MDP – IFAD PROJECT RESEARCH REPORT

Impact of IFAD-VCDP Promoted Modern Rice Processing Techniques on the Livelihood of Women Processors and Climate Change Mitigation in Kontagora and Shiroro, Niger State, Nigeria.

Prepared by: ADEOLA ADELAYO ADEDIRAN

Supervised by: Prof. Abel Olajide Olorunnisola (Head of Department, Wood Products Engineering, University of Ibadan)

Dr. Matthew Ahmed (State Program Cordinator, IFAD-VCDP Minna Office)

Dr. Yisa Fatima (Assistant Monitoring and Evaluation Officer, IFAD-VCDP Minna Office)

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ABBREVIATIONS AND ACRONYMS

CESDEV – Centre for Sustainable Development Practice

IFAD – International Fund for Agricultural Development

FAO – Food and Agriculture Organization

FCT – Federal Capital Territory

FGD – Focus Group Discussion

FGN – Federal Government of Nigeria

FMARD – Federal Ministry of Agriculture and Rural Development

GDP – Gross Domestic Product

GHG – Greenhouse Gases

KII – Key Informant Interview

LGAs – Local Government Areas

ODK – Open Data Kit

PPS – Probability Proportional to Size

SDGs – Sustainable Development Goals

VCDP – Value Chain Development Programme

ABSTRACT

This report assessed the impact of the IFAD-VCDP-promoted modern rice processing techniques on the livelihood of women processors and climate change mitigation in Kontagora and Shiroro, Niger State, Nigeria. A purposive sampling technique was used to select 165 women rice processors in the Kotangora and Shiroro LGAs in Niger State out of the five LGAs participating in the Value Chain Development Programme. Data was collected through the use of an android based questionnaire, focused group discussions, and key informant interviews. The descriptive and inferential statistics (Means, Percentages, Frequencies, t-test model) were the methods used to analyse the study objectives.

The results showed that most of the respondents were between ages 31-40 years with the mean age of about 37 years, and most have their household sizes between 6-10 persons. 83.75% of the women rice processors were married, and 61.87% had at least primary education. The results also showed great positive impact on the position of the respondents especially on their financial status, source of water, distance to water and source of energy through IFAD-VCDP intervention as 99.38% now have access to borehole water. 68.75% and 27.50% of the respondents indicated that they are now financially comfortable and very comfortable, respectively. A handful of the women processors (21.25%) now use charcoal and (23.75%) use petrol, diesel and biodiesel as sources of energy for their processing activities. However, some of the women have not fully adopted the modern processing techniques as most (55.00%) of them still make use of firewood as their source of energy. Consequently, lack of electricity and inadequate finance for various inputs slow down rice processors to easily adopt modern rice processing technologies.

It was concluded from this report that IFAD-VCDP intervention through the provision of infrastructures and modern rice processing equipment had increased the quantity and quality of milled rice. Also, the provision of modern rice processing machines (solar dryers and biofuel milling machine) and tools (smart climate readers) has some positive effect on climate change mitigation. However, more awareness should be created and rural women rice processors should be persuaded on the use of modern processing equipment as it would lead to an increase in processing and income thereby reducing poverty.

Keywords: IFAD-VCDP, Modern Rice Processing Techniques, Livelihood, Women Processors, Climate Change.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background of the Study

Rice (Oryza sativa) is an important food in Nigeria and the second most important crop in the world. Rice, which is an agricultural commodity, is the staple food for about half of the human race, and it is the most widely consumed in Nigeria. (FAO, 2012). The sharp decline in agricultural production and Nigeria's discovery of crude oil in commercial quantity led to an increase in food imports to meet human demands. Nigeria is also the largest producer in West Africa as rice is produced and processed in Ebonyi, Kaduna, Niger, Benue, Kano, Taraba, and the Borno States (Obayelu, 2015).

The rice processing sector is one of the most energy-consuming industries in the world. Energy plays a key role in the socio-economic development of any country. Rice processing involves a lot of utilities such as water, steam, electricity, and labour, which require a lot of energy. Of these utilities, electricity is the highest, and it is used in many of the different stages of rice processing such as motors, pumps, blowers, conveyors, etc. Greenhouse gas emissions from industries such as rice milling sector primarily come from burning fossil fuels for energy (Goyal *et al*., 2014).

