ADOPTION OF MODERN POST HARVEST RICE HANDLING TECHNOLOGIES IN EKITI STATE, NIGERIA

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ABSTRACT— The study assessed the Adoption of Modern Post Harvest Rice Handling Technologies in Ekiti State, Nigeria. Multistage sampling techniques were used to select 130 rice farmer-processors. Primary data on usage of modern post harvest rice technologies, level of adoption and perceived factors influencing adoption of modern technologies were obtained using a questionnaire and focus group discussion (FGD). Data were analyzed using frequency counts, mean and sigma score (Z). Modern post harvest rice handling technologies available were combine harvester, blower, parboiler using false bottom, batch dryer, de-stoning machine, modern rice miller and rice grader. Sigma scores showed that parboiler using false bottom (Z = 5.36), Modern rice miller (Z = 5.36), de-stoning machine (Z = 5.15) and blower (Z = 5.06) were the major modern postharvest rice technologies. These technologies removed drudgery experienced in the traditional methods of processing ($\bar{x}$= 4.44), improved income ($\bar{x}$= 4.24), has relative advantage ($\bar{x}$= 4.10) and not complex ($\bar{x}$= 3.01). FGD with one of the respondents established that "*using modern postharvest rice handling technologies produce quality rice*". The study concluded that there is adoption of modern post harvest technologies among rice farmer-processors and recommends that key factors that determine adoption needs to be taken into consideration when expanded program on technology adoption are to be considered for meeting the challenges of food production.

KEYWORDS: Level of adoption, Rice, Factors of innovation and Rice processing technologies.

1. INTRODUCTION

Rice is a major commodity in the world trade and a strategic commodity in the Nigerian economy. It is the main source of carbohydrates and its production and consumption is growing faster than other staples food. Rice production and consumption are of global importance, providing more than 20% of caloric needs of millions of people on daily basis [5]. This denotes that if rice is placed on a social scale with other staple crops like maize, yam, wheat, sorghum, millet, cowpea, cassava, potatoes and cocoyam, it can be ranked first because it has become a structural component of most households diet both in rural and urban areas in Nigeria.

The major rice type grown in Nigeria is the Asian rice (*Oryza sativa*). The prevalent types of rice production systems in Nigeria include Rainfed upland, Rainfed lowland, irrigated lowland, deep water floating and mangrove swamp [8], [9]. However, the major rice type grown in Ekiti State is the Rainfed Upland Rice and Rain fed Lowland rice. Upland rice is grown on free-draining soils where the water table is permanently below the roots of the rice plant although; the crop depends entirely on rainfall. Heavy rainfall has been identified as one of the constraint faced by the farmers in the study area as this leads to erosion, flooding, leaching of plant

nutrients and reduced the yield when the phenomena occurs. Rain fed lowland rice also known as *Akuro* in Ekiti native language are grown in aquatic conditions or medium ground water table, Water covers the soil completely at some stage during the cropping season this explains why it does not require herbicides, weeding, insecticides, or fertilizers.

The estimated consumption of rice in Nigeria in 2016 was 8 million MTS and local production was only 6 million MTS, the deficiency of 2 million MTS is a huge market for rice processors [11]. Although there was a vast increase in rice production in 2017 to meet the deficiency for 2016, but was not sufficient to meet the consumption rate due to increase in current population growth in Nigeria. The demand and supply gap in rice production has been widening, resulting in huge import bill [8], [6]. This deficiency can be overcome with the adoption of modern post harvest rice technologies that are provided are used effectively by rice farmers across each state to increase rice production in Nigeria.

