterprise that is highly personalized, situated within an area of operation which is relatively small in terms of size, employment, turnover and capital, and is actively managed by one or few persons for the purpose of making profit.

However, SSFPEs exhibit certain characteristics which distinguish them from their large-scale counterparts [4, 14, 15]. They are usually organized as a family business, or have a single proprietor. However, as the enterprise expands, a partnership normally evolves, leading eventually to the formation of a limited company. The location of the enterprises tends to be evenly distributed both in the rural and urban areas, although some have already been relocated in industrial areas. Small-scale businesses are characterized by small-scale investment and simple technology which makes a relatively high labour demand. Among these small-scale industrial activities, the manufacturing of food and beverages is the most important, in terms of the number of businesses and the number of workers employed [16]. Nigeria has a large number of traditional foods. The most important products in the food processing sector are sugar, carbonated soft drinks, tea, frozen shrimps, maize, rice, wheat flour, poultry feed, cooking oil, bread, biscuits, cakes and beer. In Nigeria, small-scale industries play an important role in the economic life of the people, since they are found in every province of the country and have a high capacity to employ labour.

## **III. The need for food processing**

Globally, over half of the food produced today is lost, wasted or discarded as a result of inefficiency in the human-managed food chain [17]. This is the tragic reality confronting our nation, Nigeria, in particular and the human race in general. Tables 1- 4 [18] present the estimated annual production and the associated uncontrollable postharvest losses of various food raw materials in Nigeria in a year. Fogel, [19] also reported that the hunger of 1.5 billion people could be alleviated by eradicating the food wasted by British consumers and American retailers, food services and householders, including the arable crops such as wheat, maize and soy to produce the wasted meat and dairy products. High post-harvest food losses due to limited food processing and preservation capacity are a major factor hindering food and nutrition security in Nigeria. Ineffective or

inappropriate food processing technologies, careless harvesting and inefficient post-harvest handling practices, bad roads, bad market practices and inadequate or complete lack of storage facilities, packing houses and market infrastructures, among others, are factors responsible for high post-harvest food losses in Nigeria. Therefore, farmers and other stakeholders in the food supply chain need to rise to the occasion by reducing food wastes through good postharvest management practices such as the use of appropriate processing technologies and storage facilities. This would guarantee food security. Gernah et al., [3] stressed that the value of agricultural raw materials could be improved by using appropriate food processing technologies in removing unwanted materials, and transforming of the raw material(s) into high quality finished products. Also, the utilization of storage facilities for example silos for grains, stacking for yam tubers, modified atmosphere storage for fruits and cold storage of fish and meat can preserve these products thereby adding value to them. When appropriate processing methods are employed, the transformed product has extended shelf life, higher nutritional and economic value, thus contributing to the food security concern of the population.

Table 1. Estimated annual production and postharvest losses of stored cereals in Nigeria (X 10<sup>3</sup>MT) [18]

Commodity	Benue State	Nigeria	Estimated Loss (%)	National Annual Average Loss
Maize	139.56	4186.60	20 – 30	837.30 – 1256.00
Millet	65.18	1955.40	20 – 30	391.10 – 586.60
Sorghum	191.70	5751.10	20 – 30	1150.20 – 1725.30
Rice	227.73	6831.19	5	341.60

Annual Losses of Cereals: 2378.90 – 3767.90 (10<sup>3</sup>MT)

Table 2. Estimated annual production and postharvest losses of roots and tubers in Nigeria (X 10<sup>3</sup>MT) [18]

Commodity	Benue State	Nigeria	Estimated Loss (%)	National Annual Average Loss
Cassava	3,559.50	106,785.00	10 – 25	10678.50 – 6696.30
Yam	2, 874.30	86, 229.00	20 – 67	17245.80 – 7773.40
Cocoyam	11.20	336.00	10 – 40	33.60 – 134.40
Sweet potato	195.10	5853.00	50 – 80	2926.50 – 4682.40
Ginger	0.27	8.10	5	0.41

Annual Losses of Roots and Tubers: 30, 884.40 – 89286.91 (10<sup>3</sup>MT)

Table 3. Estimated annual production and postharvest losses of legumes and oilseeds in Nigeria (X 10<sup>3</sup>MT) [18]

