



Potential of Climate Smart Agriculture in Preventing Post Harvest Loses: Instant Fufu Powder Production among Rural Women in Oyo State, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. Author FIO designed the study, managed the literature searches, wrote the protocol and wrote the first draft of the manuscript. Authors ROB and RJA performed the statistical analysis and the result analyses of the study. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJAEES/2020/v38i830396

Editor(s):

(1) Dr. Zhao Chen, University of Maryland, USA.

Reviewers:

(1) Juan Camilo Henao-Rojas, Colombian Corporation for Agricultural Research, Colombia.

(2) Pinaki Roy, Indian Council of Agricultural Research, India.

Complete Peer review History: <http://www.sdiarticle4.com/review-history/60306>

Short Research Article

Received 15 June 2020
Accepted 21 August 2020
Published 29 August 2020

ABSTRACT

This study focused on creation of market opportunities of instant fufu powder for smallholder women farmers in Oriire local government, Oyo state, Nigeria. The purpose of the project at the rural level was to ensure creation and encouragement of more of off-farm activities like processing, storage and marketing. A multistage random sampling technique was adopted to select 240 farmers/processors involved in development of value chains for Cassava flour to improve their livelihoods and incomes as direct beneficiaries. Demonstration /training were done with the assistance of trained personnel for better understanding. Physical and live practices were used for the demonstration. The data were analyzed by using descriptive statistics. The result of the study showed that 90.8% of the farmers take their products to the market with the enthusiasm of selling all, but often these products are not fully sold due to higher supply of the same

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products with lower demand in the market places. The adoption of fufu powder processing by the rural women did not result in acquisition of new assets although 88% of the beneficiaries reported increase in their capability to meet expenditure on food, children education, and meeting social obligations like naming ceremonies. Currently a 1 kg of mechanically processed odourless powder 'fufu' retails for N250 in Nigeria.

The study concluded that, the powdered cassava 'flour' packaging business is a potentially acceptable business that prevents post-harvest losses. It is still calling for massive investment by aspiring entrepreneurs. This will ensure capabilities to meet food requirements of a growing population by eliminating losses, making more nutritive food items from raw commodities.

Keywords: Fufu; powder; value chain; market opportunities; smart agriculture.

1. INTRODUCTION

conservation, afforestation and crop domestication.

1.1 Background Information

Agriculture is highly prone to climate change – the sector is predicted to come under increasing stress from climate-change-induced increases in temperature, variability in rainfall and extreme weather events, which could trigger drought, crop failures, pest and disease outbreaks, and the degradation of land and water resources. The climate challenge in agriculture requires integrated approaches that increase productivity, enhance adaptive capacity and reduce net emissions. One such approach is called 'climate-smart agriculture', which aims at sustainably improves agricultural productivity, enhances food security, boosts farmers' adaptive capacity and resilience to climate shocks and contributes to GHG mitigation. The appeal of climate-smart agriculture is its balanced approach in seeking to improve livelihoods and in increasing productivity and resilience of poor communities, including rural women, while also providing mitigation benefits [1]. Agriculture is one of the most vulnerable sectors to climate change impacts. Within agriculture, however, several studies highlight that women are likely to be affected more than men by climate impacts, especially in the developing countries where their involvement in agriculture is high [2].

Agriculture is central to women's livelihoods, especially rural women. Climatic stresses on agricultural production will make women particularly vulnerable to food insecurity. Empowering women is not just necessary for their well - being, but also a means to broader agricultural development and food security. Women play a vital role in food production, food distribution and food utilization – the three components of food security; they also undertake a range of community-level activities that support agricultural development, such as soil and water

This study focused on potential of climate smart agriculture (CSA) in preventing post harvest loses: instant fufu powder production among rural women in Oyo state in Nigeria. The project was involved in development of value chains for Cassava flour to improve the livelihoods and incomes of at least 240 smallholder women farmers as direct beneficiaries. Since climate change alters agricultural production and food systems, and thus the approach to transforming agricultural systems to support global food security and poverty reduction, the purpose of the project at the rural level was to ensure creation and encouragement of more of off-farm activities like processing, storage and marketing. It is envisaged that increased production of instant fufu powder will generate employment opportunities for the rural households (especially women) by increasing the market value and the shelf life of processed cassava, ensuring efficient post-harvest handling, storage and marketing; enhancing income of cassava farmers/processors. This will significantly strengthen the poverty eradication in the study area. With the right practices, policies and investments, the agriculture sector can move onto CSA pathways, resulting in decreased food insecurity and poverty in the short term while contributing to reducing climate change as a threat to food security over the longer term.

