

LEVELS OF ADOPTION AND USE OF FALSE BOTTOM AND LID TECHNOLOGY FOR IMPROVED PARBOILING AMONG SELECTED RICE PROCESSORS IN OGUN STATE, NIGERIA

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ABSTRACT

This study assessed the levels of adoption and use of false bottom and lid technology (FBL) for improved parboiling among trained rice processors in Ogun State, Nigeria. A complete census of 95 trained rice processors was done and data were collected with interview schedule and analysed using descriptive statistics (frequency counts, percentages, means, and standard deviations). Results revealed that most rice processors were younger than 40 years (53.7%), female (63.2%), married (82.1%), had formal education (77.8%), were members of associations (81.1%), and had 1-10 years of rice processing experience (74.7%). The mean age, rice processing experience, household size and annual income were 39 years, 9 years, 6 persons, and N235,752.69 respectively. It was revealed that 74.7% of the rice processors had high and low levels of FBL adoption. Factors influencing adoption of FBL were its observability ($\bar{x} = 1.86$), relative advantage ($\bar{x} = 1.50$), compatibility ($\bar{x} = 1.36$), trialability ($\bar{x} = 1.25$) and simplicity ($\bar{x} = 1.21$). Also, 63.2% of the rice processors were at renewal level of use while 17.9% and 11.6% were at preparation and integration levels of use respectively. Results further revealed that high technology cost (98.9%), unstable market price of rice (73.3%), insufficient funds to procure the technology (84.2%), and limited access to credit (58.9%) were the major constraints to the use of FBL. The study concluded that there were high levels of adoption and use of FBL for improved parboiling in Ogun State.

Keywords: Adoption level, FBL, Improved technology, Paddy rice, Parboiling technology, Rice processing

INTRODUCTION

With over 513 million metric tonnes of milled rice in the last harvesting year, rice is the world's second most important cereal crop after corn (Shahbandeh, 2024). Globally, rice is among the important staple food crops as it is produced and consumed in both developed and developing countries (Akinniran & Faleye, 2020; Oladimeji *et al.*, 2020). West Africa consumes more rice than any part of sub-Saharan Africa (SSA), as regional demand has continued to grow at almost 6% annually, driven by the growing population, changing consumption habits and

urbanization (Arouna *et al.*, 2021). Rice is more important especially in low to middle income countries like Nigeria (WorldAtlas, 2024) in ensuring food security of the residents. Rice is consumed in almost all the households in Nigeria on a daily basis. Hence, Nigeria is among the countries where rice is highly consumed. Despite this, the rice supply from domestic production is yet to meet the increasing demand for rice in Nigeria. Hence, to bridge this gap, huge amount of money is being expended on rice importation on a yearly basis.

Though successive Nigerian governments attempted to ban importation of rice, and promote the consumption of local rice, most Nigerians still prefer imported rice due to poor quality of the local rice. The attempt by the government has worsen the food security situation in Nigeria as imported rice is been smuggled into the country and almost all the households still consume imported rice at higher prices because Nigerians are willing and ready to consume good quality rice irrespective of the cost (Houssou *et al.*, 2013; Ndindeng *et al.*, 2021a). Hence, for Nigerians to consume local rice, it has to be of good quality. Zohoun *et al.* (2018) attributed the low quality of local rice to poor postharvest handling. This is because rice parboiling is usually done using traditional practices (Danbaba *et al.*, 2019; Arouna *et al.*, 2023).

Most of the earlier efforts were geared towards increasing rice production, whereas processing, an important value chain in the rice industry has received less attention. Rice processing entails methods used to prepare rice for use or preservation by removing the husks and sometimes polishing the grains to get it white (Adejoh *et al.*, 2017). The aims of processing operations include changing its form while maintaining the quality, reducing food losses, enhancing food security, generating income, and stimulating local production (Kwofie & Ngadi, 2017; Zohoun *et al.* 2018). Parboiling is one of the operations involved in rice processing.

