Journal of Agricultural Extension
Vol. 29 (1) January 2025
ISSN(e): 24086851; ISSN(Print): 1119944X
Website: https://www.journal.aesonnigeria.org; https://www.ajol.info/index.php/jae
Email: editorinchief@aesonnigeria.org; agricultural.extension.nigeria@gmail.com

Technological Capabilities of Rice Processors in Enugu State, Nigeria

https://dx.doi.org/10.4314/jae.v29i1.4

Nwobodo, Cynthia Ebere
Department of Agricultural Extension,
University of Nigeria, Nsukka
cynthia.nwobodo@unn.edu.ng
+234 8039462574
https://orcid.org/0000-0003-0223-1032

Dimelu, Mabel Ukamaka
Department of Agricultural Extension,
University of Nigeria, Nsukka
mabel.dimelu@unn.edu.ng
+234 8185631828
https://orcid.org/0000-0003-2073-1436

Innih, Celestina Dupe
(Corresponding Author)
Kogi State Fadama Office
Opposite Federal Medical Centre
Lokoja, Kogi State
celestinainnih@gmail.com,
+234 7037073530
https://orcid.org/0000-0002-3385-5086

Chah, Jane Mbolle
Department of Agricultural Extension,
University of Nigeria, Nsukka
jane.chah@unn.edu.ng, +234 8032420600
https://orcid.org/000-0002-6842-0955

Submitted: 29 June, 2024
First Request for Revision: 13 July, 2024
Revisions: 20 July 2024, 5 August 2024 19 August 2024, .30 September 2024, 5 November 2024
Accepted: 6 November, 2024
Published: 30 January 2025
Cite as: Nwobodo, C. E., Innih, C. D., Dimelu, M.U and Chah, J. M. (2024). Technological capabilities of rice processors in Enugu State, Nigeria . *Journal of Agricultural Extension* 29 (1) 26-36
Conflict of interest: The authors hereby declare that there is no conflict of interest
Keywords: Domestic rice processing capability, parboilers and millers
Acknowledgments: The authors wish to express their appreciation for the assistance of the enumerators who collected data for the study.
Funding: This research received no specific grant from funding agencies in the public, commercial, or not-for-profit sectors.
Authors' contributions: NCE: Conception/design, development of data collection instrument, analysis, interpretation of data, revised manuscript (40%)
ICD: Conception/design, data collection, interpretation of data, and first draft (30%)
DMU: Conception/design, Interpretation of data, and revised manuscript (20%)
CJM: revised manuscript (10%)

Abstract
The study assessed the technological capability of rice processors in Enugu State, Nigeria. Multi-stage sampling procedure was used in selecting 120 respondents across two town communities in two local governments of agricultural zones. Frequencies and percentages were used to analyze the data collected. Findings showed that 88.3% of parboilers were aware of maintaining hygienic conditions and 58.3% practice. While 100.0% knew that they should wash/dewater paddy till wash water is colourless, only 33.3% practised. The majority (80.0%)of millers were aware that operational cost is reduced by ensuring that paddy is at 1%impurity rate but only 20.0% practised. Only 15% of millers owned de-stoning machines and offered the service. A minority (31.7%) of millers package milled rice while only 1.7% practised size sorting, buffering, and polishing of milled rice. This implied that rice processing in Enugu State is still at the basic

processing level of parboiling, drying, milling, and bagging; revealing the need for training and capacity building on value-addition processing such as de-stoning, size sorting, polishing, and buffering which will place domestic rice at par with foreign rice. The reason for the high disparity between awareness and practice is a gap for extension workers to explore and address.