At the farmers' level, the aim of the project was to ensure consistent purchase of the instant fufu powder products. This case study explored the newly emerging processing techniques and packaging of the cassava 'fufu' flour business which is usually consumed in its ready to eat wet form but now being packaged in modernized ways for easy accessibility and commercialization. The implementers of the project in the local government were the

agricultural extension agents and other local government staff who jointly rendered extension services to the women farmers and were the links through which all the physical demonstrations, messages got to the beneficiaries. The Principal researcher's office coordinates training, delivery of processing equipment as well as monitoring the installation of the equipment (solar dryer/raised wooden platform for sun-drying) and implementation of the project in the chosen villages.

1.2 Motivation/Problem Definition

CSA is an approach to developing the technical, policy and investment conditions to achieve sustainable agricultural development for food security under climate change. It integrates the three dimensions of sustainable development (economic, social and environmental) by jointly addressing food security and climate challenges. It is composed of three main pillars: (1) sustainably increasing agricultural productivity and incomes; (2) adapting and building resilience to climate change; and (3) reducing and/or removing greenhouse gas emissions, where possible [3].

Women face numerous obstacles to access productive inputs, assets and services; these obstacles do not only heighten their vulnerability to food insecurity, but also considerably reduce their contribution to overall agricultural production. Women often face a greater burden in responding and adapting to climatic stresses due to their lack of access to land, financial services, social capital and technology. Among others, there is a need to reform laws that restrict women's ownership of and/or access to productive and reproductive resources [4]. Climate change necessitates a climate-smart approach to agriculture that employs policy and agro practices that enhance food security, promote adaptation and resilience and yield mitigation co-benefits. Because gender imbalances in the sector affect how men and women contribute to and benefit from climate-smart agriculture, such agriculture should be closely attuned to the unique needs and means of women and men [5].

Cassava is processed into different food products, but the one which attracts most attention apart from garri is the dried powdered fufu flour because of the processes involved in its processing. This includes various strategies for scaling-up the fufu business studied through

sourcing and testing for appropriate drying system and providing answers to the changing habits of consumers and the current wave of urbanization coupled with the need for promotion of commercialization of traditional foods like cassava products. It's been tagged from findings that it's one of the most potential small-scale project innovative business in the food production industry that spins money using always-available raw materials and easy-to-acquire production technology that has an innovative edge over most stable food products for export. Convenience forms (processed and packaged) of this cassava-based product is increasingly being produced by a number of small and medium-scale food industries in different regions of the world and most especially in the western Africa region. To meet the requirements of the World Trade Organization's (WTO) sanitary and phyto-sanitary (SPS) agreement, a number of these food industries have taken steps to improve upon the safety and quality management systems for this product hence engage in packaging of different modernized convenient forms.

The processing and packaging process of cassava (fufu flour) adapted for the empowerment of women in the emerging economies can be said to be innovative since it involves the introduction of a new method of processing and perfected the process technology for producing fufu in dry powder form (fufu flour) thus eliminating shelf- life problem as well as removing the offensive characteristic odour the wet form of the food product was characterized with. It opens up new market by converting cassava which is eaten as a stable food in form of wet *fufu* to a preservable powdery form (fufu flour) that can now be easily accessible for consumers all over the world in supermarkets and open markets which was not possible before now. The business also introduces product of significant improvement into the market because the new form in which it's now being packaged is superior to the previous form in which it was normally consumed.

Powdered 'fufu' innovative business tends to increase the production volume or efficiency all resulting in competition advantages and profit increases. The improved processing method transform the products to superior powdered dry form that last longer with finer quality. This thus attracts higher prices and invariably increases their income. Since technological development

makes very important contributions to the economic and socio-cultural life.