Rice parboiling which is the hydrothermal treatment of paddy before dehulling and polishing in order to improve the physicochemical and nutritional quality of rice including its digestibility (Ndindeng *et al.*, 2022). It also increased the processors dehulling return, and ensures longer storage shelf-life (Etoa *et*

al., 2016; Ndindeng *et al.*, 2021b). As a hydrothermal process, rice parboiling entails heat treatment to gelatinize the starch in rice kernel resulting in irreversible swelling and fusion of starch granules (Danbaba *et al.*, 2019). Traditionally, parboiling involves soaking, steaming, and drying paddy rice before milling (Arouna *et al.*, 2023). Parboiling helps to reduce rice breakage on milling as well as change the cooking characteristics and achieve desirable flavour, impact different heating characteristics, reduces losses of nutrient during milling (Rahimi-Ajdadi *et al.*, 2018). Using the conventional methods, however, results in inefficiencies and quality issues. In recent years, innovations such as False Bottom and Lid (FBL) technology have emerged to address these challenges. This technology is an improved method of parboiling paddy rice introduced into Nigeria by the Japan International Cooperation Agency (JICA) in Nigeria (Salami & Adisa, 2023). The Federal Ministry of Agriculture and Rural Development (FMARD) and JICA partnered to develop False Bottom Technology for efficient rice parboiling process (Salami & Adisa, 2023). A pilot project called Rice Post Harvest Processing and Marketing Pilot Project (RIPMAPP) was conducted in North-central States (FCT, Niger and Nasarawa States) from the year 2011 to 2016 with the purpose of improving the capacity of rice processors in Nigeria through the use of False Bottom Technology (RIPMAPP, 2016). Because of the technology adaptability and implication on market price, other rice parboilers in North-central states have adopted this technology through extension agents of state ADPs and some by spillover effect. Ogun is among the States where the technology has been promoted and diffused to reach all rice processors through the State Agricultural Development Programme, OGADEP. One of the attempts made by OGADEP was the training of rice processors across the State in 2017 (Balogun, 2023). It therefore becomes necessary to investigate the extent to which the trained rice processors had adopted the technology and whether are still using the technology for improved rice parboiling in Ogun State. Specifically, this study described the socio-economic characteristics of the trained rice processors, determined rice processors' level of adoption of FBL technology, identified factors influencing the adoption of FBL technology, determined the level of use of FBL technology, and identified the constraints to the use of FBL technology among the trained rice processors.

MATERIALS AND METHODS

Study area

The study was carried out in Ogun State, Nigeria which is located in the southwestern geopolitical zone of the country. Rice is one of the six major crops that Ogun State has comparative advantage in producing.

Study population and sampling

The study population was rice processors who were trained on False Bottom and Lid (FBL) technology by the Ogun State Agricultural Development Programme (OGADEP). No sampling was done as all the trained rice processors were included in this study through a complete census.

Data collection procedure

Data were collected using an interview schedule designed by the researchers in line with the research objectives. The rice processors were visited in their homes or processing sheds for face-to-face interviews. The contents of the interview schedule were read to the rice processors and their responses were recorded by the researcher.

Measurement of key variables

Level of use: This was measured by adapting the Level of Use Matrix by Hall *et al.* (1975). The 'Level of Use' (LoU) matrix identifies eight levels or stages of innovation adoption - non-use, orientation, preparation, mechanical use, routine, refinement, integration, and renewal. Each of the adoption levels is further defined in terms of attributes or actions of participants regarding knowledge, acquiring information, sharing, assessing, planning, status reporting, and performing. Eight items were developed to represent each level as identified by LoU matrix under the seven categories using a self-reflected scale rated from 1-8. The LoU index was generated as the respondents' average score. Based on the LoU index, the respondents were classified into Non-use (0-1), orientation (1.1-2.0), preparation (2.1-3.0), mechanical use (3.1-4.0), routine (4.1-5.0), refinement (5.1-6.0), integration (6.1-7.0), and renewal (7.1-8.0).

Level of adoption: This was measured following the Orr and Mrazek (2009) steps of using LoU index to determine level of adoption. This was done by categorising the 8 levels of LoU matrix into four as non-adoption (LoUi 0-3), low adoption (LoUi 4), moderate adoption (LoUi 4.1-6.0), and high adoption (LoUi 6.1-8.0).

Factors influencing adoption of FBL technology: This was measured using a 21-item ordinal scale with five components - relative advantage, compatibility, complexity, trialability, and observability of the technology. The scale has three response options - Major factor, Minor factor, and Not a constraint with ordinal scores of 2, 1 and 0 respectively. Mean values were calculated for each of the components such that the mean values were from 0-2. the mean values were used to rank the factors in descending order of importance.

Constraints to use of FBL technology: This was measured using an 8-item scale on a three response options - Major constraints, Minor constraints, and Not a constraint with ordinal scores of 2, 1 and 0 respectively. Mean values were computed and used to rank the constraint items in descending order of severity.