Introduction

The world's population is increasing rapidly causing demand for food to rise. About three billion people, accounting for nearly half the world's population depend on rice for survival (Singathala et. al, 2023). Rice is therefore very important to the teeming population. According to OECD/FAO (2021), rice is a major staple food in Asia, the Caribbean, and Latin America, and is becoming rapidly acceptable in Africa. In Nigeria, rice is one of the most consumed staples with consumption per capita of 32kg per annum (USDA/GAIN, 2023). Consumption of rice is estimated to be rising at 5-10% annually and is expected to reach 20 million metric tons between 2020 and 2030 (FMARD, 2020). Consumers' preference for rice is attributed to factors such as changes in family occupational structure, where more women now have to work outside the home, and ease of preparation (Onoja et. al, 2024).

Nigerian consumers will choose a certain variety of domestic rice such as Ofada and Igbemo over imported rice because of their taste and peculiar aroma (Onuwa & Dalla, 2023; Okoro et. al, 2023). However, the poor processing quality of domestic rice is such that the majority of urban consumers still prefer imported rice, because imported rice is homogenous and as such cooks fast, is free of debris, and has a pleasant aroma. The quality of domestic rice in Enugu State and across the country, in terms of the organoleptic properties such as volume of broken grains, the level of contaminants, colour of grains or post-processing odours and taste vary and is below consumer acceptable standards, particularly urban consumers. Largely, the technological capability that exists in the system accounts for the difference in quality. Thus, paddy processing into milled rice is critical in obtaining quality rice which, given ample attention will complement the efforts of the Nigerian government to achieve self-sufficiency in rice production and reduce rice importation to a minimum level.

Capabilities are transferable knowledge, skills, and abilities relevant to a role. Capability is realized through the interaction of a person taking on a role to carry out specific process activities using appropriate technology (Beverley et.al, 2024). Technological capability (TC) involves technical attempts to master new technologies, make them suitable to local conditions, and then enhance and exploit them (Sony et.al, 2022). therefore, processing capability refers to the skill of rice processors about their knowledge and experience as well as improvements made in response to innovative adoptions and entails carrying out a certain number of routinized activities. Processing capability includes workflow planning and monitoring, manufacture of components, sub-assembly and assembly of components and final goods stretching, control and maintenance of machinery and equipment, inventory control, productivity, and quality control, efficiency enhancement in task execution, improvement and cost savings in machinery and equipment, inverse engineering and development of machinery.

Purpose of the study

The general purpose of the study was to assess the technological capability of processors in the rice value chain in Enugu State, Nigeria. Specifically, the study sought to: ascertain rice processors' awareness and practice of standard parboiling and milling tasks; assess value-addition practices of rice processors; and make recommendations based on the findings of the study.

Methodology

The study was conducted in Enugu State, Nigeria located between 060 210 N and 060 300 N latitude and between 070 260 E and 070 370 E longitude, (NBS, 2021). It has a population of 4.8 million people, with a total land area of 7,161sq kilometres (Enugu State Investment Guide, 2022; Enugu Investment Brochure, 2023). The state has 17 local government areas. The population for the study consisted of all parboilers and all millers of rice in Enugu State. A multistage sampling technique was used in selecting the respondents for the study. At the first stage, two agricultural zones namely Nsukka and Awgu were purposively selected out of the six agricultural zones because the zones are the hub of rice production and processing in the state. In the second stage, Uzo-Uwani, (Nsukka) and Aniri (Awgu) LGAs were selected purposively given the intensity and age-longed history in rice production. Thirdly, one community namely Adani and Oduma was purposively selected from each LGAs, Uzo-Uwani and Aninri, respectively. This is based on the high concentration of rice cultivation and processing in these communities.

At the community stage, five rice milling clusters each with a relatively large number of parboilers and milling facilities were purposively selected from Adani and Oduma communities giving a total of 10 rice milling clusters. Six parboilers and six millers were selected using on-the-spot techniques from each of the 10 rice milling clusters giving a total of 60 parboilers and 60 millers giving a total of 120 respondents. The data collected were analyzed using frequencies and percentages.