Commodity	Benue State	Nigeria	Estimated Loss (%)	National Annual Average Loss
Soybeans	169.68	5090.40	30 – 40	1,527.12 – 2036.16
Cowpea	26.99	809.70	30 – 40	242.91 – 323.88
Bambara g/nut	12.37	371.10	30 – 40	111.33 – 148.44
Beniseed	4045.00	7685.50	20 – 50	1,5371.00 – 38427.50
Melon	29.16	874.80	10 – 30	87.50 – 262.44
Groundnut	358.27	10748.10	30 – 40	3,224.40 – 4, 299.24
Pigeon Pea	6.56	196.80	10 – 15	19.68 – 29.50
Palm nuts	150.30	2555.10	10 – 15	255.50 – 383.27

Annual Losses of Legumes and Oilseeds: 30, 884.40 – 89286.91 (10<sup>3</sup>MT)

Table 4. Estimated annual production and postharvest losses of fruits and vegetables in Nigeria ( $10^3$ MT) [18]

Commodity	Benue State	Nigeria	Estimated Loss (%)	National Annual Average Loss
Citrus	1, 067.13	32, 013.90	20 – 95	6,402.80 – 30,413.21
Mango	986.35	29,590.50	20 – 80	5,918.10 – 23,672.40
Garden egg	24.66	739.80	40 – 100	295.92 – 739.80
Okra	29.79	893.70	30 – 70	268.11 – 625.60
Pepper	10.14	304.20	10 – 20	30.42 – 60.84
Tomatoes	18.85	565.50	20 – 50	113.10 – 282.75

Annual Losses of Fruits and Vegetables: 20, 839.44 – 45,910.40 ( $10^3$ MT)

#### IV. Impacts of small-scale food processing enterprises

The ability to process and preserve food is directly related to the level of technological development. The slow progress in upgrading the traditional food processing and preservation techniques in Nigeria contributes to food and nutrition insecurity in the country. Simple, low-cost, traditional food processing techniques are the bedrock of SSFPEs that are crucial to rural development in Nigeria. By generating employment opportunities in the rural areas, SSFPEs reduce rural-urban migration and the associated social problems. Unfortunately, rapid growth and development of SSFPEs in Nigeria are hindered by adoption of inefficient and inappropriate technologies, poor management, inadequate capital; limited access to banks and other financial institutions, high interest rates and low profit margins, among others [20-23]. However, some successes, while a lot still needs to be done, have been achieved in upgrading traditional Nigerian food processing technologies. These include the mechanization of gari (fermented cassava meal) processing, the production of instant yam flour or flakes, the production of soy-ogi (a protein-enriched complementary food), the industrial production of “dawadawa” (a fermented condiment) and the upgrading of the “kilishi” (a traditional roasted dry meat product) process and the traditional Nigerian cheese-making process [24]. There is no doubt that, in Nigeria, large-scale food industries financed through joint ventures with equity and loans from national and international financial institutions play a unique role in promoting industrial development through employment generation, value-added processing and training of skilled manpower. Although food multinationals have considerable export potentials through value-added processing, their impact is felt greatest in the urban areas. Rural development is closely linked with the promotion of small-scale food industries that involve lower capital investment and rely on traditional food processing technologies. It is clear from experiences with large, fully mechanized processing plants in Nigeria and other West African countries, that small-scale food industries, involving limited mechanization of the traditional methods of food processing, with possibilities for replication in the rural areas where the raw materials are produced, offer better prospects for success. Full mechanization often results in higher overhead costs. In addition, small-scale plants have the advantage of being able to match processing capacity with raw material supply and are therefore, less adversely affected by raw material shortages than large-scale food industries. Moreover, SSFPEs rely on locally fabricated equipment and a study of these enterprises in Nigeria identified lack of spare parts for equipment maintenance and repair as a major problem constraining their growth [25]. The critical role that SSFPEs plays in national development cannot be overemphasized especially where high post-harvest losses is a major factor hindering food and nutrition security.