Even though the fufu packaging business cannot be said to have the entire main attributes of a new business because there has been an already laid out platform on ground, this is just a newly improved system of business based on the previous one. But nevertheless it involves some activities like setting a particular product targeted at the food industry. The powdered 'fufu' flour which is the main product in this business is uniquely different from its predecessor and other available powered cassava products of its kind and also has a unique name of its own which is not same or similar to other names associated to the processed product of cassava.

The short shelf life of *the wet fufu* has a clear negative effect on the prices and margins processors and many assembly traders are able to command. With the modern, mechanized production and packaging of this food product, which can be stored by processors, traders and consumers over a longer time period, most of the above problems are solved. It is now possible to obtain fufu that is odourless with good aroma, low fibre load and good texture that retain its normal taste for a longer time when it's stored and also internationally acceptable.

The production and marketing of traditionally processed cassava products are important income generating activities in many African countries. Cassava tuber losses contribute to food insecurity and low farm incomes not only in Nigeria but also in other sub-Saharan African countries [6]. Therefore, efficient post-harvest handling, storage and marketing can tremendously contribute to social economic aspects of rural communities in Nigeria. The losses are directly measurable in economic, quantitative, qualitative, (nutritional) terms. Economic loss is the reduction in monetary value of harvested cassava as a result of physical loss. Quantitative cassava loss involves reduction in weight and therefore can be defined and valued. Qualitative loss although difficult to assess because it is frequently based on subjective judgments (like damage), can often be described in comparison with locally accepted quality standards [7]. Postharvest food losses significantly endanger the livelihoods of stakeholders across the value chain by reducing valuable incomes and profitability.

In view of the renewed emphasis on cassava production (supply), processing and utilization in

Nigeria, it becomes necessary to assess the production, demand and utilization patterns of processed cassava to instant fufu powder, its prospects especially in combating hunger and raising food security among vulnerable groups including women and infants. On the basis of the fact that cassava is useful in various ways, its potential for export, the need to reduce postharvest losses as a way of bridging the gap between demand and supply, it is imperative therefore to carry out research work on value addition to cassava in order to reduce post-harvest losses; the basis upon which Oriire Local Government was chosen as the study area.

The following research questions were formulated in order to achieve the objectives.

1.3 Research Questions

1. To what extent have the cassava tuber post-harvest losses affected the smallholder's output?;
2. To what extent will physical demonstration of the production of instant fufu powder affect their adoption?
3. What effect will the processing methods have on the farmer's perceived hygiene?
4. What were the costs incurred by cassava processors in the study area?
5. Was there any difference in output of cassava processed into fufu powder and the wet fufu?;
6. To what extent had the consumers accepted the products?;
7. What are the attitudes towards the products? and
8. What factors determine the market and optimum price levels for these products?

2. CONCEPTUAL FRAMEWORK

An agro-value value chain consists of a series of activities that add value to a final product, beginning with production, linking with processing, getting the final product, and marketing, sale to the end user or consumer and disposal after use. It is because of the interdependence and linkages between the activities, that a clear understanding of the chain, market for the final product, and the various actors of the chain is important not only for financing or investment decision, but for developing the entire chain [8]. Some of these factors shaping value chain evolution may not be optimal from a social welfare standpoint.

3. RESEARCH METHODOLOGY

3.1 The Study Area

The project was demonstrated and carried out at Oriire local government area (LGA) with its headquarter at Ikoyi-Ile. The LGA created on the 3rd of May, 1989 covers a total geographical area of 2,040 hectares and has estimated population of 93,000 according to National Population Commission [9]. The LGA is bounded in the North by Olorunsogo, the west by Oyo West, East by Kwara State, and Southeast by Ogbomosho land. The LGA counts as one of the largest LGA of the state both in areas and in population. It has a tropical climate, notably dry and wet seasons with relatively high humidity. The dry season lasts from November to March while the wet season starts from April and ends in October. The LGA lies on 334 m above sea level. In winter, there is much less rainfall than in summer. The average annual temperature in Ogbomosho is 26.1°C | 79.0°F. In a year, the rainfall is 1217 mm | 47.9 inch.