Result and Discussion

Parboilers' awareness and practice of standard parboiling tasks

Table 1 shows that the majority (88.3%) of respondents were aware of maintaining hygienic conditions and 58.3% of them observed hygienic conditions. However, a substantial (41.7%) proportion did not. Which implied that a good size of parboilers is not committed to addressing the problem of impurities especially stones often found in domestic rice. Entries from Table 1 show that the majority (88.3%) of the respondents were aware of the preferred choice of paddy. However, only 45.0% were committed to purchasing the preferred choice of paddy others purchased whatever species of paddy that was available; Table 1 shows that 90.0% of the respondents were aware of winnowing and sorting paddy, while 68.3% observed the practice. According to the respondents, the practice is that when traders buy paddy, winnowing is given on contract to specialized operators who winnow paddy in open space along the direction of the wind. Often, the contrary wind blows chaff back to clean paddy. However, whatever chaff is left from winnowing is sieved out when parboilers wash paddy in preparation for parboiling. At this stage, brown rice, small-diameter stones, etc are equally eliminated by parboilers

who pay attention to doing so. Table 1 also shows that all (100%) of the respondents were aware of the practice of washing and dewatering paddy till water is colourless before parboiling. However, only a small proportion (11.7%) observed the practice. While some parboilers who did not observe the practice blamed it on insufficient water, the majority did not see the need nor have the patience to wash and dewater paddy till the water was colourless. The result implies that the milled rice produced is not rid of dirt including dust and other impurities.

Entries in Table 1 further show that all (100.0%) of the parboilers were aware and soaked paddy in hot water. As described by the respondents soaking entailed turning washed paddy into the cooking cauldron, pouring in water to submerge the paddy, heat is applied till bubbles appeared in the water and slight vapour at the surface. After heat (burning logs of wood) is removed, the paddy is left to soak in boiled water till the paddy husk slightly cracks open. The paddy is then drained and parboiled in small quantities in pots. The respondents employed a similar method of parboiling on different varieties of rice. According to Muchlisyiyah et al (2023), different parboiling techniques (timing of parboiling and moisture content of paddy) produce rice with varied physical qualities. Therefore, parboilers need to learn appropriate techniques suitable to each rice variety to give the best quality rice.

Table 1 shows that a large proportion (81.7%) of the respondents were not aware of the need to rewash and dewater paddy after soaking. Consequently, the majority (73.3%) did not observe practice. Rewashing is necessary to rinse the paddy rice to eliminate pigments dissolved in water. In addition to the re-washing, the parboiler could further remove stones. The result therefore implies that the low awareness and observation of rewashing paddy after soaking contributes to the dull colour and impurities found in domestic rice. A respondent disclosed that in an attempt to clean paddy, they add detergent while soaking the paddy. In that regard, the health of consumers may be jeopardized considering that detergents containing anionic surfactants could be toxic if misused (Chahine et.al, 2022). Entries from Table 1 show that all (100.0%) of the respondents were aware and pre-cooked paddy. Under standard conditions, paddy is not allowed to have direct contact with boiling water but rather steam from boiling water cooks the paddy till husk opens. However, in the study area, the respondents cooked paddy directly in boiling water.

Table 1 shows that all (100.0%) of the respondents were aware and sun-dry parboiled paddy. Respondents rely solely on direct sun rays for drying parboiled rice in open spaces. Constant turning to allow even drying of paddy is usually done by hand or a rake-like tool. The sole reliance on direct sun rays for drying according to Ying and Spang (2024) becomes a challenge because it is highly dependent on weather conditions. As a result, rice processed during rainy seasons sometimes have a dull colour and unpleasant odour. The result shows that little or no change is recorded in the practice of small-scale rice processors. Moreover in the study area, people and animals were seen walking on dry paddy. For instance, a mill owner rode his motorbike on a dry paddy. When the researcher expressed concern, the miller claimed that the grains would not break at the level of dryness. Aside from the fears of rice breakage, stones could be further introduced into the paddy by such actions. Table 1 shows that the majority (73.3%,) of respondents