The different techniques for processing rice are three; the modern, the traditional such as hand pounding, parboiling, soaking, sprouting, parching, etc., and the conventional processes. Hand-pounding is one of the traditional methods of food processing for removing outer layers (husk or hull) of food grains by using mortar and pestle. It involves hand pounding of paddy in a mortar with a pestle, which induces upward and downward forces on grain against the grain that removes the husk and bran layers. The pounding also breaks up the cracked grain. The final cleaning is by winnowing in a woven bamboo tray. The modern rice processing technique consists of the following processes: pre-cleaning, husking, husk aspiration, paddy separation, de-stoning, whitening, and polishing, sifting, length grading, blending, weighing and bagging (Tangpinijkul, 2010).

Rice processing machines are developed to reduce human labour and enhance the quality and nutritional value of rice. The adopted modern rice processing technique, which involves the use of

machines, requires energy through fossil fuel that leads to a high amount of CO_2 in the atmosphere that contributes to global warming. It is a growing concern that the machines and other technologies involved in modern rice processing contribute to climate change in the amount of carbon released annually through fossil fuel use. Developing countries have a primary need to formulate strategies to achieve food self-sufficiency, which is energy efficient (Goyal *et al*., 2014).

In Nigeria, rice is generally processed by small-scale farmers who lack technological know-how as the current Nigerian rice processing sector reflects the combined impact of the traditional and non-traditional rice processing techniques, which is primarily consumed in its parboiled form. It is generally agreed that one of the major constraints that affect the development of the Nigerian rice sector is the inability of the local rice to match the quality of imports (Adegun *et al*., 2012). Paddy processing into rice is considered as the critical point for the determination of the rice quality (Lançon, 2003). Owing to this fact, IFAD promoted modern rice processing techniques in Nigeria to enhance the quality and purity of locally processed rice in six states under the Value Chain Development Programme (VCDP) to meet with the growing demand for rice. This will also play a role in improving the lives of rural women as they dominate the agricultural sector. (Metcho *et al*., 2019).

About 75% of women account for the farming population. (FMARD, 2013). These women are largely involved in the production, processing, and marketing of the agricultural produce and participate actively in harvesting, off-farm activities like processing. In 2014, the National Bureau of Statistics (NBS) revealed through a study that women involved in agricultural activities have increased compared to men, and most of these women carry out the task of off-farm activities such as processing using traditional and rudimentary technologies (Ademilua *et al*., 2017).

As agriculture is being continually influenced by technology, farmers' and processors' ability and willingness to adopt recent agricultural technologies is key to productivity growth, food security, and structural transformation, which in turn reduces poverty and improves the standard of living among people in rural areas. The ability to adapt quickly to external changes will also lead to an increase in climate change as weather events are expected to increase significantly (Adika *et al*., 2018). However, the adoption of the modern methods by farmers is affected by many factors that include: the level of access to modern inputs and resources, profitability, and the extent to which these improved technologies are available. Although, farmers will generally adopt a technology if

it suits their socioeconomic and agro-ecological circumstances irrespective of environmental concerns. Farmers can easily adopt the modern rice processing technique by educating them about the cropping techniques, prices and market conditions, improved rice varieties, optimal input use, and the efficient methods of rice production, storage, and nutrition. This can be achieved by assigning extension agents who can communicate effortlessly with farmers, able to comprehend and solve complex problems, and have good management skills to manage the use of resources efficiently (Adika *et al*., 2018).

This project takes a standard approach to assessing the impact of the IFAD-VCDP promoted modern rice processing techniques on the livelihood of women processors and climate change mitigation in Kontagora and Shiroro, Niger State, Nigeria.

1.2 Problem Statement

Modern rice processing machines such as destoners, which are made of angle iron and sheet metals, vibrating sieves, boilers, and mechanical dryers, all depend on electricity and use diesel, a fossil fuel that contributes to climate change. This is a problem as rice production in the Nigerian rice sector has witnessed a remarkable improvement due to the Federal Government policy ban on rice importation (Metcho *et al*., 2019). The use of fossil fuels in modern rice processing machines contribute to the global problem of climate change which results in changes in rainfall pattern which is by far the most important element of climate change in Nigeria and water resources potential in the country (Adejumo, 2004).

Another constraint of modern rice technologies is the lack of credit and processing facilities. Farmers' low purchasing power for necessary farm inputs reduces the level of adoption of modern rice processing technologies. Other challenges are lack of awareness of modern rice processing machines, inadequate power supply, poor extension services, and conservative attitudes of rice processors (Mustapha *et al*., 2012). As demand for rice continues to grow daily, modern techniques adopted in rice processing need to be properly assessed to know whether they have contributed to climate change or not. Also, the effects of these modern techniques on the livelihood of women processors should be assessed.