It comprises the following villages: Iluju, Tewure, Ikoyi, Fapote, Ajegunle-oba, Afala, Elewure, Ogogo, Alaropo, Jegede, Orile-dada, Oko Oba, Olorunda etc. The inhabitants are predominantly Yoruba with few Hausas and Fulanis. The people of Oriire are predominantly farmers but also engage in trading, hunting and fishing. In terms of farming, the communities are known for the production of food crops such as yam, cassava, maize, vegetables and so on. Women who also own personal farms although farm sizes are smaller compared to men's farms in most cases did processing of the product. Cassava processing groups in the area consisted of pure cassava farmer and cassava processors who were women although they owned individual cassava farms. Ownership of land in this area was by rent and lease for no woman had no right to inherit the land.

3.2 Cassava Farmers

Cassava farmers in Oriire local government area consist of small scale (0.5 to 2 ha) and medium scale (2 to 4 ha). Cassava was grown as intercrop of maize, melon and vegetables [10]. Men and women in the study area did cassava cultivation. Cassava was grown on rented or lease land as well as owned land. It was very easy to rent or lease a land in the area if the farmer was recommended by known indigene or if the farmer resides in the area.

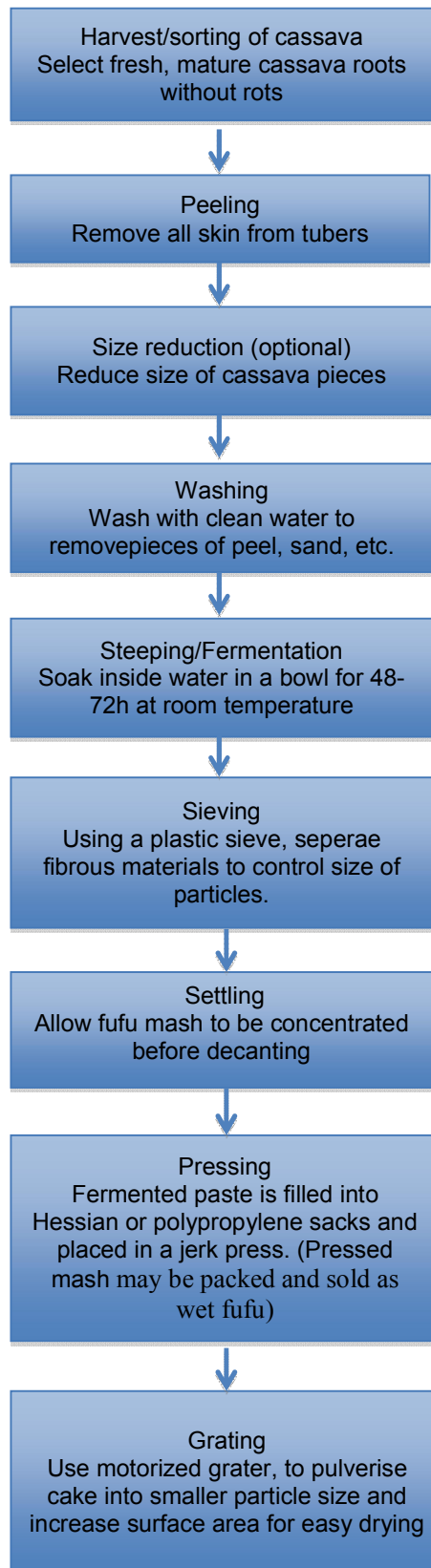
3.3 Cassava Processing

Dried Fufu is made by steeping whole or cut peeled cassava roots in water to ferment for a maximum of three days, depending on ambient temperature. During steeping, fermentation decreases the pH, softens the roots, and helps to reduce potentially toxic cyanogenic compounds. When sufficiently soft, the roots are taken out, broken by hand, and sieved to remove the fibers. At present, processors sieve manually by adding water to the retted mass on nylon or cloth screens. The fiber produced as a by-product is sold for animal feed, either in its wet form or after sun drying. The sieved mass is allowed to sediment in a large container for about 24 hours. After sedimentation, the water is poured off while the fine, clean sediment (mainly starch) is dewatered using a high-powered Press. The cake is then sifted before drying (Fig. 1).

Processing of cassava in Oriire area was mainly women occupation although cassava graters are owned by men and are pushed on a truck around villages. Cassava was processed into gari, fufu and lafun but gari processing was more prevalent than wet fufu because of its bulkiness and high perishability. Processed products were sold in the local market (Tewure and Iluju) where traders from Ogbomosho and Ilorin were the major buyers.