Methods of data analysis

The study adopted a descriptive cross-sectional survey research design. This is because no sampling was done as all the trained rice processors were included in this study. It was contained in different research methodology textbooks that when data is collected from the entire population, inferential statistics are not necessary, as the data represents the entire population (Heeringa *et al.*, 2017). The descriptive statistics used in this study are frequency counts, percentages, means, standard deviations, and rankings. Analysis was done using Statistical Package for Social Sciences - SPSS version 21.0.

RESULTS AND DISCUSSION

Socio-economic characteristics of rice processors

Results on the socio-economic characteristics of the sampled rice processors are presented in Table 1. Findings reveal that 44.2% and 32.6% of the rice processors were in the age brackets of 31-40 and 41-50 years respectively. The mean age was 39 years and the standard deviation was eight which suggests a relatively homogenous population with less variability. This implies that greater proportion of the rice processors in Ogun State were youthful and active economically and reproductively. This corroborates the finding of Adediran *et al.* (2019) who also found a mean age of 39 years among rice processors in Niger State, Nigeria. The dominance of youths in rice processing activities could be adduced to the fact that rice processing activities are tedious, strenuous and energy-sapping. Age is a major determinant in technology adoption. The implication is that proven technologies, such as the false bottom and lid technology can be easily adopted by rice processors in Ogun State because they are relatively younger.

According to Lee (2019), younger rice processors are probably more receptive to implementing novel technologies like FBL. Because of their youthfulness, they can be more open to trying novel techniques and equipment to boost output and efficiency in rice processing activities. This, therefore, is a good development for the rice industry as younger rice processors will contribute to ensuring consistent and reliable rice availability in Ogun State. This is because younger people are frequently more actively involved in agricultural pursuits, such as the production and processing of rice, which adds to the total amount of rice available in the community market (NBS, 2020). Their engagement in rice processing activities and inclination to embrace technology advancements such as FBL can aid in streamlining production procedures, diminishing losses after harvest, and augmenting the calibre and amount of rice accessible for trade and consumption.

Women frequently face particular barriers, such as restricted access to resources, decision-making authority, and knowledge (Doss, 2001). Gender norms and roles can also impact the adoption patterns of technology. Close to two-thirds (63.2%) of the rice processors were female while 36.8% were male

implying that rice processing in Ogun State was dominated by women. This is consistent with previous findings (Danbaba *et al.*, 2013; Funmilola, 2017) which indicated that apart from their involvement in other agricultural activities, processing of agricultural produce was dominated by the female folk. This has implications on the adoption of technologies as women are restricted to productive resources such as capital, and credit facilities that could aid their adoption of technologies. The gender dynamics in agricultural activities are reflected in the prevalence of female involvement in rice processing, where women are frequently key players in post-harvest tasks like sorting, packing, and processing (FAO, 2011). The fact that women work in the rice processing industry is indicative of their vital role in the agricultural value chain and emphasises the significance of taking gender-specific viewpoints into account when developing technology adoption strategies.

Higher education is often linked to greater openness to and acceptance of agricultural technical improvements (Foster & Rosenzweig, 2010). Findings also reveal that rice processors had different levels of educational attainment which will influence their adoption of the FBL technology. It reveals that 23.2%, 34.7% and 20.0% of the rice processors had primary, secondary and tertiary levels of education. This implies that close to 80 percent of the rice processors had formal education, and suggests that most of the rice processors are likely to adopt FBL because technology adoption is positively influenced by education. This means that people with at least secondary education are more likely to have the cognitive abilities, knowledge, and problem-solving skills needed to comprehend, accept, and apply new technologies like FBL in rice processing operations. This finding, however, disagrees with that of Abubakar *et al.* (2023) which reported that close to two-thirds of the rice processors in Niger State had no formal education. The discrepancy in educational attainment of rice processors could be linked to regional variations in the literacy rates between the southern and northern parts of Nigeria. Rice processors in Niger State, which is primarily made up of rural and agrarian areas, would have less formal education than those in Ogun State, which might have greater educational chances and resources (United Nations Development Programme, 2019).