1.3 Justification of the Study

Rice processing receives very little attention to meet the country's demand, and it is mostly practiced by small-scale farmers in Nigeria. This had led to a significant increase in rice importation over the decades. The adoption of improved rice processing technologies leads to increased product quality and, thus, higher income to farmers. This could, in turn, lower the market prices of the product; generate greater efficiency and national economic growth. The adoption of modern rice processing techniques can help policy actors, investors, donors, and entrepreneurs to identify the efficient ways of processing rice locally and attract medium or large scale farmers to venture into rice processing. The findings of this research can proffer a greater insight into the nexus between policy actors, market and non-market institutions, poverty reduction, food security, women empowerment, and socio-economic development.

Therefore, it is envisaged and hoped that the findings of this research be useful to rice processors, farmers, academia, and policymakers to identify the needs and address the gaps in adopting modern rice processing in Nigeria. The findings in this research also accentuate the links between the researcher, government agencies, and international organisations, consumers, and the farmers to bolster cooperation, integration, and coordination for effectively improved rice processing and production in Nigeria.

1.4 Research Questions

1) What are the modern processing techniques used in promoting efficient rice production in Niger State?

2) To what extent have the IFAD-VCDP promoted modern rice techniques been adopted by women processors in Niger State?

3) To what extent have the IFAD-VCDP promoted modern rice techniques improved the socio-economic status and livelihood of women processors in Niger State?

4) In what ways are the IFAD-VCDP promoted modern rice techniques, either mitigating or contributing to climate change?

1.5 Objectives of the Study

This internship report aims to assess the impact of the IFAD-VCDP promoted modern rice processing techniques on the livelihood of women processors and climate change mitigation in Kontagora and Shiroro, Niger State, Nigeria.

1.5.1 Specific Objectives

- To describe the socio-economic status of women processors in the study areas
- To identify the rice processing techniques in the study areas.
- To examine the level of adoption of IFAD-VCDP promoted modern rice processing techniques by women processors.
- To determine the perceived impact of IFAD-VCDP promoted modern rice processing techniques on the livelihood of women processors in the study areas.
- To determine the impact of IFAD-VCDP promoted modern rice processing techniques on climate change mitigation.

1.6 **Research Hypothesis**

H1: There is a positive correlation between the IFAD-VCDP promoted modern rice processing techniques and the increase in the livelihood of women processors and climate change.
H0: There is no positive correlation between the IFAD-VCDP promoted modern rice processing techniques and the increase in the livelihood of women processors and climate change.

1.7 **IFAD Operations in Nigeria**

Nigeria is the most populated country in Africa, having over 200 million inhabitants with an annual growth rate of 3%. Approximately 105 million Nigerians (59%) are under the age of 35. Nigeria covers 92.4 million hectares, and 53% of the population lives in rural areas. GDP growth averaged 3.8% a year from 2009 to 2014 as Nigeria became a middle-income country before the economic recession, which slowed down GDP growth in 2016. Amid falling oil prices, security risks, and policy uncertainty, growth subsequently slowed sharply. The Government aims to reduce the overdependence on oil and diversify the economy. Poverty is especially severe in rural areas, at 44.9%. Young people lack economic opportunities, and sporadic civil unrest worsens poverty and

malnutrition. Poor rural women and men depend on agriculture as 70% of rural people are subsistence smallholder farmers who produce 90% of Nigeria's food on un-irrigated plots completely dependent on rainfall (IFAD, 2019).

Agriculture contributed to approximately 23% of gross domestic product (GDP) in 2018 but is underdeveloped because of numerous impediments. Only 46% of arable land is cultivated. Farmers have no title to 95% of agricultural land, so there is a general lack of access to finance or credit facilities to bring about the needed improvement in agriculture. Poor rural roads undermine farm profitability, increases waste, and impedes access to markets, inputs, equipment, and new technology. Rural schools, healthcare, and clean water supplies are inadequate. Land degradation and erosion arising from over-cultivation, deforestation, and overgrazing are increasing, and drought has become common in the north. Since 1985, IFAD has been Nigeria's trusted partner for reducing rural poverty and has invested a total of US$317.6 million in ten projects and programmes in Nigeria, benefiting more than 3,700,000 households. IFAD loans improve outreach, and its impact has led to building the capacity, productivity, and market participation of rural people. In line with IFAD's Strategic Framework 2016-2025, IFAD's approach encourages involvement in reducing rural poverty at all levels of government; sets up and strengthens farmers' organisations; and supports the empowerment of poor rural people, especially women and young people. IFAD's current strategy, in agreement with the Nigerian government, covers the period 2016-2021.