#### V. SSFPEs and national development in Nigeria

Small firms are backbone of national development. For a country to reach its full potential in terms of economic and social development, it cannot afford to ignore the importance of its indigenous small-scale enterprises and the contributions that they make to the country's economy. On this note, trade liberalization and the encouragement of foreign directive investment, by the government and non-governmental organizations; have to go hand in hand with a concentrated effort to helping the growth and development of SSFPEs to enhance development. Unlike the large-scale industrialization strategy, which is the category of import-substitution strategy practiced by Nigeria without any success, small-scale industrialization has made a very glaring impact on the economy of nations. Fabayo [26] observed that one major claim for focus on small-scale enterprises is that they are large employers of labour and this makes them vital in coping with the problems of unemployment and poverty. According to him, strong evidences based on country and regional experiences exist to show that small firms are major source of employment opportunities for a wide cross-section of the



workforce: the young, old part-time workers and the cyclically unemployed. Venkatarman [27] noted that more jobs per unit of investment capital and per unit of energy consumed are created worldwide by small scale enterprises than large-scale enterprises. International Labour Organization, ILO [28] estimated that food processing activities form the basis of nearly 30% of industrial output and 20% of employment under manufacturing in developing countries within the formal sector of the economy. Micro and small scale enterprises (MSEs) also play intermediate role in the development of large scale enterprises [29, 30]. They reduce regional disparities through the creation of employment opportunities in the rural areas and mobilize local resources more readily than large-scale industries. Uzor (2004) opined that micro and small scale enterprises (MSEs) contribute to national development by positively influencing the distribution of income both in functional terms, wages and profits in nominal terms. Another outstanding contribution of modern small business is its significant influence on the competitive price structure. The large number of small firms forms a broadly based variety of piece enterprise firms, providing a near perfect competitive situation. In this way, small scale businesses act as a natural antidote to the price formation of large and powerful monopolistic or oligopolistic conglomerations. SMEs also help to improve rural infrastructure and the living standard of the people when they are cited in rural areas; social amenities such as road, electricity, pipe-borne water, telecommunication facilities and so on are attracted to the area as a result of the presence of SMEs in the community. SMEs provide promising alternatives for countries that desire the fastest option for industrial and technological development since they have short-term gestation period and high potentials for quick yield on investment, and at the same time providing opportunities for the development of local skills and technological acquisition. SMEs are training avenues for the creation of local entrepreneurs/capacity building in several areas of economic activities. They are regarded as the 'university' where a large class of small scale food processors usually receives training. It is therefore more important to lay a good foundation of an industrial class by promoting small-scale food processors than it is to build a few large factories. Most small-scale food enterprises are involved in primary and secondary economic activities that rely heavily on locally sourced equipment and parts. As a result they achieve high local value added operators. Small-scale food enterprises can survive on rudimentary industrial infrastructure, and as result they serve as major facilitators for industrial dispersal and rural development and thus help in mitigating the rural-urban drift. Most small-scale food processing enterprises can serve as channels for import substitution and export promotion of processed food even with a low take-off capital requirement. Small-scale food processing enterprise therefore widens the scope for participation in food processing activities by individuals with limited capital. They are effective instruments of mass participation in industrial development.

## **VI. Food security challenges, the journey so far and the way forward in Nigeria**

Food security challenges include, among others, the constraints in agricultural raw materials processing in Nigeria. Several factors such as inadequate processing industries, inadequate power for industrial operations, poor water supply for processing and portable use, lack of appropriate technology for certain highly technical operations, poor packaging materials and equipment, among others, militate against value addition of agricultural raw materials in Nigeria. Government monetary and banking policies are also not friendly enough for fund acquisition for industrial and agricultural purposes leading to food security. Olayide [31] conceived the food and nutrition problem in terms of food supply and demand imbalance. Factors that constrain food supply and food demand invariably affect food security. On the supply side major factors hampering the supply of food in Nigeria are ownership of productive assets and resources which are biased against agricultural producers, nature of farm organization and technology which are crude and undeveloped, and the lack/primitive state of marketing infrastructures and mechanisms, all of which influence food output and availability. The demand for food is affected by poor growth rate/distributional structure of income, high food prices, preference structure which is largely in favour of foreign products, and various socio-cultural factors relating to poor state of nutrition education, intra household food distribution decisions, poor cooking technologies and low access to adequate health care [31-34]. Despite the considerable arable land resources, Nigeria is a net importer of food. The country spends more than USD3 billion annually on bringing in food, even though at one point, agriculture was the nation's greatest source of foreign exchange. Most agriculture is carried out by small farmers and processing and storage facilities are limited, restricting the country's ability to withstand a food emergency. According to Eme and Onyishi [35] several agricultural policies have been formulated in Nigeria to curtail food security challenges but unfortunately, have not yielded the desired results of increase in food production. But matters have improved over the course of the decade, and the government and other stakeholders are working on programmes to guarantee the nation's food security for the coming years (CN, 2010). Former President Yar'Adua made Food Security one of the items in his Seven Point Agenda for government, and the current administration also considers ensuring food security to be a high priority [36]. According to Akinyele [37], in September 2008, the Federal Ministry of Agriculture and Water Resources launched a new National Food Security Programme to bring about sustainable access to affordable and high-quality food for all Nigerians. The