Further findings reveal that majority (82.1%) of the rice processors were married. This suggests that the rice processors were responsible individuals as marriage comes with inherent responsibilities. This implies that apart from rice processing, the rice processors are involved in additional responsibilities in the home - such as house chores (cooking, laundry, and care giving) and contributing to household income. The mean age is also an indication that most of the rice processors are within the reproductive age period during which they are into child bearing and rearing. Though complementary, these roles could be

conflicting especially among women rice processors. The adoption behaviour of rice processors can also be influenced by their marital status because decisions about technology adoption are often made jointly in the context of the home. According to Doss (2006), marriage frequently denotes joint decision-making and family responsibility. When making important decisions, like implementing new agricultural technologies, married people in many cultures, including Nigeria, may confer with their spouses and other family members (Kazianga *et al.*, 2013). Household size also has implications on technology adoption. It was found that three-fifths (60.0%) of the rice processors had household size of 4-6 persons and that the mean household size was 6 persons with a standard deviation of two. This suggests that the rice processors relatively had moderate household size. Larger households frequently require more deliberate decision-making and resource allocation (Doss, 2006). Larger families may prioritize investments and technology adoption by considering their combined requirements, goals, and resources. By implication, rice processors with large household sizes are less likely to adopt the FBL technology as they are more likely to have access to family members who can assist them in their processing activities at little or no fees at all. This supports the observation of Omoare and Oyediran (2017) that larger households provide cheap labor that will assist in rice production and processing activities. Considering the interests and preferences of every family member, the adoption of FBL technology may be assessed in terms of its ability to increase productivity, lower labour requirements, and promote household well-being. More than half (52.6%) of the rice processors were spouses in their households while 42.1% were household heads. This implies that some of the women rice processors were household heads suggesting a changing household structure from the conventional rural households which placed household headship exclusively on an adult male member. A reason for the changing household structure could be death of husband or divorce. Rice processing operations within married partnerships are collaborative, as seen by the noteworthy percentage of rice processors who are also spouses in their houses. Inside households, spouses frequently share duties and decision-making power, especially when it comes to livelihood pursuits and agriculture (Doss, 2006). Spousal engagement can include collaborative decision-making about labour division, resource allocation, and technology adoption in the rice processing industry. Both spouses can profit from and contribute to the adoption of technologies such as False Bottom and Lid (FBL). Headship of a household also influences the adoption of technologies. Hence, rice processors who were the heads of their households are more likely to adopt the FBL technology as they do not need to await the approval of their spouses, most of the time. According to Kazianga *et al.* (2013), household heads frequently

have crucial responsibilities in determining priorities, allocating resources, and making strategic decisions that impact household members' welfare and means of subsistence. Based on their assessment of the advantages, hazards, and compatibility with the objectives and priorities of their households, rice processors may have a say in whether technologies are adopted, including FBL technology.

Majority (74.7%) of the rice processors had 1-10 years of rice processing experience and the mean rice processing experience was 9 years. This suggests that most of the rice processors had substantial years of experience in rice processing enterprise. This could affect their adoption of FBL technology as newer rice processors are less likely to be familiar with the technology and hence, may be observing the outcome of the technology among the more experienced rice processors. This aligns with the position of Rogers (2003) who stated that unlike novices or experts, people with moderate experience in a certain field are frequently more open to implementing new technology. When faced with difficulties or inefficiencies, rice processors with over a decade of experience may have gained a firm grasp of conventional processing techniques and been inspired to look for alternate options, like FBL technology, to enhance their procedures. With a mean experience of 9 years, rice processors have gained practical knowledge, skills, and insights into rice processing techniques, equipment operation, and quality control measures through their cumulative experience (Mohan, 2019). It is also possible that the rice processors, with their experience, exhibit a balance between established routines and openness to innovation (Adegbola *et al.*, 2018).

While 40.0% of the rice processors individually owned their rice processing business, 26.3% and 33.7% of the rice processors indicated that their rice processing enterprises were jointly owned by friends and family members, and cooperatives respectively. This reflects the diverse organizational arrangements and collaborative partnerships prevalent within the rice processing sector in Ogun State, Nigeria. According to Adegbola *et al.* (2018) and Ogunlela *et al.* (2020), individual rice processors have complete autonomy and control over how resources are allocated, decisions are made, and how their enterprises are run. Unlike in individual ownership, joint ownership of rice processing enterprise - either in cooperatives or with family and friends, decision-making on technology adoption may not be an easy task as the views of everyone who has a stake in the business must be considered before any tangible decision can be made (FAO, 2006; Doss, 2006). This is likely to slow down the adoption process of the FBL technology.

