

Review Article

Analysis of Challenges Facing Rice Processing in Nigeria

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Rice is the most economically important food crop in many developing countries and has also become a major crop in many developed countries where its consumption has increased considerably. It has become necessary to meet the demand of the world's current population growth rate, and the least costly means for achieving this aim is to increase rice productivity, wherever possible. The main challenges encountered by rice processors in Nigeria are to find appropriate solutions for quality rice processing. Therefore this work provides basic information about the challenges of rice processing and focuses on the challenges faced by the small scale rice processors and reasons for continuous rice importation with a view to guiding decision-making to be self-sufficient in rice production, thereby making some improvement in Nigerian economy.

1. Introduction

(a) Background of Study. Rice (*Oryza sativa*) a cereal belonging to the Gramineae, a large monocotyledonous family of some 600 genera and around 10,000 species [1]. It is valued as the most important staple food for over half of the world population [2] and ranks third after wheat and maize in production on world basis. More than half of the world's population depends on rice as the major source of calories [3]. The amount consumed by all these people ranged from 100 kg to 240 kg per annum in the year 2000 alone [3]. Two species have emerged as our most popular cultivated rice, *Oryza sativa* and *Oryza glaberrima*; of these two species the more widely produced is *Oryza sativa*.

In Nigeria, rice consumption has risen tremendously at about 10% per annum due to changing consumer preferences [4]. However, [5] discovered that most Nigerians prefer to consume imported rice brands as compared to local rice varieties. The reason is that most Nigerian rice processors lack adequate technology of rice processing to meet international standard.

Rice processing involves several steps: removal of the husks, milling the shelled rice to remove the bran layer, and an additional whitening step to meet market expectations for appearance of the rice kernels. This process generated several streams of material which include the husks, the bran, and

the milled rice kernel [6]. Nigeria has the potential to be self-sufficient in rice production, both for food and industrial raw material needs and for export purpose. However, a number of constraints have been identified as limiting factors to rice production. These include problems with research, pest and disease management. Addressing at least most of these problems is good first step towards attaining the target of rice self-sufficiency [7]. Therefore the aim of this paper is to review the causes of the challenges facing rice production in Nigeria and provide guide to overcome these problems.

(b) World Rice Production. The world rice production for over almost a decade (2003–2012) is as shown in Figure 1. In 2003, about 580 million tons of rice was produced worldwide, 602 million tons in 2004, 620 million tons in 2005, and 622 million tons in 2006. The production continued to grow yearly; by 2007, the production had risen to 648 million tons. The production reached the peak in 2011 with a total production 720 million tons in order to feed the increasing global population. Furthermore, the world's annual production growth rate was stagnated in 2012. The reason could be attributed to natural disaster such as storm, tornado, and unfavourable climate as reported by [8].

Furthermore, [9] reported that instant low temperature below the critical point can affect seedling establishment in the early growth stage and high grain sterility in

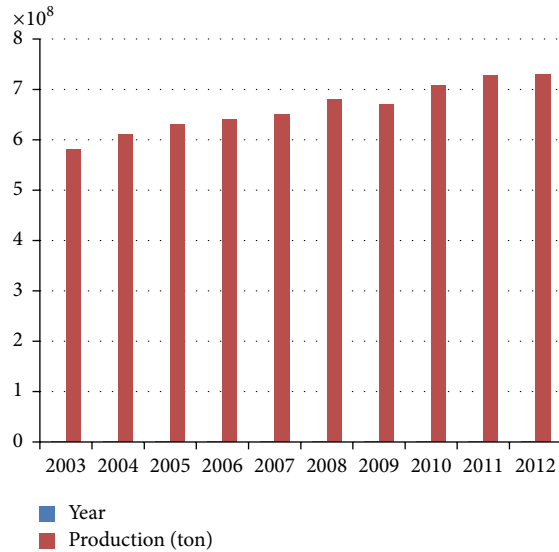


FIGURE 1: World rice production. Source: FAO [24].