Post harvest rice handling is a hierarchical operation that rice must pass through starting from the period of harvest till consumption. Postharvest rice handling must be efficiently carried out to reduce rice importation, improve its quality and double farmers yield in order to feed the teaming population and enhance food security. All these are very important for national economic growth and development. Swastika (2012) reported that three groups of factors that determine the characteristics of rice quality to be: (1) genetic control (variety), (2) environmental conditions (cultural practices), and (3) post harvest and processing techniques. This study was conducted to assess the adoption of modern post harvest rice handling technologies in Ekiti State, Nigeria. The specific objectives were to:

1.   describe the usage of modern post harvest rice handling technologies among respondent in the study area
2.   determine the level of adoption of modern post harvest rice handling among the respondents in the study area
3.   Ascertain the perceived factors influencing respondents decision to adopt modern post harvest rice handling technologies in the study area

2. Methodology

The study was carried out in Ekiti State in Southwestern Nigeria between the months of April 2019 to February 2019 to capture the cultivation of rain fed upland and lowland rice in Ekiti State. The list of four registered rice mills was collected from Agricultural development project office and Federal ministry of Agriculture and Rural development in Ekiti State. The interview schedule was carried out after modern post harvest rice handling technologies have been introduced to rice farmers to address the quality issues in rice. The various technologies includes combine harvester with ripper, thresher, winnower, parboiling with steaming using false bottom and dryer. The populations of the study consist of rice farmer- processors in Ekiti State. Rice farmer-processors in Ekiti state are farmer that cultivate and process harvested rice. These are farmer that have a progressive attitudes toward farming and would therefore accept innovations that will increase their income and in turns help to boost rice production in the country.

Two stage sampling procedure was used to select the respondents. At the first stage, purposive sampling technique was use to select four out of the five registered rice mill in Ekiti State, this was due to the availability of modern rice technologies. The second stage involved a simple random sampling approach to select 30 rice farmer-processors out of the total population of rice farmer-processors contacted who uses the rice mills while 40 rice farmer-processors was selected from Dioceses of Ekiti west rice mill in order to give a representative that they deal mainly with farmer-processors.

Level of adoption of modern post harvest rice handling among the respondents in the study area was obtained using sigma scoring method as suggested by [10] and used by [7], [2] on the eight technologies.

Factors influencing adoption of modern post harvest rice handling technologies was measured using five attributes of the innovation which are: (1) relative advantage, (2) compatibility, (3) complexity, (4) trialability, and (5) observability as develop by Rogers 2003. Compatibility was measured using perceived compatibility index of yes=1 and No=0.while perceived relative advantage, perceived complexity, perceived trialability, perceived observability was measured by adopting a 5-points Likert typed rating scale using the following indices: 1 = strongly disagree, 2 = disagree, 3 = undecided, 4 = agree and 5 = strongly agree as used by kwandwo et al., (2018). This was modified for the study.

3. Results and Discussion

3.1 Usage of Modern Post Harvest Rice Handling Technologies
As shown in Figure 1, forty two (42.0%) of the respondents used more than 4 technologies out of the listed 8 modern post harvest rice handling technologies frequently. people in this category
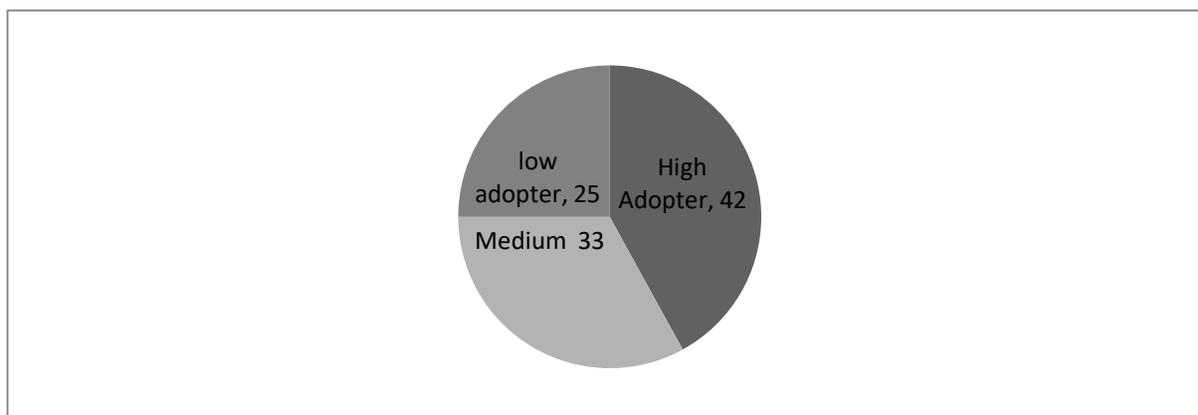