It was shown in Table 1 that 41.1% of the rice processors were also into trading while 22.1% had no other occupation apart from rice processing. This suggests that most of the rice processors engaged in

different income generating activities as a means of survival, and this aligns with Abubakar *et al.* (2023) and Hassan (2018) who in their different research established that reasonable proportion of sampled small-scale rice processors engaged in income diversification activities as minor occupation. The noteworthy percentage of rice processors who trade suggests that they incorporate several revenue-producing endeavours into their portfolios of livelihoods (Barrett *et al.*, 2001). Trading activities might involve using the networks, knowledge, and market access gained via rice processing operations to buy and sell rice products, raw materials, or other things in nearby markets or overseas. Rice processors can reduce income volatility, take advantage of market opportunities, and strengthen their overall financial resilience by diversifying into trading. On the other hand, a significant portion of rice processors dedicate their entire workday to rice processing. This area of expertise demonstrates their dedication to becoming experts in and optimising rice processing methods, tools, and value-added product offerings (Ogunlela *et al.*, 2020). Specialising in processing, rice processors can gain from economies of scale, technical know-how, and positive brand recognition in the rice industry, establishing them as important participants in the regional agricultural value chain. Majority (81.1%) of the sampled rice processors were members of associations and 62.1% earned an estimated income of $\leq$ N200,000 with mean annual income of about N236000. This implies that the monthly income of the rice processors is less than the minimum wage of civil servants, and suggests that rice processors are among the low-income earning categories in Nigeria. This contradicts the findings of Adam *et al.* (2018) and Ouma *et al.* (2020) who reported that most of the rice processors in Kebbi and Sokoto States respectively earned higher income than the civil servants. The discrepancy could be linked to the fact that rice processing is more common in northern parts of the country.

Level of adoption of FBL by rice processors

Results on levels of adoption of FBL among the sampled rice processors are presented in Figure 1. Findings reveal that majority (74.7%) of the rice processors had high level of adoption of false bottom and lid technology while 20.0% had low level of adoption of the technology. This implies that the technology had been adopted by most of the sampled rice processors, and suggests that the technology is in use by rice processors in Ogun State. This finding agrees with the report of Omoare and Oyediran (2017) that there was a high adoption of improved parboiling techniques using false bottom technology among rice farmers in both Ogun and Niger States. Abubakar *et al.* (2023) and Kosheri (2016), however, reported moderate level of adoption of FBL among rice processors in Niger State.

The high adoption rate of FBL technology among rice processors suggests the presence of favorable factors

facilitating technology uptake and utilization. It could also be attributed to rice processors' educational attainment, and youthful age and awareness of the technology. Figure 2 shows that the highest proportion (46.3%) of the rice processors had adopted chaff and jute bags, 31.6% adopted the iron type while the perforated stainless tray was adopted by 22.1% of the sampled rice processors. This implies that the different FBL types had been adopted by different rice processors. The choice of the type could be influenced by several indicators such as availability, ease of use, and cost among other variables.

Factors influencing rice processors' adoption of FBL technology

As shown in Table 2, the mean values ranged from 1.21 to 1.86 indicating that all the listed variables were factors that influenced rice processors' adoption of FBL technology. The observability of the technology ($\bar{x} = 1.86$) ranked first among the listed variables. This was followed by relative advantage ($\bar{x} = 1.50$), compatibility ($\bar{x} = 1.36$), trialability ($\bar{x} = 1.25$) and complexity ($\bar{x} = 1.21$) of the technology. This implies that the rice processors adopted the FBL technology because it was observable, had relative advantage, is compatible with existing practice, can be tried, and is simple. These findings are consistent with the theoretical framework of technology adoption and diffusion, as proposed by Rogers' Diffusion of Innovations theory (Rogers, 2003). Studies indicate that innovations viewed as providing notable benefits, such as enhanced productivity, better product quality, and lower costs, have a higher chance of being embraced by users (Lee, 2019). Rice processors are more likely to accept and incorporate FBL technology into their operations if they see the potential benefits in improving parboiling procedures and product outputs.

The findings also indicated that FBL technology was relatively simple to use, probably because according to Olawoye and Garba (2018), it aligns with familiar processing practices and equipment already used by rice processors. It also suggests that FBL is compatible with existing norms, values, and infrastructure. This is in tandem with Lee (2019) who observed that rice processors can implement FBL technology without having to make major investments in new equipment or drastically alter their current processing processes because it may work with conventional parboiling techniques. Ascertaining that trialability is a factor influencing the adoption of FBL could be attributed to the fact that the rice processors were first exposed to training sessions and allowed to trial the technology bit by bit before deciding to adopt. This corroborates the position of Olawoye and Garba (2018) that pilot projects, demonstrations, and hands-on training sessions may facilitate trialability and encourage rice processors to experience the benefits of FBL technology firsthand.