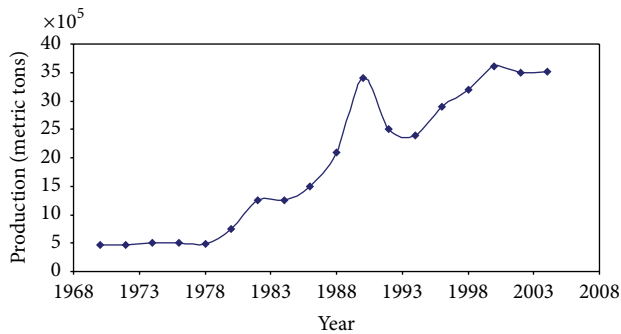


FIGURE 2: Rice production in Nigeria. Source: United State Department of Agriculture [16].

the late crop season. Unavailability of water has impeded farmers from growing rice in the southern part of California and in Southern Italy, even though these areas are more favourable in terms of climate for growing rice than the northern parts of the countries [10]. Asia accounts for 90% of the world's production and consumption of rice because of its favourable warm and humid climate, but suitable lands for increasing rice production are almost exhausted [11].

(c) *Rice Production and Importation Trend in Nigeria.* According to Hardcastle [12], rice production started in Nigeria in 1500 BC with the low-yielding indigenous red grain species *O. glaberrima* Steud and then widely grown in the Niger Delta area. WARDA [13] reported about the high-yielding white grain *O. Sativa* L. introduced in 1890, and by 1960 it accounted for more than 60 percent of the rice grown in the country. Also, Figure 2 shows the trend of rice production in Nigeria since 1968 through 2008 (four-decade) study. Rice production remained at low level from 1968 to 1978 perhaps due to dietary idiosyncrasy for tubers. WARDA [13] reported that paddy rice production had risen from 13400 to 344000 tons in 1970 and area was cultivated from 156,000 to

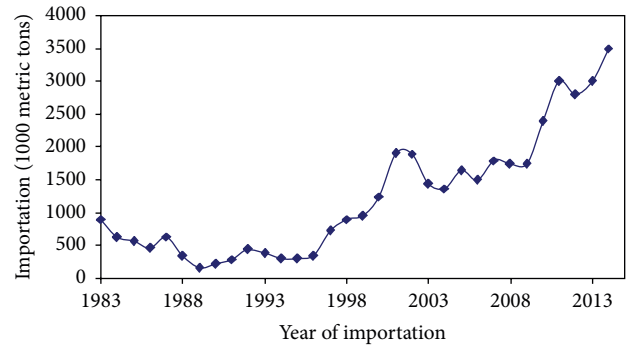


FIGURE 3: Rice importation in Nigeria. Source: United State Department of Agriculture [16].

255,000 ha. Since then, paddy rice production has been on the increase. Tremendous increases in area planted, output, and productivity in paddy rice production were achieved over the last two decades and now stand at 1.09 million tons. More so, the production continued to rise higher from 1978 and since 1980.

Nigeria has become the highest rice productions country in West Africa and the third largest in Africa, after Egypt and Madagascar [13]. The production reached the peak in 1990 in which the country was producing 3.4 million tons of rice from about 1.2 million tons [14] before it slightly fluctuated down the slope in 1993.

However, the production soared up from 1993 to 2006 where the production remains 3.8 million metric tons. The graph shows that as years increased the production also increased; this may be due to increase in population growth as well as increase in consumption trend of rice in the country. This healthy production trend would have been sustained but for the unsteady government policy on rice imports. Increased production over the last two decades could be attributed to the ban imposed on rice imports in 1985 and if this restriction had been maintained, Nigerian rice farmers would have risen to the challenge of meeting the domestic demand for the commodity. This has not been the case; however, as the government slackened rice import restriction in 1997, the resultant effect was that foreign rice flooded back onto Nigeria markets. Restrictions on rice imports were reintroduced later in 1997, and local production has increased in response to the attractive prices offered [15]. For rice production to be boosted, Nigerian government introduced institutions to monitor production and distribution of local rice. Table 1 highlights the specific objectives of each institution.

As the years went by, the indigenous production of rice could not meet the demand for rice. Therefore, Nigeria started importing rice into the country. Figure 3 shows clearly the rice importation figures as reported by United State Department of Agriculture [16]. This importation of rice did not follow a regular pattern but it is observed from the figure that rice importation was not up to 1 million metric ton per year since 1983–1998. However, from 2006 upwards, the importation figure soared yearly to reach the peak in

TABLE 1: Summary of the different Federal Government policies on rice production.