Figure 1: usage of Modern Post Harvest Rice Handling Technologies

make use of the technologies because of the important feature of rice (properties such as the grain size, general appearance, colour and shapes) which is to improved rice quality such that it will meet industrial standard. This will reduce importation of rice and double farmer's yields. 33.0% uses between 2-4 technologies and people in this category are referred to as medium adopter while only 25.0% uses less than two of the technologies and are regarded to as low adopter. The implication of the studies implies that there is still room for improvement to full adoption of the technologies among respondents in the area.

3.2 Level of Adoption of Modern Post Harvest Rice Technologies
The level of adoption of improved rice processing technologies among the respondents as revealed in table 1 shows that high level of the usage of modern post harvest rice handling was recorded for Parboiler using false bottom and modern rice miller Sigma score (Z) is (5.36), Destonner machine (Z = 5.15) and blower (Z = 5.06). These results could be attributed to the high level of awareness on these technologies which is directly proportion to the quality of rice produced. Invariably, awareness precedes adoption of a particular technology. Awareness of agricultural technology is very important since it stimulate farmers' interest in new ideas and practice. There was low usage recorded for the following technologies combined harvester with rippers (Z= 0.0073), Thresher (Z = 0.34), batch dryer (Z = 3.60) and Rice Grader (Z = 2.69) among rice farmer-processors in Ekiti state. These technologies was not adopted due to scarcity/non availability of the technology, faulty

technology at the time of data collection and other constraining socioeconomic variables.

Table 1: Level of adoption of rice modern post harvest technologies (n=130)

Post harvest rice Technologies	Frequency (Yes)	Percentage (%)	Sigma
Combined harvester and rippers	5	3.8	0.01
Thresher	3	2.3	0.34
Blower	123	94.6	5.06
Par boiler using false Bottom	130	100.0	5.36
Batch Dryer	89	68.5	3.60
Modern rice milling	130	100.0	5.36
De-stoning machine	125	96.2	5.15
Rice Grader	68	52.3	2.69

Two approaches are common in the agricultural technology adoption literature. The first approach lay emphasizes on the adoption of the whole technologies introduced to farmers while the second one rest on the sequential adoption of components of the technologies introduced which is the case of rice farmer- processors in the study area. Reasons could be associated with this are based on the profitability, uncertainty, limited cash among others. Farmers make rational decisions taking into account the environment under which they operate. It can thus be inferred that the adoption potentials of the respondents can generally be enhanced if those limitations are accordingly addressed by the various stakeholders through the establishment of effective linkage system and collaboration of the major stakeholders towards appropriate technology development at affordable price which must be made available across each local governments so that rice farmer processors can have access to all the technologies.

This finding is in line with the report of Abubakar (2017) who stated that creating awareness on new research findings and technologies in agriculture to rural farmers remain a promising strategy for increasing agricultural production. Supportively, [3], [2], reported that adequate information is one of the major prerequisite for widespread acceptance of agricultural innovations. This finding is in line with [4] who also reported high adoption level for improved technologies in Abia State as a result of farmers' awareness that the technologies increase yields and minimize loses.

3.3 Perceived Factors influencing the choice of adoption of modern post harvest rice handling technologies (MPHT)

Perceived factors influencing the adoption of MPHT in the study area key variable used were relative advantage, compatibility, complexity, trialability and observability as develop by Rogers (2003).

Table 2 revealed that the respondent agreed that the technologies introduced were compatible with their belief, the technology is unaffordable and the technology is a digression from the traditional technologies with a frequency of (93.1%, 91.5% and 86.9% respectively while the use of rice technologies does not worth using for small scale rice production.