3.4 Physical Demonstration of the Production of Instant Fufu Powder

The Powdered cassava 'fufu' flour is a creamy white, odourless starch preparation, which has low cyanic acid content and low fibre load readily available for consumption in different packages and sizes. Cassava powder 'fufu' flours is produced from disease resistant varieties of cassava tuber and the production process includes procurement, receipt, sorting, peeling, washing (to remove unwanted impurities), fermenting, pulping, screening, sedimenting, dewatering, granulating, drying, grinding, weighing and packaging. Fermentation is done primarily to soften the tubers, and remove the repulsive odour and the dangerous hydrocyanic acid. The detailed description of each of the above processes and the necessary steps and precautions are taken to ensure that the finished product is such that it meets international food standard. The product is packaged for sale in neat plastic woven bags, jute bags, paper boxes etc and sizes of these packages depending on the target market.



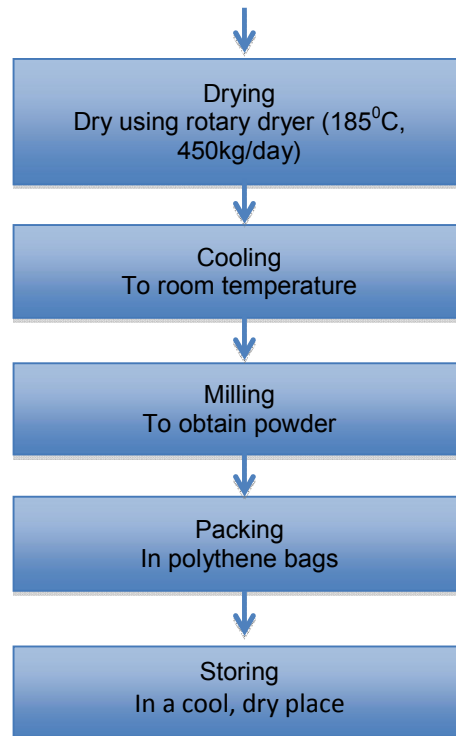


Fig. 1. Process flow chart for dried fufu powder

3.5 Research Strategy

Case study was used as strategy for this research because in-depth information is needed to be able to unravel the effects of this project on the beneficiaries. This strategy was also chosen because the respondents are mostly illiterate and may not be able to fill the structured questionnaire. The research was conducted in six villages in Oriire Local government in Oyo state namely Iluju, Tewure, Ikoyi, Fapote, Afala and Elewure. These villages were chosen because there were active farmers and processors and as such were able to provide relevant information of the effect of the project. Qualitative data on wet processed fufu and dried fufu powder were collected in order to make inference about income that accrue to participants of the project. Interview schedule was chosen because most small - scale farmers in Nigeria hardly keep records of their operations therefore great insight was obtained by involving them in discussion which can generate the needed information. In order to gain access to the study area, the agricultural extension officers were contacted before each interview was conducted. The extension officers assisted the researcher to make appointment based on the availability of the respondents.

3.6 Research Population

The population of the study consists of all female cassava farmers/processors. Respondents of this research were pure cassava farmers and cassava processors who are beneficiaries of the project because they were able to provide in-depth information on the subject matter.

Using a table developed by [11], a multistage random sampling Technique was adopted to select 240 processing respondents for the study. The lists of the processors whose population were 600 in number were obtained from executives of the association of cassava processors in the study area. Out of 10 wards in the local government area, six wards were randomly selected for the study. From each of the ward, two villages were randomly selected making a total of 12 villages out of which 20 cassava female farmers were chosen. Secondly stratified random sampling was done to select 120 households consuming fufu as a staple food. The demonstration /training were done with the assistance of trained personnel for better understanding. The cassava was peeled, soaked, grinded, sun dried and packaged for sale in the markets and cities. Physical and live practices were used for the demonstration.