government set aside USD1.3 billion for the programme, with the short-term objective of raising agricultural productivity by shifting from traditional subsistence farming to commercialized agriculture. C.N., [36] reported that the National Food Reserve Agency (NFRA), a parastatal of the Ministry of Agriculture, was established in 2007 to oversee Nigeria's food security strategy with the aims of storing 5% of national food output to ensure supply in the event of a food crisis, promoting the involvement of the private sector in agriculture and facilitating farmers' access to agricultural machinery and feedstock. Also, in the medium to long term, the government hopes to expand capacity in the sector, improve storage and processing facilities and create a more efficient regional infrastructure, with the intent of, in the future, obtaining more than half of Nigeria's foreign exchange from agriculture.

Regardless of the existence of all these important programmes, Nigeria is still characterized by high reliance on food imports. Malnutrition is widespread in the entire country and rural areas are especially vulnerable to chronic food shortages, unbalanced nutrition, erratic food supply, poor quality foods, high food costs, and even total lack of food. This phenomenon cuts across all age groups and categories of individuals in the rural areas [37]. The problem of food and nutrition security in Nigeria has not been adequately and critically analyzed, despite various approaches at addressing the challenges. Therefore, the enormous amount of money and other resources spent in attempting to assure the food security of Nigerians without success calls for a fundamental review of the past approaches and achievements to see what lessons can be learned to re-strategize and develop an approach that will ensure that better progress is made toward achieving the first Millennium Development Goal. Since the majority of Nigerians live in rural areas, an analysis of the food and nutrition security status of rural dwellers will provide a clear picture of what needs to be done to assure food security in Nigeria with the attendant improvements in nutrition status when all the other necessary conditions, such as adequate health and care, are present. We must therefore look inwards for solutions to this problem by enhancing the production, processing, preservation and storage, and distribution techniques of local food products. This is aimed at markedly improving the quality of the local foods to meet local demand and ensure National food security.

## **VII. Contributions of engineering in the promotion of small-scale food processing in Nigeria**

The contributions of food engineering in improving food quality, nutrition security, food safety and handling, food packaging and distribution, product's shelf-life and reduction of post-harvest losses in Nigeria can be felt in the areas of mechanization of food processing unit operations, development of new and existing technologies, design and development of machinery and systems for processing and preservation of different agricultural produce of high target. This will facilitate the achievement of the technical roles of food processing. There are many different unit operations/technologies associated with the conversion of raw food materials to consumer products. Most of them include drying, canning, chemical preservation, sterilization, pasteurization and blanching, freezing, heating, salting, irradiation, fermentation and germination. The entire spectrum of bioprocess engineering is associated with the design, development, operation and maintenance of food processing systems, plants, machinery and effective technologies for conversion of raw food materials into safe products of the highest quality and carrying out sophisticated research involving process design, development and improvement. In Nigeria, different methods are used for processing of food crops. These methods can be classified as traditional and improved. Traditional systems make use of manual labour with little or no machinery involvement. In the improved systems, most of the unit operations are mechanized. The summary of the processing techniques, methods, various processed products and machines/systems used for processing some of the major crops in Nigeria are presented as follows:

### **7.1 Cassava processing:**

Cassava is the most important staple food in sub-Saharan Africa, especially, in Nigeria and Bénin, and ranks second after rice in Sierra Leone [38]. Cassava can be processed into many products in Nigeria [39]. Some of the products are garri, "abacha", flour, noodles, starch and animal feed. For garri production, the unit operations include peeling, drying, grating, pressing/fermenting, sifting, frying and drying. For flour production, they are peeling, cleaning, slicing/chipping, drying, grinding and sieving. The unit operations for animal feed are peeling, cleaning, slicing/chipping, drying, grinding and pelleting. For starch production, the operations are peeling, cleaning, chipping, drying, grinding, sieving and wet processing. For some of these operations, there are simple machines, which can either be manually powered, motorized or engine powered [40]. Tremendous success has been recorded with small-scale gari processing factories in which some of the tedious manual operations of traditional cassava processing such as grating, pressing and sifting are replaced by machines. Thus, the mechanization of gari processing underscores the role that improvements in small scale food processing technologies can play in national development in Nigeria. These small-scale gari processing factories have sufficient flexibility, allowing processing capacity to be matched with raw material supply. They provide

employment in the rural areas, reduce post-harvest cassava losses and provide a good source of income to farmers and processors.

#### 7.2 Groundnut processing:

Groundnut is the most important crop in northern Nigeria, and the 13th most important food crop of the world and the 4th most important source of edible oil, animal feed and also consumed as snacks [41, 42]. It generates employment on the farm during cultivation and in agro-processing [43]. Many products can be obtained from groundnuts but the most important is groundnut oil. The unit operations involved in post harvest handling and processing of groundnut include stripping, decorticating, grinding, pressing and refining. Nigeria is the fourth largest producer of groundnut with a proportion of 4.5% of the total world production [41]. It follows China, India, and USA with 41.5%, 18.2% and 6.8% respectively of total world groundnut production [44]. In West-Africa, Nigeria produces 41% of the total groundnut production [45]. Groundnut processing is basically the transformation of the raw groundnut into other finished commodities like groundnut oil, cake and animal feed among others. Processing of groundnut perhaps is the best area an investor can engage in with maximum utilization of the product. Therefore, groundnut processing can lead to reduction in food wastage, enhanced food security, improvement in livelihood of low income groups and empowerment of women especially in Nigeria where processing of groundnuts into various products is mostly done by women either for home or commercial consumption [46].

#### 7.3 Yam processing:

Yam can be processed into three major products: flour, “fufu” or pounded yam, yam flour and flakes. For yam flour, the operations are peeling, washing, slicing, drying, grinding and sieving. The operations for “fufu” production are peeling, cutting, washing, cooking and pounding. The product is so popular that considerable quantities are exported to other parts of the world, especially Europe and North America, where there are sizable African populations. For yam flakes, the operations are peeling washing slicing, steeping, mashing and drum drying. Commonly, instant yam flour is produced by sulfiting peeled yam pieces, followed by steaming, drying, milling and packaging in polyethylene bags [47]. Instant yam flour can also be produced by drum drying cooked, mashed yam and milling the resultant flakes into a powder using a process similar to that used for production of dehydrated mashed potato [48, 49]. This achievement is made possible with the appropriate application of engineering technologies, machines and systems in food processing.

#### 7.4 Soybean processing:

Soybean can be processed into different products such as soymilk, soya yoghurt, soya oil and cake among others. The unit operations include washing, soaking, removal of skin, grinding, and filtering. The unit operations involved in processing soya oil and cake are: cleaning, crushing, conditioning, solvent extraction, distillation, de-acidification, bleaching and deodorizing. For each of these unit operations, there is a machine for operation, and the engineer should know how to design and maintain them.

#### 7.5 Oil palm processing:

Oil palm is the most important crop in eastern Nigeria. The main products of its processing are palm oil, shell, palm kernel oil and cake. The unit operations involved include sterilizing, digesting, pressing, clarification, drying, kernel cracking, separation, crushing, pressing and refining.

#### 7.6 Rice processing:

The unit operations involved in processing rice include threshing, cleaning, grading, parboiling, steaming, drying, milling, destining, size grading. Rice processing is fully mechanized in Nigeria and the description of the machines involved is beyond the scope of this work.