were aware of the need to dry parboiled paddy in the shade, and 53.3% observed practice. Drying in the middle of the day's heat intensity can lead to cracking, which the respondents avoid by heaping paddy and covering the heap with sacks and re-spread later in the afternoon or the next morning. Table 1 shows that 21.7% of the respondents were aware of sales of packaged parboiled rice. A practice that could be profitable if there is demand for it. However, the majority (78.3%) of the respondents were not aware of such venture and on the whole, all (100%) of the respondents did not engage in the sales of parboiled paddy. This could be an opportunity for the employment of more actors in the rice value chain, particularly among the youth.

Table 1: Parboilers awareness and practice of standard tasks

Parboiling tasks	Aware	Practice
Maintain hygienic conditions	88.3	58.3
Make materials/equipment needed available	100.0	100.0
purchase only a good variety of paddy	88.3	45.0
Winnow/sort paddy	90.0	68.3
Wash/dewater paddy till wash water is colourless	100.0	33.3
Soak paddy in water	100.0	100.0
Rewash/de-water paddy again after soaking	63.3	43.3
Pre-cook/Steam paddy	100.0	100.0
Sun drying	100.0	100.0
Shade drying	73.3	46.7
Package, store & sell parboiled paddy	21.7	0.0

Millers' awareness and practice of standard milling tasks

Table 2 shows that a greater proportion (58.3%) of the respondents were not aware of ensuring continuous operation by accumulating paddy. Though 41.7% were aware, 83.3% did not observe the practice. The result implies that the respondents were ignorant of the importance of the practice hence the negligence. The Federal Ministry of Agriculture and Rural Development (FMARD, 2020) observed that during off seasons, milling of paddies that are brought in trickles to mills increases the cost of production. The Project facilitators therefore recommended that paddies be accumulated for about two weeks. Such measures will not only save production costs but will prevent machines from staying idle for long periods. Also, 80.0 % of the respondents were aware of the reduction of operational costs by ensuring that paddy is at a 1% impurity rate. Only 36.7% observed the practice, while 63.3% did not. The result reveals that respondents do not appreciate the benefit(s) of observing the right processing standard(s) in the long run. For instance, if millers begin to ensure that paddy is clean at a 1% impurity rate, thus reducing the rate at which millers change consumable parts of milling machines; the annual profit that accrues will outweigh the immediate profit of getting paid for milling a few batches of paddy with a lot of impurity. It is therefore important that the respondents be encouraged to pay attention to details by keeping records. In this way, millers will not only ascertain that they record profit but can tell how much profit was made and also note the activities that either increased or reduced their profit for future modification and better profit.

Similarly, the Table shows that the majority (80.0%) of the respondents were aware that the quality of milled rice could be improved by ensuring that paddy is a single variety or at a 10% mix rate and 63.3% of the respondents observed the practice. when the mix rate of paddies is high, the implication is that there is difficulty in adjusting the milling machines to suit the grain thickness, hardness, shape, variety, and degree of milling (DoM); thereby generating substantial amounts of broken rice, waste, poor quality and low profit. Despite the respondents' awareness of the implication of a high mix rate, not all (100%) enforce the practice. This indicates that the millers are not sensitive to the concerns, acceptability, and preferences of consumers. Table 2 shows that the majority (93.3%) of respondents were aware of the need to sun-dry excessively wet paddy brought to mills before milling, and about 87% observed the practice. The routine is considered so vital that a respondent expressed that the milling machine could stop running if excessively moist paddy is turned into it. A greater proportion (95.0%) of respondents were aware of the importance of replacing consumable parts of milling machines at the right time yet 80.0% did not observe the practice. In defense of their laxity, the respondents complained that though spare parts are available, accessing durable consumable parts is difficult.