4. RESULTS AND DISCUSSION

4.1 Assess the Extent of Cassava Tuber Post-harvest Losses

Using 3 points likert – scale of measurement, Table 1 shows the experience of the respondents concerning the cassava post- harvest losses encountered in the recent times. This position justified the status of the rural farmers selling below the cost prices of their products. All the farmers, 100 percent take their products to the market with the enthusiasm of selling all, but often these products are not fully sold due to higher supply of the same products with lower demand in the market places. Only 1.7 percents often sold all their produce while the largest (91.7) percents of the farmers never did. The reasons for these unsold products were mainly due to poor-availability of means of transportation and poor storage system; hence, they are forced to sell the products below the cost price so as to avoid spoilage. This had often become the farmer's practices; and so finds it difficult to increase their income. These results were also established and corroborated by [12].

4.2 Assessing the Economic Losses Due to Cassava Post-harvest Wastages

The adoption of fufu powder processing by the rural women did not result in acquisition of new assets although the 88% of the beneficiaries reported increase in their capability to meet expenditure on food, children education, and meeting social obligations like naming ceremonies [13]. In their research confirmed the post - harvest wastages. This was an indication that conversion of unsold cassava at the market square due to either fall in cassava's price or low demand for the product at that point in time, were converted to dry form, which invariably reduced post-harvest wastages.

4.3 Determining the Public's Acceptance of Hygienically Processed and Packaged Instant Fufu Powder

Both quantitative and qualitative approaches were used to collect data. Interviews were conducted in homes of 120 respondents to test reactions to hygienically prepared and packaged fufu powder. Respondents were purposively selected from the major areas in Ogbomosho city. Selection also focused on: homemakers of both sexes in households where either partners or parents have jobs outside the house, or singles

whose professions make them spend less time home and therefore have the need for convenient, quick cooking foods; people within 25 to 40 years age bracket. A sample of the product was provided to this sub-sample after the first interview. Arrangements were made to re-interview those respondents within one or two days of the product being consumed. The result of the survey showed that all the consumers eat fufu. For the target group, food choices were mainly influenced by availability, convenience in preparation and affordability. From Table 2, out of 120 respondents interviewed, only 45 (37.5%) of them were aware of the packaged fufu powder. On the average, more than half (28) of those that were aware of the concept had tried the products. The fact that no respondent refused the willingness to try the product (100%) showed that members are ready to experiment with the new products. This result was also confirmed by [6].

4.4 Establish Levels of Acceptance

When asked about their willingness to buy into the concept of purchasing hygienically prepared and packaged fufu powder, the majority (90%) said that they were ready to purchase. The respondents were ready to purchase the dried form of the products due to lack of offensive odour, easier storage, and cooking. This figure is high and indicates the possibility of high patronage. The majority (84%) of those who tried the products said they were satisfied with the experience. Furthermore, there was a slight rise in purchase intention level (90% - 93%) after the packaged powdered fufu product trial. The proximate composition of dried fufu flours showed low moisture, high carbohydrate and high dry matter contents. These are indications of stable shelf life, cheap and available source of calories to the consumers most especially in the rural areas and ease of reconstitution during preparation into fufu dough. Their good sensory qualities met the demand of the consumers. The results were corroborated with [14].

4.5 Ascertain Attitudes towards the Products

The perceived quality associated with the processed and packaged fufu powder lead to respondents feeling that they are better than traditionally prepared ones. The respondents in addition had the notion that the packaged fufu powder sell at relatively high prices; may have an unpleasant taste and they may contain food

additives. These perceptions need to be taken into account in the promotion of the products. Table 3 showed a number of important factors perceived by the consumers for the preparation of high quality fufu powder. About 95.8 % of the consumers were of the opinion that the product will be preferred if they could afford the price, since willingness to purchase the product is typically based on their income [15] Secondly, the conditions of preparation also played a significant role in its acceptance. The respondents also felt that the products must be readily available (58.3%) to purchase at any point in

time. Packaging method (84.2%) is also important and it pre - determines the preference for the product.