The goal is a rural economy in which those we help can benefit from economic growth, in line with two strategic objectives:

- developing the sustainable, climate-resilient economic and financial inclusion of young people in profitable agribusiness; and
- strengthening institutions at state and community levels to work with private companies in key value chains.

IFAD continues to partner with the Nigerian Government in building rural institutions, establishing community-driven development initiatives, developing profitable smallholder agri-businesses, and pursuing financial inclusion for poor rural households (IFAD, 2019).

Fig 1.1: Researcher checking the Rice Milling Machine at IFAD-VCDP Rice Processing Plant in Kuta, Shiroro LGA, Niger State.

Source: Field Survey, 2019

1.8 **IFAD Value Chain Development Programme in Nigeria**

The IFAD Value Chain Development Programme (VCDP) is a six-year development initiative of the Nigerian Government and IFAD, which is aimed improving cassava and rice value chains in six states viz: Anambra, Benue, Ebonyi, Niger, Ogun and Taraba to address the constraints within the agricultural value chain. Enhancing productivity and providing access to the market for rice and cassava smallholder farmers via Value Chain Development Programme is embedded in the Nigeria Government's plan (IFAD, 2019).

The value chain approach adopted by the Nigerian Federal Government is aimed at concentrating commodity production activities around existing rice mills, which is achieved by organising farmers in groups (Farmers Organizations/cooperatives) to readily access inputs such as improved

seeds, agrochemicals, fertilisers and innovative methods of production from extension services. Intense efforts are being made to achieve self -sufficiency in rice production in Nigeria, in which several bilateral, multilateral agencies, as well as local entrepreneurs, are currently supporting rice production and processing in Nigeria. There is also a commitment to improving the performance of VCDP in the environment and climate change. For instance, VCDP has deployed more smart weather readers, partnered with insurance firms to ensure a total of 4,460 ha of VCDP rice farmers against flood, and provided a well in Niger State to feed an irrigation demonstration plot and propagate plants to overcome erosion on the roads (IFAD, 2019).

Fig 1.2: Researcher at the IFAD-VCDP State Programme Management Unit in Minna, Niger State.

Source: Author, 2019

1.9 **IFAD-VCDP Promoted Rice Processing Technique (False-Bottom Parboiling Technology)**

IFAD-VCDP introduced the improved "false-bottom drum" parboiling technology for rice processing to help women rice processors in Niger state to improve the quality of rice and the

market value. Before the programme, the majority of the women rice processors have to carry their traditionally processed rice to the market and beg people to buy at any price but the intervention of IFAD-VCDP's false bottom technology has led to the availability of a structured market, which has boosted the socioeconomic status of most of the women involved in rice processing (IFAD report, 2016; VCDP, 2017).

False-bottom drum parboiling technology refers to the use of a perforated metal sieve that prevents the paddy from direct contact with the vat bottom. The sieve is placed at the bottom of the vat and a giant lid above it with the water in between. The paddy is placed on top of the sieve. Once the fire is lit and the water begins to boil, vapour goes upward through the sieve to steam the paddy. The resulting parboiled rice is unbroken, clean, and white (VCDP, 2017). The women use de-stoners provided by IFAD-VCDP to remove stones from the milled rice, and a scale to weigh exact quantity into bags. The false bottom parboiling technology was introduced to make locally grown rice in Nigeria compete favourably with imported rice from places like Thailand. For a long time, consumers have developed a taste for the long-grain, clean, parboiled imported rice from Thailand. IFAD, through VCDP, introduced farmers to Faro 44, a rice variety known for its long grains. The women in most local governments in Niger state have a cooperative society. Some of them procured this rice variety from rice growers and used the false bottom technology to make the product market-friendly to meet international quality standards (VCDP, 2017).