Dates of establishment	Institutions	Mandates
1970	Federal Rice Research Station (FRRS)	Development of improved varieties of grains
1972	National Accelerated Food Production Program (NAFPP)	Design, test, and transfer technology package for production of rice, maize, sorghum, millet, and wheat
1974	National Cereals Research Institute (NCRI)	Research on high-yielding rice varieties for farmers, on-farm adaptive research, seed multiplication, and training of extension staff
1976	The Operation Feed the Nation (OFN)	Self-sufficiency in domestic food supply
1978	Abakaliki Rice Project	Rice production and processing
1987	Agricultural Development Project (ADP)	Policies on rice production were implemented
1988	Nigerian Agricultural and Cooperative Bank (NACB)	Special credit schemes to boost rice production
1999	The Presidential Rice Initiative	Addressing the widening demand supply gap and attain self-sufficiency in rice production

Source: Emodi and Madukwe [15].

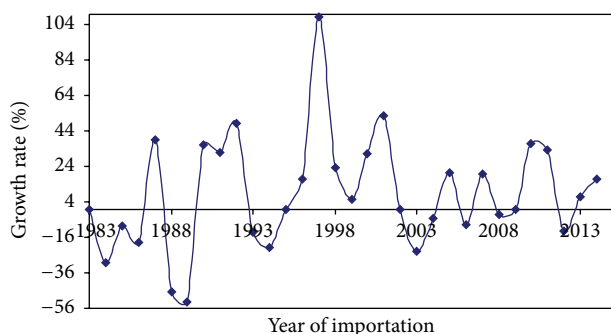


FIGURE 4: Rice importation growth rate in Nigeria. Source: United State Department of Agriculture [16] modified.

2013 with 3.5 million metric tons. The major reason is the preference of foreign to indigenous rice which has a low level of processing technology [17].

Furthermore, Figure 4 shows the importation yearly rice growth rate from 1983 to 2013. It is observed that growth rate is irregular and in some years there is no growth at all in rice importation business. From this figure, the growth rate is counted when the curves are upward ones and no growth rate occurs when curves are downward ones. This growth rate implies that the higher the growth rate is, the higher the country depends on importation of rice and the less the production of local rice is. This means that in 1997 Nigeria depended heavily on imported rice to feed its populace. This had negative consequence on the economy.

(d) *Rice Consumption Trend in Nigeria.* As reported by Imolehin and Wada [14] that in the 1960s Nigeria was almost 99 percent self-sufficient in the rice production consumed by its citizens. Over the following two decades (1970s and 1980s) self-sufficiency declined to 38 percent, leading to demand outstripping supply.

Table 2 shows the percentage of expenditure on categories of foods consumed in urban centers in Nigeria. The table

TABLE 2: Household expenditure by commodity, urban.

Serial number	Commodities	Percentage of foods
1	Maize	3.54
2	Rice	8.65
3	Other cereals	3.98
4	Bread and similar foods	6.05
5	Tubers and plantains	23.93
6	Poultry	0.96
7	Meats	3.52
8	Sea foods	4.57
9	Dairy products	1.14
10	Oils, fats, and oil rich nuts	3.65
11	Fruits	2.42

Source: National Bureau of Statistics [26].

shows that tubers and plantain take 23.93% followed by rice which means Nigerian spent a lot of money on rice. That is why the local rice could not be sufficient; therefore import is necessary. Philippine Rice Research Institute [18] reported that the Federal Government of Nigeria resorted to massive importation of rice. More than 540,000 tons of rice was imported in 1983 alone. Per capita rice consumption rose from 3.5 kg in 1970 to more than 14 kg in the 1990s.

The same trend of household expenditure on rice is found in Table 3 for rural dwellers except that the expenditure on rice is 9.07% which is slightly higher than that of urban expenditure. The reason is that most of the other food items are produced in rural areas; hence rice may be viewed as a special diet by the rural dwellers; therefore they may commit more finance to rice than the urban dwellers. From these Tables 2 and 3, it is observed that rice constitutes a staple food among Nigerians that the demand has always exceeded the supply. Because of this reason, Nigeria has a favourable market for rice production. However, because of the poor quality of locally produced rice, most consumers prefer

TABLE 3: Household expenditure by commodity, rural.