#### 7.7 Maize processing:

Maize can be processed into different products including maize flour, oil, “Akamu”, corn flakes and “Agidi”. For maize flour, the operations are cleaning, sorting, degerming, drying, milling and sieving. The operations for oil are soaking, steeping, degerming and oil extraction. For “Agidi” and “Akamu”, the operations are milling, sieving and boiling.

### **VIII. Major constraints of SSFPEs in Nigeria**

The fact that small-scale industries have not made the desired impact on the Nigerian economy in spite of all the efforts and support of succeeding administrations and governments gives a cause for concern. This shows that there exist fundamental problems, facing small-scale industries but which have either not been addressed at all or partially tackled. According to [50], rapid development of SSFPEs in Nigeria are hampered by adoption of inefficient or inappropriate technologies, poor management, inadequate capital [51] and limited access to banks and other financial institutions, high interest rates and low profit margins, limited capacities for research, development and adaptation, poor road networks, poor power supply and unreliable telecommunications, inadequate storage facilities, stiff competition from imports, high dependence on imported raw materials, lack of suitable market information, lack of transparent government policy, etc. Aluka [52] categorized the problems facing small-scale industries as; financial, management and technical problems. Ogundipe [53] classified these problems in the following ways; first the problems vary from lack of institutional credit which is the most important of all to the inability of these enterprises to effectively market their products. The second classification includes poor transportation and infrastructural development, restricted market, lack of adequate incentive, non-enforcement of official guidelines and poor preparation of project proposals by small-scale entrepreneurs.

### **IX. 9. Measures for development of SSFPEs in Nigeria.**

Realizing that these problems exist, the Nigerian governments and non-governmental organizations should adopt good supportive measures that will encourage the development of food processing industries, especially SSFPEs. This will facilitate the achievement of the overall goals of a small-scale food processing development strategy which include: promotion of industrial efficiency, global competitiveness, industrial expansion and the creation of employment within the sector; achievement of increased levels of production of value-added products within the sector; and generation of wealth for the stakeholders in the industry on a fair basis within an enabling environment [20-23, 54, 55]. These supportive policies and incentives should take the form of regulations, extension activity, financial assistance and development of necessary infrastructure, as well as encouragement of research and development to mention but a few.

### **X. Conclusion**

The long-term effect in the economic and national development in Nigeria can be achieved through the development of small-scale food processing techniques, and these culminate to rapid food processing and industrialization. Thus, this paper focuses on efficient food processing in Nigeria, particularly with reference to SSFPEs. It discusses the roles, challenges and prospects of small-scale food enterprises' development in Nigeria. The development of SSFPEs represents one way of diversifying agricultural products. It has the potential to increase farmers' incomes, open up new job opportunities in rural areas, and support the eventual development of advanced food processing industries. SSFPEs which involve lower capital investment and rely on traditional food processing technologies are crucial to rural development in Nigeria while the impacts of large food multinationals are felt greatly in the urban areas. However, SSFPEs in Nigeria are faced with significant challenges that compromise their ability to function and to contribute optimally to the economy. Financial constraints, market difficulties and lack of management skills are the major constraints, among others, that hamper the efficient performance of such enterprises in Nigeria. The promotion of food processing and preservation in Nigeria demands more technological inputs in terms of mechanization of the food processing unit operations, development of new and existing technologies, design and development of machinery for processing different agricultural produce of high target. While a lot still has to be done in upgrading conventional small-scale food processing technologies in Nigeria, some successes have been achieved including the mechanization of gari processing, the production of instant yam flour, mechanization of "utara akpu" pounding, the production of "soy ogi", the industrial production of "dawadawa", and the upgrading of the "kilishi" process and the Nigerian cheese-making process [56-59]. SSFPEs in Nigeria still need huge support to develop their production efficiency, quality control, and hygiene. Several supportive policies should be implemented, including regulations, extension activity, financial assistance and the development of necessary infrastructure. It is envisaged that small-scale food processing will continue to play a very important role in the economy of every developing country, as it expands in line with policies and incentives introduced by the governments of such countries where they are adopted as measures for national development in food processing and preservation.



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