IFAD-VCDP, through women rice processors, has improved local rice quality and increased the target for rice production by 55,513 tonnes since the VCDP started implementation in 2015. IFAD-VCDP has also trained more than 50 different women annually on these technologies and provide them with rice processing equipment such as de-stoner, vibrating sieves, boilers, and mechanical dryers. The women were taught how to form and manage cluster-groups and rice value chain development. They were equally groomed in value development at each processing stage and what value addition needed at each stage (IFAD Report, 2016; VCDP, 2017).

Fig 1.3: False Bottom Parboiling technology built by IFAD-VCDP used for Rice Processing in Kuta, Shiroro LGA, Niger State.

Source: Field Survey, 2019

Fig 1.4: Solar Sun dryer machine in the IFAD-VCDP Rice Processing Plant in Argungu, Kotangora LGA, Niger State.

Source: Field Survey, 2019

CHAPTER TWO
MATERIALS AND METHODS

2.0 Introduction

This chapter presented the methodology of the study; it included a description of the research design, study area, data collection methods, sampling procedure and sample size, data collection process, and the analytical framework. The analytical framework was presented per objective to indicate how each objective of the study was achieved.

2.1 Field Methodology, Data, and Sample

2.1.1 Research Study Area

The study was carried out in Niger State, one of the states participating in the VCDP initiative of the FGN and IFAD programme on the improvement of rice and cassava value chains for smallholder farmers. Niger State is in the North Central region of Nigeria. It is the largest state in Nigeria in terms of landmass with its capital in Minna. Other major cities include; Bida, Kontagora, and Suleja. Niger state was formed in 1976 with a total population of 5,556,200 million inhabitants (2016 census) and lay between latitude 80^0 to 11^0 30' North and longitude 03^0 to 07^0 40' East.

The state is bordered at the North by Zamfara State, West by Kebbi State, South by Kogi State, South West by Kwara State, North-East by Kaduna State and southeast by FCT. The State also has an International Boundary with the Republic of Benin along Agwara and Borgu LGAs to the North West. The state is named after the River Niger. Two of Nigeria's major hydroelectric power stations, the Kainji Dam and the Shiroro Dam, are in Niger State. There are three major ethnic groups (Nupe, Gbagyi, and Hausa) in the State, and other tribal groups include Kadara, Koro, Baraba, Kakanda, Gana-Gana, Dibo, Kambari, Kamuku, Pangu, Dukkawa, Gwada, and Ingwai. (Metcho *et al*., 2019).

Agriculture is the primary economic activity of a majority of its citizens, and its economy is based largely on subsistence crops, livestock, internal markets, and export of raw commodities. Over 80% of arable land in Niger State is used for agriculture as it possesses one of the largest and most fertile agricultural lands in the country. Niger State can produce most of Nigeria's staple crops. It also has ample opportunities for grazing, fishing, and forestry (Adika *et al*., 2018).