Entries from Table 2 show that the majority (96.7%) of respondents were aware of the need to do timely checks and replacement of the quality/quantity of lubricant oil, cooling water, and grease but 86.7% did not observe the routine. The routine, if properly observed, prevents mechanical damage. The results show that 96.7% were aware of the need to check for tension/tightness of belts, nuts, and bolts for ease in machine operation, though 90.0% did not observe practice. Regular check for tension/tightness of belts prevents an increase in fuel consumption due to belt slippage, the breakage or damage of the belt, and paddy logging inside the machine. Furthermore, 90.0% of the respondents were aware of the need to check for abnormal noise, trembling, heat, and odour to detect mechanical faults at an early stage. However, 28.3% observed practice, while 71.7% did not. A greater proportion (66.1%) of the respondents were aware that it is important to operate machines empty once or twice a month even if paddy is lacking, and a significant proportion (65.0%) observed the practice.

The need to clean machine(s) after each day’s operation was not a popular practice among the respondents as only 1.7% observed practice. Cleaning machines after operation helps improve machine durability and prevent insects and rats from harbouring inside the machine. Also, cleaning allows early detection of defective parts in the machine. Only 1.7% of the respondents sort broken grains from whole kernels, though 35.0% were aware of the practice. The majority (85.0%) of the respondents were aware of issuing payment receipts reflecting quality category, weight, unit price, and amount, but 96.7% did not observe the practice. Overall, the respondents are aware of most standard milling practises but showed poor application and use of knowledge acquired. They have a poor maintenance culture of facilities used in rice processing. This could be attributed to several factors including lack of skills or technical know-how, cost and/or lack of spare parts, and maintenance among others.

Table 2: Millers' awareness and practice of standard tasks

Milling tasks	Aware	Practice
Ensure continuous operation by accumulating paddy	41.7	58.3
Reduction of operational cost by ensuring that paddy is at 1%impurity rate	80.0	20.0
Improve the quality of milled rice by ensuring that paddy is a single variety or at a 10% mix rate	83.3	16.7
check stored parboiled paddy for moisture before milling	93.3	6.7
Replacement of consumable parts at the right time	95.0	5.0
Timely check &replacement of the quality/quantity of lubricant oil, cooling water, and grease	96.7	3.3
Checking for tension/tightness of belts, nuts &bolts for ease in machine operation	96.7	3.3
Check for abnormal noise, trembling, heat, and odour to detect mechanical fault at an early stage	90.0	10.0
Even if paddy is unavailable, operate machines empty once or twice a month	66.1	33.9
Clean machine(s) after each day's operation	45.0	55.0
Sort broken grains from whole kernels	35.0	1.7
Issuing payment receipts reflecting quality, weight, etc	85.0	15.0

The standard practice of charging milling commission

Figure 1 shows that a greater proportion (68.3%) of respondents were aware of the practice of charging varied prices for milling based on the quality of paddy. However, only (1.7%) observed the practice. Specifically, this was observed in Tara Mills, an industrial mill located in Adani local government areas. Evidence has shown that when milling commission is charged on a white rice basis, users or customers care less about the quality of paddy material, resulting in a low quantity of healthy grain in paddy material, as well as extremely low machine efficiency compared to the white rice produced (FMARD, 2020). Also, it results in high operational costs owing to low milling yield and equipment loss. On the contrary, If the milling commission is charged on a quality of paddy basis, users or customers will pay more attention to getting rid of the presence of immature paddy and foreign substances including dust thereby improving the quality of paddy material. The respondents revealed that they do not put the knowledge into practice because of the fear of losing customers especially when there is no consensus among the millers so that if refused by one, a customer could patronize another mill facility. Agricultural extension professionals with the Ministry of Agriculture and Agricultural Development Programme (ADP) should explore that gap and facilitate the formation of cooperatives among rice processors.