4.6 Determine the Market and Price Levels for These Products

Current market prices and acceptable price ranges for the products were determined and are detailed in Table 4. The prevailing price in the study area encouraged the processing of fufu powder but it is not known whether the current price can be sustained because cassava tubers

Table 1. Cassava post - harvest experience by the respondents

Questions to respondents	Often freq. (%)	Seldom freq. (%)	Never freq. (%)
Do you take cassava to the market for sale?	240 (100)	-	-
Do you sell all the produce?	4 (1.7)	6 (2.6)	220 (91.7)
Do you transport the unsold back home?	-	30 (12.5)	210 (87.5)
Do you sell off the rest at desired price?	-	10 (4.2)	230 (95.8)
Do you sell the rest below the cost price?	-	-	240 (100)

Source: Author's calculation, 2018
Parenthesis indicates Percentage

Table 2. Awareness of packaged fufu powder

	Frequency	Percentage (%)
Aware	45 (120)	37.5
Not aware	55 (120)	62.5
Product trial	28 (45)	62.2
Willingness to try	120 (120)	100.0

Source: Author's calculation, 2018
Parenthesis: Number of respondents

Table 3. Factors that determine the consumer's preference

Qualitative factors	Most important	Important	Less important
Must Be Like The Traditional Wet Fufu	29 (24.2 %)	18(15.0 %)	73(60.8 %)
Product Needs To Be Advertised	95 (79.2 %)	22(1.83 %)	03 (2.5 %)
Should Be Well Packaged	110 (91.7 %)	8 (6.7%)	02(1.6 %)
The Hygienic Condition	118 (98.4 %)	1 (0.8 %)	1(0.8 %)
Availability?	70 (58.3 %)	45(37.5 %)	05 (4.2 %)
Affordable?	115 (95.8 %)	5 (4.2 %)	0 (0 %)
Have Attractive Package	101(84.2 %)	12(10 %)	07(5.8 %)

Source: Author's calculation, 2018

Table 4. Acceptable price ranges for high quality processed and packaged fufu powder in urban areas in Ogbomoso

Product	Current market price for 1kg	Acceptable Price Range for 1 kg	Current Market price for 2 kg	Acceptable Price Range for 1 kg
Fufu Powder	₦250	₦180 - ₦280	₦450	₦370 - ₦500

Source: Author's calculation, 2018

usually experience price fluctuation and also, the advent of rain might reduce the quality of the product since, sun-drying methods are used.

5. CONCLUSION

This was a preliminary piece of research that had provided enlightenment on the need to change the sociological perception of agriculture as a way of life rather than as a business. The training created awareness on the need to keep adequate farm records and encourage more of off-farm activities like processing, storage and marketing thereby creating employment opportunities for the rural households (especially women) by having access to a sustainable improved income and at the same time reducing or eradicating cassava post-harvest losses.

From the observations made in this particular study, it was concluded that there is potential for the production of high quality cassava products (packaged fufu powder) for urban markets in Ogbomoso urban centers. Price, hygienic manufacture and packaging of the product were determined to be key criteria for adoption/acceptance of the products. The price information was used in the design of processing system, which ensured that the final product was affordable to the target group.

This case-study has demonstrated that the business of processing and packaging powdered cassava 'fufu' flour is no doubt an innovative one even though just emerging and not still been practiced on a large scale as most of other food products business such as sorghum, millet, maize and the likes, it's a prospective lucrative business for young and aspiring entrepreneurs in the regions where the raw materials of this food product can be easily sourced and the product itself has a potential market. It has also shown that the business qualifies as an innovative business in that it includes some innovative activities such as having a unique name of its own and involving selling a food product uniquely independent of all other business in the food industry.

Finally, the powdered cassava 'flour' packaging business is a potentially acceptable business that prevents post harvest losses. It is still calling for massive investment by aspiring entrepreneurs especially in the west and central African regions where the product is mainly

consumed. Processing of cassava in various food forms like *fufu* flour has the potential to help Nigeria improve its food security, diversify its manufacturing base, generate more income, raise employment and achieve trade balance.

6. RECOMMENDATIONS

1. Fufu processors in the study area should be linked with credit sources so that they can increase the volume and quality of their product because there is ready market for these products in the local market as well as Ogbomoso town, which is less than an hour journey to the area.
2. Establishment of cassava flour industries by investors should be encouraged since there are good demands for the product in the area.
3. Cassava processors must take good care of fufu processing implements and maintain high hygienic conditions.
4. There will be creation and encouragement of more off-farm activities like processing, storage and marketing. It is envisaged that increased production of instant fufu powder will generate employment opportunities for the rural households (especially women).
5. It seeks to increase the market value and the shelf life of processed cassava.
6. Efficient post-harvest handling, storage and marketing can tremendously contribute to social economic aspects of rural communities in Nigeria.
7. Enhance incomes of cassava farmers/processors in the country hence significantly strengthen the poverty eradication in the country.
8. Notable application of the training has the potential of minimizing the menace of nutrition insecurity in the country.