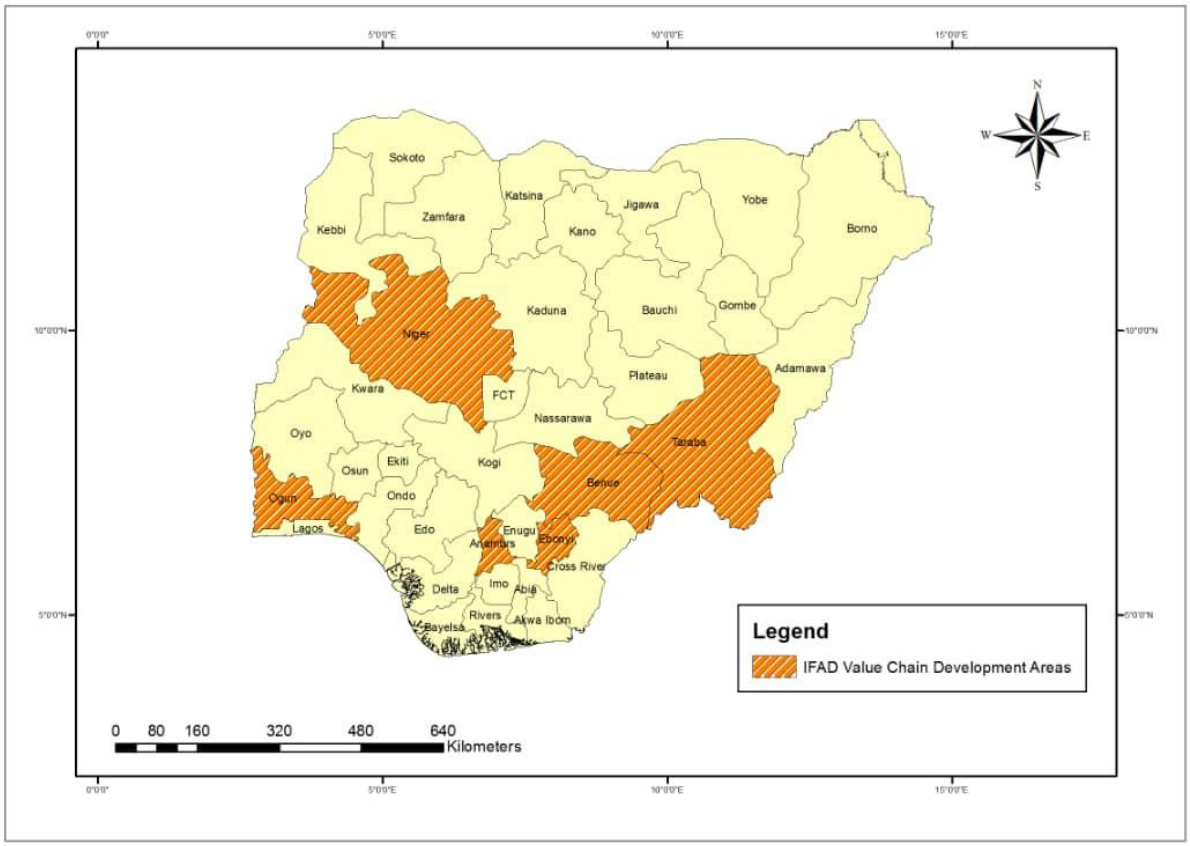

Fig 2.1: Showing the IFAD Value Chain Development Programme areas

Source: IFAD in Nigeria, 2012

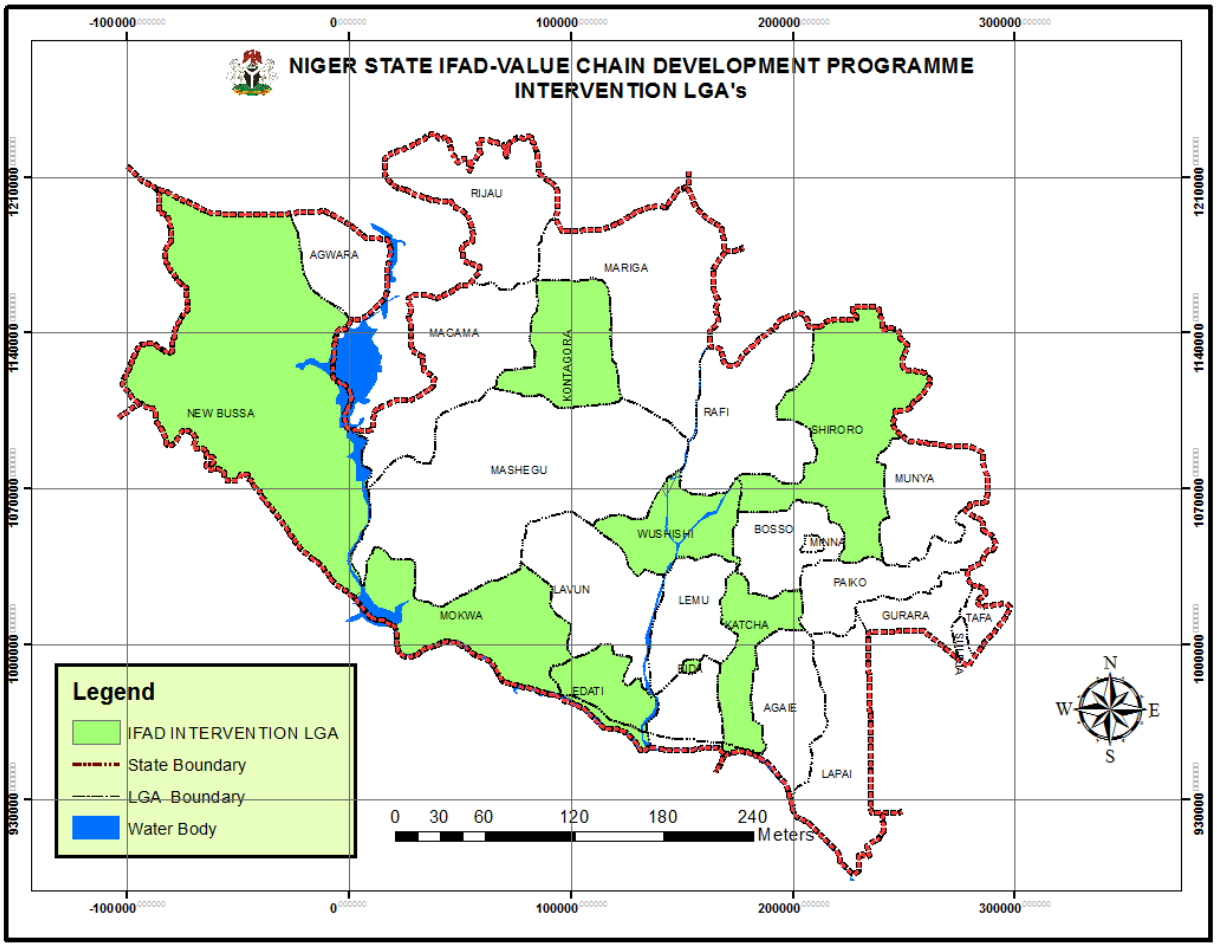

Fig 2.2: Map of Niger State Indicating the study area

Source: Niger State VCDP Minna Office, 2019.

2.1.2 Sampling Technique

A purposive sampling technique was used to select the women rice processors in the two selected LGAs (Kontagora and Shiroro) in Niger State out of the five LGAs participating in the Value Chain Development Programme. The Yamane sampling method calculator was used for this selection by taking a precision level of 4.12%, which also represents 27% of the study population. The total sample size used for the study was 165 respondents, 85 and 80 respondents in Kotangora and Shiroro LGAs, respectively from a total population size of 616 women rice processors. The

respondents were randomly selected from the two LGAs based on their sample size using probability proportional to size (PPS) sampling technique to administer the questionnaires.

(i) Yamane method

$$n = \frac{N}{1+Ne^2}$$

Where

n = sample size

N = Total population of rice processors

e = error term

2.1.3 Data Collection

The study used both primary and secondary sources of data. Primary data were sourced through a structured questionnaire, Key Informant Interview (KII) and Focused Group Discussions (FGD) with the rice processors on issues relating to the study objectives. Also, a group of government bodies that have oversight functions on the Value Chain Development Project participated in Focused Group Discussions while the community leaders in both LGAs were approached as a key informant. The primary data collected was supplemented with secondary data obtained through publications, VCDP progress report, Ministry of Agriculture, policy documents and past research findings on adoption and impact of modern rice processing techniques.

2.1.4 Training of Enumerators and Questionnaire Pretesting