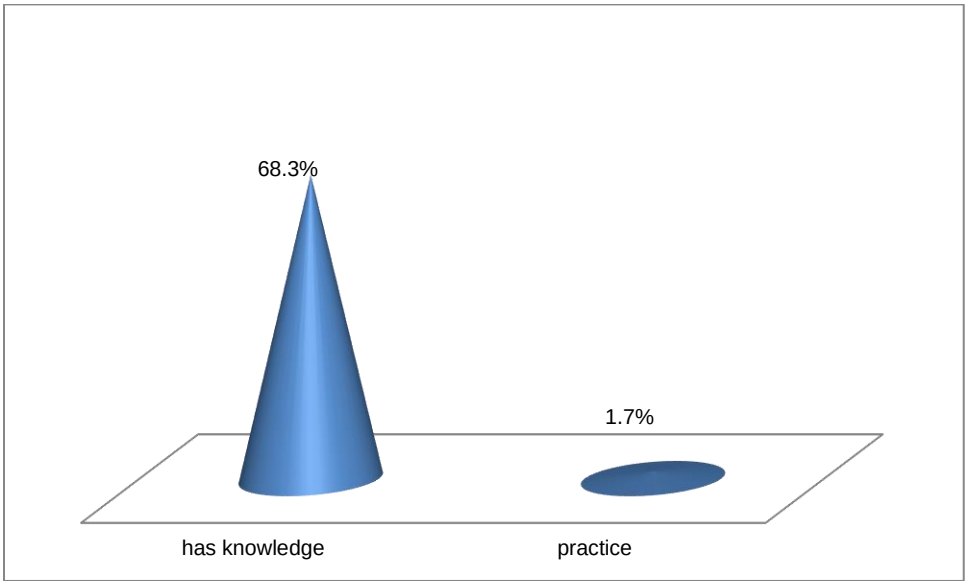

Figure 1: Milling commission based on paddy quality

Value addition practices of rice processors

Table 3 shows that 15.0% of the respondents owned a de-stoning machine, while 85.0% did not. Reasons given for the situation varied; for instance the majority, 56.7% indicated financial constraint, giving that a de-stoner cost of up to a million naira, while 8.3% stated that the low rate of demand for the service is not motivating enough to invest in a de-stoning machine, adding that the number of de-stoning machines available in the study area is meeting current demand. Another 18.3% of the respondents expounded that should de-stoned rice be sold at a higher price, customers are not usually willing to bear extra costs. The respondents explained further that the quantity of rice reduces after de-stoning. Evidence exists that de-stoning results in the loss of some good grains of rice (Akande et.al, 2022). The practice is to direct customers to millers who own de-stoning machines. A small proportion (1.7%) of the respondents owned an industrial de-stoning machine engrafted as a chamber in a chain of rice processing mills, while 15.0% owned small-size and detached de-stoning machines.

A small proportion (32%) of the respondents packaged milled rice and branded the pack of rice. Personal observation of the researcher reveals that only two mills in Adani, one of them being the industrial-size Tara mill did proper branding of rice packs that outlined quality category, weight, and nutrient component of rice. The remaining 68.3% sold rice with bushels from mounds of rice on sacks spread out in the marketplace or front of rice mills. Table 3 further shows that 31.7% of the respondents stated that the reason for not packing milled rice and branding packs was financial constraints. The greater proportion (56.7%) of respondents did not see the need since customers could always purchase empty bags of different weights from specialized sellers. the result agrees with the findings of Enwelu et al., (2020) which revealed that 95.0% of the study population used manual dehulling machines, (63.8%) sold unbranded rice without label while 100%

packed milled rice in hand-sewn bags neither had they started using de-stoner nor rice polishing machine.