Level of use of FBL among rice processors

Table 3 shows that 63.2% of the rice processors were at renewal level of use while 17.9% and 11.6% were at preparation and integration levels of use respectively. The Level of Use (LoU) index, a widely used methodology for evaluating the breadth and depth of technology utilisation within a particular environment, can be applied to evaluate these findings (Hall *et al.*, 1973). The results show that the majority of rice processors were using False Bottom and Lid (FBL) technology at the renewal level, indicating a high level of familiarity and regular use of the technology in their processing processes. At this point, rice processors have completely incorporated FBL technology into their workflows, exhibiting a reliable and skilled application of the technology to attain the intended results, including increased product quality and parboiling efficiency. Users at the renewal stage are probably very happy with FBL technology and might actively look for ways to get the most of it by experimenting, learning new things all the time, and adapting to how processing conditions change (Hall *et al.*, 1973).

Constraints to the use of FBL

Results on the constraints to the use of FBL technology are presented in Table 4. It reveals that the highest proportions of the rice processors considered that the technology is expensive (98.9%), unstable market price of rice (73.3%), insufficient funds to procure the technology (84.2%), limited access to credit (58.9%), unavailability of the technology (53.7%), and limited after-training advisory services (58.9%) were major constraints to the use of false bottom and lid technology. The mean values indicated that the expensive nature of the technology ($\bar{x} = 1.99$) was the most severe constraint to the use of FBL. This was followed by insufficient funds ($\bar{x} = 1.82$), unstable market price of rice ($\bar{x} = 1.64$), limited access to credit ($\bar{x} = 1.58$), unavailability of the technology (1.42), and limited after-training advisory services ($\bar{x} = 1.40$). On the other hand, small farmland and uneasy to use the technology were not considered as constraints to use of FBL technology.

The findings reflect that the use of FBL technology was chiefly constrained by financial burdens because high upfront costs, maintenance expenses, and operational investments may deter rice processors, particularly those with limited financial resources, from adopting FBL technology despite its potential benefits (Kivunike *et al.*, 2017). Rice processors may find it difficult to finance the costs of acquiring, installing, and running FBL equipment due to a lack of funding and restricted access to credit facilities (Olawoye & Garba, 2018). Unstable market price is another constraint limiting the use of the FBL technology despite its potential benefits. The profitability and sustainability of rice processing businesses can be impacted by changes in market pricing, which can also have an impact on the ability of rice processors to recover expenditures in

technology adoption and operating costs (Kivunike *et al.*, 2017).

The results also point to the necessity of continuous assistance and capacity-building programmes to maintain rice processors' adoption and use of new technologies. According to Kariuki *et al.* (2018), rice processors can enhance their proficiency in using FBL technology by attending training programmes. However, to effectively tackle operational challenges, optimize technology performance, and promote continuous learning and improvement, rice processors require continuous advisory services, technical assistance, and troubleshooting support. This result might suggest that the technology is reasonably accessible or that market activities, government interventions, extension programmes, or other means have previously addressed the availability and awareness of FBL technology to some degree (Olawoye & Garba, 2018). The study also suggested that small farmlands and difficulty in use of the FBL technology were not significantly impeding FBL technology adoption among the rice processors in Ogun State. This, according to Kivunike *et al.* (2017), may imply that rice processors have adapted their processing practices to accommodate the requirements of FBL technology, or they may prioritize other constraints such as financial viability and market access over factors related to land size and technology usability.

Conclusion and Recommendations

The study concludes that the trained rice processors in Ogun State had bottom different variants of the False Bottom and Lid (FBL) technology, and that they regularly use the technology for improved rice parboiling. The adoption of the technology was because it has comparative advantage over the conventional parboiling method, it is compatible with current practice, it is easy, observable and can be tried by the rice processors. Based on the findings from this research, it is suggested that the technology should be scaled up to other rice processors in Ogun State. The scaling up could include raising awareness and organizing training sessions on the FBL technology. Extension service providers should prioritize improving financial literacy, encouraging saving and investing habits, and expanding access to micro-finance institutions or agricultural credit programmes designed with rice processors' requirements in mind in order to solve the financial restrictions. In order to reduce the high cost of the technology and increase rice processors' access to it, cost-sharing arrangements, subsidized financing options, and incentive programmes should be considered.