The researcher collected data with the help of eight enumerators. The enumerators were trained for a day to master the research and the data collection tools, using the open data kit (ODK), which is web-related, using android phones. This was so to minimize human errors and to check for data quality. Questionnaires were pretested for one day to ensure that wording and coding matched field situations. The tested questionnaires were used for corrections and production of final questionnaires into the ODK server to collect household data.

Fig 2.3: Showing how enumerators are trained on the use of administering questionnaires through the ODK server at IFAD-VCDP Office in Minna.

Source: Author, 2019

Fig 2.4: Researcher at the IFAD-VCDP Rice Processing Plant during data collection in Argungu, Kotangora LGA, Niger State.

Source: Field Survey, 2019

Fig 2.5: Destoner machine used to remove stones from rice inside the IFAD-VCDP Rice Processing Plant in Argungu, Kotangora LGA, Niger State.

Source: Field Survey, 2019

2.1.5 Analytical Techniques

Table 2.1.5: Analysis of objective, data collection, and method of analysis.

S/N	Objectives	Data Collection	Method Of Analysis
1	To describe the socio-economic status of women processors in the study areas.	Questionnaire and Key Informant Interview	Frequencies, Percentages, and Means
2	To identify the modern rice processing techniques on the by IFAD-VCDP in the study areas.	Questionnaire, Key Informant Interview, and Focus Group Discussion.	Frequencies, Percentages, and Means
3	To examine the level of adoption of IFAD-VCDP promoted modern rice processing techniques by women processors.	Questionnaire, Key Informant Interview, and Focus Group Discussion.	Frequencies, Percentages, and Means
4	To determine the impact of IFAD-VCDP promoted modern rice processing techniques on the livelihood of women processors.	Questionnaire, Key Informant Interview, and Focus Group Discussion.	Frequencies, Percentages, Means and t-test
5	To determine the impact of IFAD-VCDP promoted modern rice processing techniques on climate change mitigation	Questionnaire, Key Informant Interview, and Focus Group Discussion.	Frequencies, Percentages, and Means

CHAPTER THREE

RESULTS AND DISCUSSION

3.1 Socio-economic Status of the Women Rice Processors in the Study Area

The result of the socio-economic distribution is presented in the tables below. This indicates the information about age, marital status, household size, and educational status of respondents.