Serial number	Commodities	Percentage of foods
1	Maize	5.48
2	Rice	9.07
3	Other cereals	14.30
4	Bread and similar foods	2.30
5	Tubers and plantains	22.30
6	Poultry	0.36
7	Meats	2.61
8	Sea foods	4.09
9	Dairy products	1.10
10	Oils, fats, and oil rich nuts	3.80
11	Fruits	1.55

Source: National Bureau of Statistics [26].



FIGURE 5: Small scale rice parboiler. Source: <http://www.propcom.org/>.

the imported rice from other countries such as Thailand, Bangkok, and China to the indigenous rice [19].

2. Traditional Methods of Processing Rice Paddy

The traditional methods of processing rice paddy involve soaking of the paddy in water for 2 to 3 days to soften the kernel, followed by steaming of the soaked paddy for 5–10 minutes as shown in Figure 5 and dried in the sun as shown in Figure 6, followed by pounding the dried paddy in a mortar and pestle device to remove the husk or use of simple machines for dehulling/milling as shown in Figure 7; then the grain is cleaned using a winnowing basket [20]. Though the traditional method of processing rice is simple, but tedious, it has very low outturn and results in breakages of rice kernels and incomplete removal of husks. More so, it has a short storage life as the fat in the bran develops rancidity [20].



FIGURE 6: Traditional method of rice drying in Nigeria. Source: Basorun [25].



FIGURE 7: Small scale rice dehusser. Source: Propcom [21].

3. Modern Methods of Processing Rice Paddy

Propoor Opportunities in Commodity and Service Markets Project [21] carried out survey on modern rice processing and discovered that there has been improvement in rice processing in Nigeria compared to the 1990s. In modern methods, the rough rice or paddy is first cleaned to remove contaminants, and the husks are then removed by the so-called shellers; these are most commonly horizontally spaced rotating abrasive stones, but increasing use is being made of rubber roll or rubber belt made shellers. The rice and hulls are separated by aspiration and any paddy remaining with the rice is removed in a paddy separator. It is discovered that the main problem of Nigerian rice is the presence of stone in the rice grains. The reported survey shows that there has been locally produced destoner made in Kano, Nigeria, as shown in Figure 8. The machine costs N65,000 and was fabricated using angle iron and sheet metals.

Another improvement in rice processing in Nigeria reported by Propcon is the drying process. The traditional sun drying has been replaced by mechanical dryer or improved sun drying method. A typical example of mechanical dryer is as shown in Figure 9. This type of dryer is found scattered all over the country. It can process about 3000 kg and remove 50% moisture of rice in 6 hrs.

Apart from this mechanical dryer which uses diesel or electricity, other dryers have been developed such as solar dryer for drying rice paddy. An example of this is as shown in Figure 10 developed in National Centre Solar Energy Research, Sokoto, Nigeria. The development of this is a result of incessant power outage all over the country. This type of solar dryer is equipped with fan to enhance hot air distribution over the rice paddy.



FIGURE 8: Photograph of the destone machine. Source: Propcom [21].



FIGURE 9: A mechanical dryer. Source: Propcom [21].



FIGURE 10: Showing the diagram of a solar dryer. Source: Propcom [21].

4. Constraints of Rice Processing in Nigeria

Several factors are militating against rice production/processing in Nigeria. Wilfred [22] reported that the inadequate knowledge on the use of herbicides and pesticide, postharvest handling, processing and marketing, pest and diseases, soil fertility management, irrigation and water, harvesting skills are some of the constraints facing the rice farmers. Agidi [23] iterated the labour intensity involved such as ploughing, planting, weeding, harvesting, threshing, and transportation being strenuous and laborious; the problem is worsened by lack of appropriate rice farming tools, implementation, and equipment. Besides this, the equipment available is often too expensive for the average farmer. Most farmers depend on rudimentary, labour, and time consuming hand tools such as hoes, slashers, sickles, axe, and rake for various farm operations. Other factors include lack of industrial drive due to poor government policy and high cost of production.

Because local rice is of low quality, the rice merchants use this opportunity to expand on rice importation. The solution lies in the provision of incentives, machineries, and government policies to confront these challenges faced by rice processors.

5. Conclusion

In conclusion, Nigeria has a good climate for rice production and it has favourable market to absorb the production. There is need to improve the quality of indigenous rice to compete with foreign rice through selection and adaptation of modern rice technologies to ease labour in production and enhance nutritional qualities in rice processing and production. Government has role to play in forming strong policies that will favour production of local rice as it is being practiced in the advanced world.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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