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Table 1: Distribution of rice processors by socio-economic characteristics (n = 95)

Socio-economic variables	Frequency	Percentage	Mean±stdev
Age (years)			
21-30	9	9.5	39±8
31-40	42	44.2	
41-50	31	32.6	
51-60	13	13.7	
Sex			
Male	35	36.8	
Female	60	63.2	
Educational level			
No formal education	20	21.1	
Adult education	1	1.1	
Primary education	22	23.2	
Secondary education	33	34.7	
Tertiary education	19	20.0	
Marital status			
Single	8	8.4	
Married	78	82.1	
Divorced	2	2.1	
Widowed	7	7.4	
Household size (persons)			
1-3	10	10.5	6±2
4-6	57	60.0	
7-9	23	24.2	
>9	5	5.3	
Position in rice processing household			
Head	40	42.1	
Spouse	50	52.6	
Other members (e.g. children, relatives)	5	5.3	
Rice processing experience (years)			
1-10	71	74.7	9±5
11-20	20	21.1	
>20	4	4.2	
Ownership pattern			
Individual	38	40.0	
Joint (family and friends)	25	26.3	
Cooperative	32	33.7	
Other occupations			
Civil service	7	7.4	
Artisan	15	15.8	
Business	2	2.1	
Farming	11	11.6	
Trading	39	41.1	
None	21	22.1	
Membership of associations			
Members	77	81.1	
Non-members	18	18.9	
Income from rice processing (N/annum)			235752.69±161
≤200000	59	62.1	788.48
200001 - 400000	26	27.4	
400001 - 600000	5	5.3	
600001 - 800000	5	5.3	

Table 2: Distribution of rice processors by factors influencing adoption of FBL technology (n = 95)

Factors	Mean	Ranking
Relative advantage of the technology	1.50	2 nd
Compatibility of the technology	1.36	3 rd
Complexity of the technology	1.21	5 th
Trialability of the technology	1.25	4 th
Observability of the technology	1.86	1 st

Table 3: Level of use of FBL among rice processors

Level of use	Frequency	Percentage
Non-use	1	1.1
Orientation	0	0.0
Preparation	17	17.9
Mechanical use	2	2.1
Routine	3	3.2
Refinement	1	1.1
Integration	11	11.6
Renewal	60	63.2

Table 4: Distribution of rice processors by constraints to use of FBL

Constraints	Major constraints	Minor constraints	Not constraint	a mean	Rank
The technology is expensive	94 (98.9)	1 (1.1)	0 (0.0)	1.99	1 st
Unstable market price of rice	70 (73.3)	16 (16.8)	9 (9.5)	1.64	3 rd
Insufficient funds to procure the technology	80 (84.2)	13 (13.7)	2 (2.1)	1.82	2 nd
Limited access to credit	56 (58.9)	38 (40.0)	1 (1.1)	1.58	4 th
Relatively small farmland	26 (27.4)	27 (28.4)	42 (44.2)	0.83	7 th
Unavailability of the technology	51 (53.7)	33 (34.7)	11 (11.6)	1.42	5 th
It is not easy to use	19 (20.0)	40 (42.1)	36 (37.9)	0.82	8 th
Limited after-training advisory services	56 (58.9)	21 (22.1)	18 (18.9)	1.40	6 th