Table 2: Compatibility Index Adoption of Modern Post Harvest Rice Handling Technologies (n=130)

Technology related factor	Frequency	Percentage (%)
Compatibility		
Is the technology compatible with the existing technology	36	27
Is the technology compatible with your belief	121	93.1
Will the use of the technologies add to your prestige and respect in your community	30	23.1

Is the technology a digression from the traditional technologies	113	86.9
The technology is unaffordable	119	91.5
The technology does not worth using for small scale rice production	2	1.5

However in Table 3, the variables under the relative advantage were all relevant except that the technology is expensive as compared to traditional methods with mean score point of 1.42. This implies that most of the respondents in the study area adopted the MPHT due to its relative advantages. Under the complexity, most of the respondents adopted the MPHT due to the fact that the technologies is easy to learn and understand as well as it is easy to operate with mean score point of 3.70 and 3.39 respectively.

Table 3: Perceived factors influencing adoption of modern post harvest technologies in Ekiti State (n=130)

Technology related factor	SA	A	U	D	SD	Total	Mean $\bar{x}$	Grand mean
Relative advantage								
Modern post harvest technologies provides quality rice	445	152	6	0	1	604	4.65	4.10
The used of modern post harvest technologies increase my income	205	308	30	2	1	546	4.20	
Used of modern post harvest technologies saves my time	475	136	0	2	0	613	4.72	
The technology remove drudgery that is experienced in the traditional methods	295	280	0	2	0	577	4.44	
The technology is expensive as compared to traditional methods	15	4	0	80	86	185	1.42	
It can enhance our rice production reputation	540	72	60	0	1	673	5.18	
Complexity								
The technologies is easy to learn and understand	110	220	147	0	4	481	3.70	3.01
Most of the technology is easy to operate	140	24	270	0	6	440	3.39	
Modern post harvest rice technology requires more energy than using traditional technology	35	4	87	58	64	248	1.91	
Triability of the technology								
Using of modern post harvest rice technology is accessible	15	40	0	152	41	248	1.91	2.65
Using of modern post harvest rice technology is affordable	40	108	12	104	39	303	2.32	
Modern post harvest rice technology is scarce	315	120	0	18	28	481	3.70	
Some of the technology can be replicated in our homes	15	96	111	118	7	347	2.67	
Observability								
The technology improve my income	190	352	6	2	1	551	4.24	3.21
Adoption of the technologies will lead to better income	225	332	6	0	0	563	4.33	
The technology waste so much rice	0	0	0	14	123	137	1.05	

**Keyword: SA, A, U, D and SD represents Strongly Agree, Agree, Undecided, Disagree and Strongly Disagree respectively

Under the trialability class, only one variable which stated that MPHT is scarce was more relevant while other variables were less relevant. Hence, rice processors can group themselves or be grouped into cooperatives so that they can pool their resources and attract government attention. Lastly, it was observed that under the observability class that two variables out of the three variables were more relevant while the remaining one was less relevant.

An Understanding of the factors that influence adoption of agricultural technology is paramount during planning and executing technology related programmes for meeting the challenges of food production. Hence, MPHT introduced to rice farmers in the study area were compatible, have relative advantage, can be easily

operate and not complex, which are the determinant factors influencing the adoption of such technologies. This is are consistent with characteristics of a good innovation as evident in the literature

[1]. During the focus group discussion, one male farmer said:
"*Using modern post harvest technologies* are easy to practice and give good quality rice products"
This was also supported during KII where one rice miller said:
"They require less labour and they are faster than the traditional method of processing"

4. Conclusion and Recommendation
High level of the usage of modern post harvest rice handling was recorded for parboiler using false bottom and modern rice miller (sigma score = 5.36), destonner machine (sigma score = 5.15) and blower (sigma score = 5.06). Also, MPHT introduced to rice farmers in the study area were compatible, have relative advantage, can be easily operate and not complex. The study recommends that:

I.   The key factors that determine adoption need to be taken into consideration when expanded program on technology adoption is to be considered for meeting the challenges of food production.
II.   There should be establishment of effective linkage system and collaboration of the major stakeholders towards development of appropriate technologies. This must be made available across each local government so that rice farmer processor can have access to all the technologies at all times.
III.   Interventions by governmental, non governmental organization and relevant agencies must be flexible enough to accommodate the diversity and be able to produce sustainable response to promotional efforts.

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