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

ACKNOWLEDGEMENTS

The author appreciate Ladoké Akintola University of Technology (Lautech), for providing fund through 2009-2012 Merged tetfund research

project intervention and ensuring the completion of this research project. The inputs of the Directorate of Academic Planning, Head of Department, Agricultural Economics, Lautech, and Chairman, Oriire Local Government Chairman Ikoyi, are highly recognised and appreciated.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Food and Agriculture Organization of the United Nations (FAO). The state of food insecurity in the world – how does international price volatility affect domestic economies and food security? Rome: FAO; 2010.
2. Goldsmith R, Feygina I, Jost JT. The gender gap in environmental attitudes: A system justification perspective. In: Alston M, Whittenbury K (eds). Research, action and policy: Addressing the gendered impacts of climate change. Springer, Amsterdam; 2013.
3. Lipper L. Climate-smart agriculture for food security. *Nature Climate Change*. 2014;4: 1068–1072.
DOI: 10.1038/nclimate2437
4. Agarwal B. Food security, productivity and gender inequality. *The Oxford Handbook of Food, Politics and Society*; 2013.
Available: <https://doi.org/10.1093/oxfordhb/9780195397772.013.002>
5. International Panel on Climate Change (IPCC). Climate change 2014: Impacts, adaptation, and vulnerability. Part a: Global and sectoral aspects. Contribution of working group II to the fifth assessment report of the intergovernmental panel on climate change [Field CB, Barros VR, Dokken DJ, Mach KJ, Mastrandrea MD, et al. (eds.)]. Cambridge, UK and National Population Commission (1991): “National population commission provisional results of the 2006 national population of human and housing census” New York: Cambridge University Press; 2014.
6. Muhammad-Lawal AOA. Omotesho, Oyedemi FA. An assessment of the economics of cassava processing in Kwara State, Nigeria. Invited paper presented at the 4th International Conference of the African Association of Agricultural Economists, Hammamet, Tunisia. 2013;1-18.
7. Okorie OC, Ohajianja DO, Ehrim NC. Value chain analysis of cassava and cassava-based products in Imo State, Nigeria. *International Journal of Natural and Applied Sciences*. 2006; 2(4).
8. Olagunju FI. Implication of financial viability and value chain analysis of agro-processing industries for development: Women experience in Oyo State, Nigeria. *European Journal of Business and Management*. United States. 2013;5(2).
ISSN: 2222-2839.
9. National Population Commission. National Population Commission Provisional results of the 2006 national population of human and housing census; 1991.
10. Olasunkanmi M, Bamiro MA, Daramola F. Enterprise combinations in cassava based food crop farming system in Nigeria: Evidence from Ogun State. *Greener J. Agric. Sci*. 2012;2(1):13-20.
ISSN: 2276-7770.
11. Krejcie RV, Morgan DW. Determining sample size for research activities. *Educational and Psychological Measurements*; 1970.
12. Okorie OC, Ohajianja DO, Ehrim NC. Value chain analysis of cassava and cassava-based products in Imo State, Nigeria. *International Journal of Natural and Applied Sciences*. 2006;2(4).
13. Etudaiye HA, Nwabueze TU and Sanni LO. Quality of fufu processed from cassava mosaic disease resistant variety, *African Journal of Food Science*. 2009;3(3):61-67. Adebayo K. Dynamics of technology adoption in rural-based cassava processing enterprises in South-West Nigeria. *Int. J. Agricultural Econ*. 2009;2(1).
14. Etudaiye A. Hussein, Nwabueze T, Ugochukwuand Sanni, O. Lateef. Nutritional quality and preference of fufu processed from selected cassava mosaic

- disease (CMD) resistant cultivars. Advances in Applied Science Research. 2012;3(5):2687-2692.
15. Ezedinma C, Ojiako IA, Okechukwu J, Lemehi AM, Umar L, Sanni M, Akoroda F, Ogbe E, Okoro G, Tamwali, Dixon A. The cassava food commodity market and trade network in Nigeria". IITA, Ibadan. Nigeria; 2007.

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