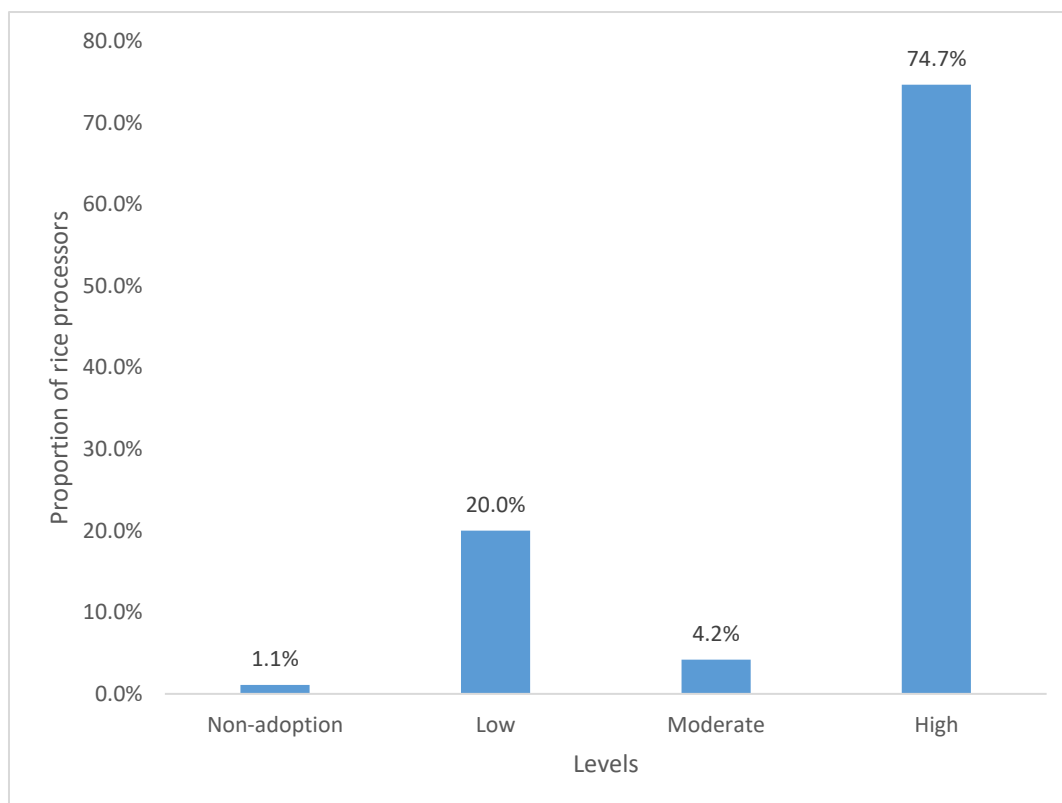


Figure 1: Distribution of rice processors by level of adoption of FBL

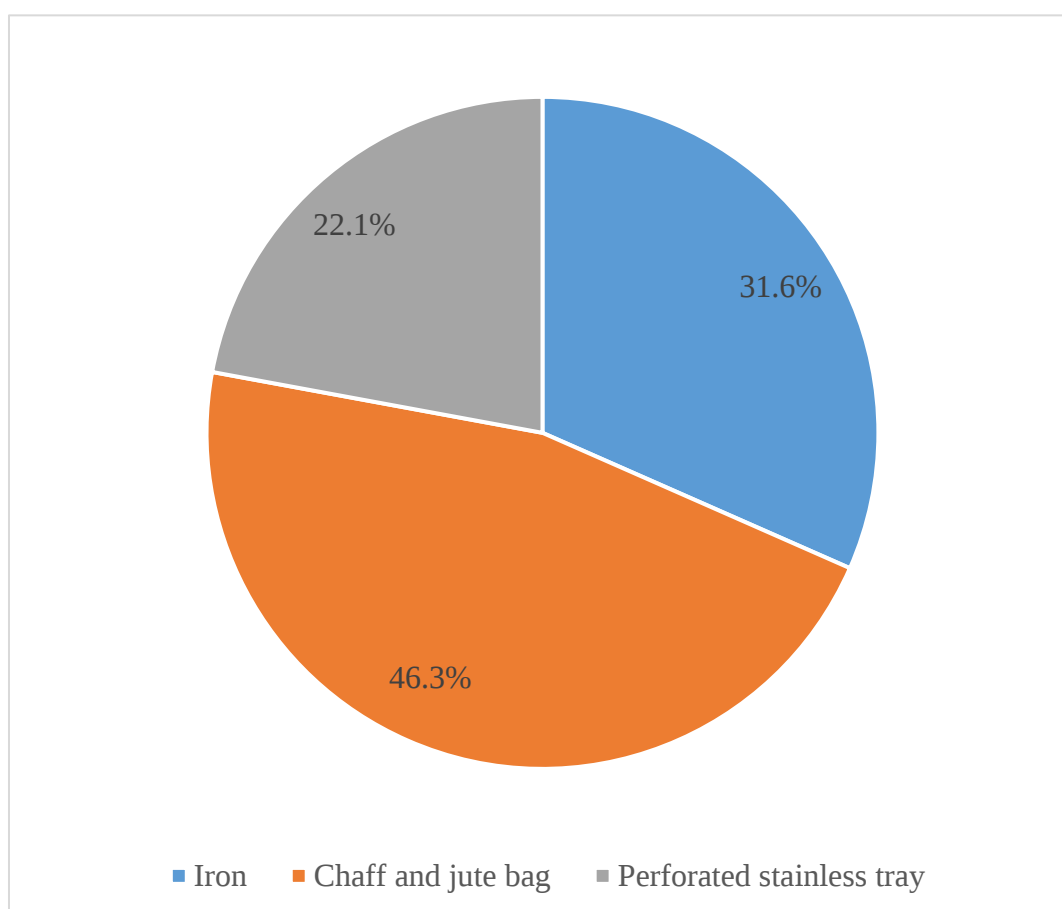


Figure 2: Distribution of rice processors by types of FBL technologies adopted