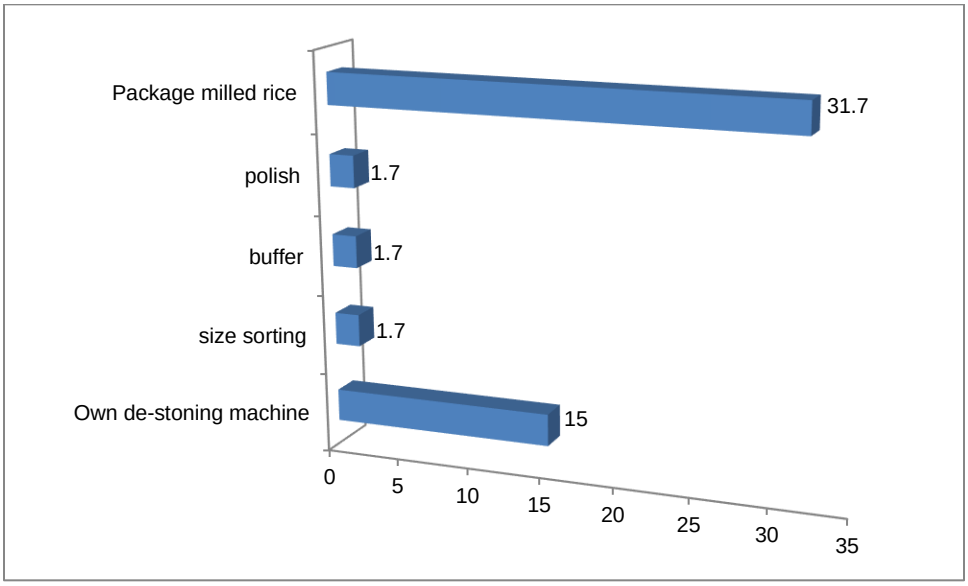

Figure 2: Value addition practices of rice processors

A critical look at the result suggests that extra efforts put into improving the quality of milled rice do not attract profit huge enough to motivate the respondents to go all out to invest in equipment and acquisition of skills that will take them from primary (parboiling, drying, milling, and bagging) processing to further (elimination of stone, polishing, size sorting and packaging) processing. This is in line with a study conducted by FMARD (2020) which revealed that Nigeria has no comparative advantage in processing paddy rice into value-added rice.

Table 3: reasons for not practicing value addition to milled rice

Value addition practice	Percentage (%)
financial constraint	56.7
service not demanded for	8.3
customers are not willing to bear the extra cost	18.3
Reasons for not packaging milled rice	
financial constraint	31.7
do not see the need for it	56.7
Description of equipment for packaging rice	
industrial sealing machine	1.7
small sealing machine	5.0
Needle with wide hole and rope	25.0
describe method	
Mechanical sealing powered with electricity	6.7
Manual (hand-sewn)	25.0

Conclusion and recommendation

The study revealed that small and medium-scale rice processors (parboilers and millers) are the key actors in rice processing. Hence the two key actors (parboilers and millers) are dependent on each other. However, the millers convert paddy to milled rice. There is an urgent need for small-scale millers in Nigeria to be sensitized and motivated to graduate into the stage where they will begin to add value (polish, sift, and grade to separate any remaining small impurities and broken grains from the head rice) to milled rice. If this is achieved, a larger volume of domestic rice that is at *par* with foreign rice will reach urban consumers. Clean and homogenous domestic rice with freshness as an added advantage will ultimately reduce imported rice to its barest minimum. The study recommended that subsequent interventions of government and international donor agencies should target small and medium-scale processors. Interventions should be geared toward upgrading the equipment of small and medium-scale processors and giving training on the use of modern equipment. The reason for the high disparity between awareness and practice is a gap for extension workers to address.

References

Ajayi G. T and A. Ajiboye, (2020). Analysis of Consumers' Preference for Local Rice among Households in Ekiti State , Nigeria. Asian Research Journal of Agriculture 12(1): 18-23, Article no.ARJA.53388, ISSN: 2456-561X

Akande, S. Azeez, T.M. Kayode J.F.. Onuoha, K. I., Ikumapayi O. M., Akinlabi S. A., and Akinlabi E. T. (2022). Development of an efficient rice De-stoner. Materials Today: Proceedings, https://doi.org/ 10.1016/j.matpr. www.elsevier.com/localte/matpr

Beverley, J. Koch, P. M., Limbaugh, D., Smith, B. (2024). Capabilities Department of Philosophy, University at Buffalo, 135 Park Hall, Buffalo, NY 14260-4150, USA

Chahine. C. R., El-Teres, F. F., Chahine, N. R., Chalhoub, W. W. (2022). Effects of dishwashing detergents residues on redox status and cell proliferation in mice liver and kidney International Journal of Research in Medical Sciences Chahine CR et al. Int J Res Med Sci.10(8),1606-1614 www.msjonline.org

Enugu Investment Bronchure (2023). Made in Enugu for Africa: Investment Opportunities. Enugu State Government w w w . e n u g u s t a t e . g o v .ng

Enugu State Investment Guide (2022). Why Enugu: Our Govering Philosophy. Enugu State Government w w w . e n u g u s t a t e . g o v . n g

Enwelu, I.C, Ozioko. R.I., Edeh, I., Ohagwu V.A, Udoye C.E, Okoro J.C . (2020). Value Addition in Rice Processing and Marketing in Rural Communities of Enugu State, Nigeria**.** Proceedings of the Annual Conference of the Agricultural Extension Society of Nigeria ISSN: 1595 – 1421 http://aesonnigeria.org/ConfProc

Federal Ministry of Agriculture and Rural Development, FMARD(2020). *National Rice Development Strategy II (2020-2030)*. Federal Capital Territority (FCT), Abuja.

Muchlisyiyah, J., Shamsudin, R., Basha, R. K., Shukri, R., How, S. Niranjan, K., and Onwude, D. (2023). Parboiled Rice Processing Method, Rice Quality, Health Benefits,

Environment, and Future Perspectives: A Review**.**
Agriculture 13(7)1390; https://doi.org/10.3390/agriculture13071390

Nigeria National Bureau of Statistics, NBS (2021). Map of Nigeria; southeast Nigeria; Enugu State and Enugu city.

Okoro, J.C., Ugah D. E., Aroh, J.A.,Obioha, O.G., Udoye, C.E. & Agwu, E.A. (2023). Perceived Factors Influencing Farmers' Preference for Rice Varieties in Enugu State, Nigeria. *Journal of Agricultural Extension, Vol. 27* (1)**, 86-93** https://dx.doi.org/10.4314/jae.v27i1.8

Onoja, N.M., Olajide, R.B., Haruna, O.E., Ajibade, Y.E. and Onoja, A.E. (2024). Effect of Anchor Borrowers' Programme on rice yield in North-Central, Nigeria. Journal of Agricultural Extension, 28(3), 70-78

Onuwa, G. and Dalla, A. (2023). Determinants of Rice Consumption and household preferences in Jos-North, Plateau State, Nigeria. Agricultural Socio-Economic Journal 23(3),301-308 P-ISSN: 1421-1425 E-ISSN: 2252-6757

Singathala, H., Malla, I., Lekkala, P. (2023). Quality Analysis and Classification of Rice Grains using Image Processing Techniques. International Research Journal of Engineering and Technology (IRJET) 10 (8) www.irjet.net

Sony, M., Antony, J. and Mc Dermott, O. (2022). How do the Technological Capability and Strategic Flexibility of an Organization Impact its Successful Implementation of Industry 4.0? A Qualitative Viewpoint. Benchmarking: An International Journal Vol. 30 No. 3, 2023 pp. 924-949 Emerald Publishing Limited 1463-577 DOI 10.1108/BIJ-09-2021-0541

United States Department for Agriculture (USDA) and Global Agricultural Information Network (GAIN) (2023). Grain and Feed Update for Nigeria. Report Number: NI2023-0008

Ying, T. and Spang, E. S. (2024). Paddy Drying Technologies: A Review of Existing Literature on Energy Consumption. Processes 12, 532. https://doi.org/10.3390/pr12030532