3.1.1 Ages of the respondents

The results in Table 3.1 showed that most of the respondents (61.88%) were aged between 31 – 40 years with the mean age of about 37 years. This implies that the majority of the sampled women rice processors were at the middle age and are economically active and likely to adopt new technologies more than those in higher age brackets. The age of the respondents is very important in influencing their level of agricultural innovations, such as improved rice processing techniques.

3.1.2 Household sizes of the respondents

As shown in Table 3.1, most of the women rice processors in the study areas have their household sizes between 6-10 persons with an average mean of 8 persons. The household size is important as it could greatly impact on the welfare and standard of living of the family. Women rice processors with small household size could have a better per capita standard of living than those with large household size. However, large household size could also enhance the provision of a cheap source of labour for agricultural activities.

Table 3.1: Distribution of respondents according to their socio-economic status

Socio-economic variable	Frequency (n=160)	Percentage	Average
Age (years)			37.00
Less than 31	30	18.75	
31 to 40	99	61.88	
41 to 50	25	15.63	
Above 50	6	3.75	
Household size (number)			8.00
1 to 5	47	29.38	
6 to 10	85	53.13	
Above 10	28	17.50	

Source: Field survey 2019

3.1.3 Marital status of the respondents

The result presented in Figure 3.1 shows that majority (83.75%) of the respondents were married. Others were single, divorced, separated, or widowed. Since the larger percentage of the respondents was married, the family sizes would probably increase and thereby enhancing or inhibit their standard of living as well as enhance their interest in the adoption of modern rice processing techniques.

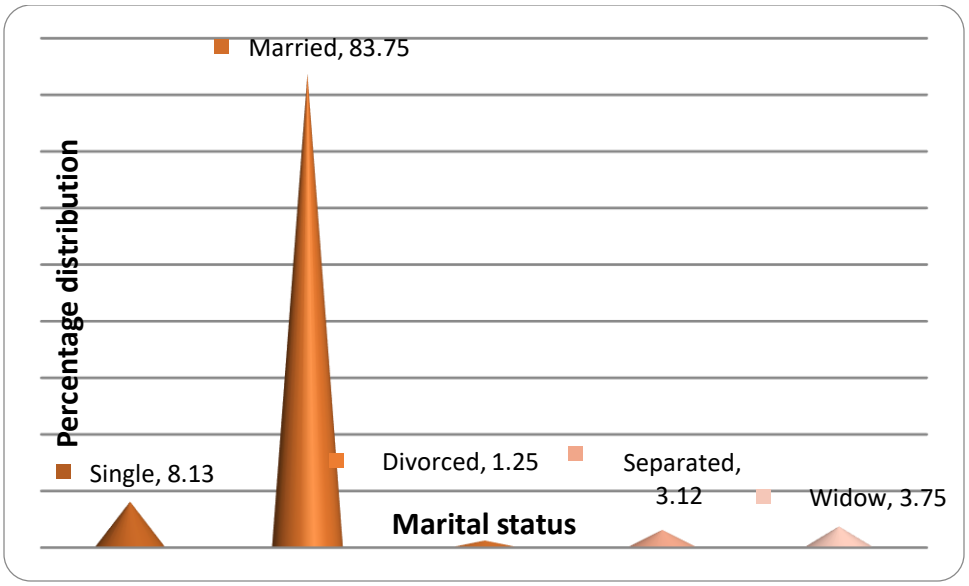

Fig 3.1: Distribution of respondents according to their marital status

3.1.4 Educational status of the respondents

As shown in Figure 3.2 showed that the majority of the respondents (61.87%) had at least primary education and only a few (23.13%) of them had no education at all, and 15% had Quranic education. It was observed that most of the respondents had one form of formal education or the other from primary level (41.88%) to secondary (16.25%) and tertiary level (3.74%). It can be seen that the literacy level of the rice processing households in the study area was relatively moderate. Formal education is a vital variable that can enhance the chance of farmers to accept modern agricultural technologies especially processing techniques.

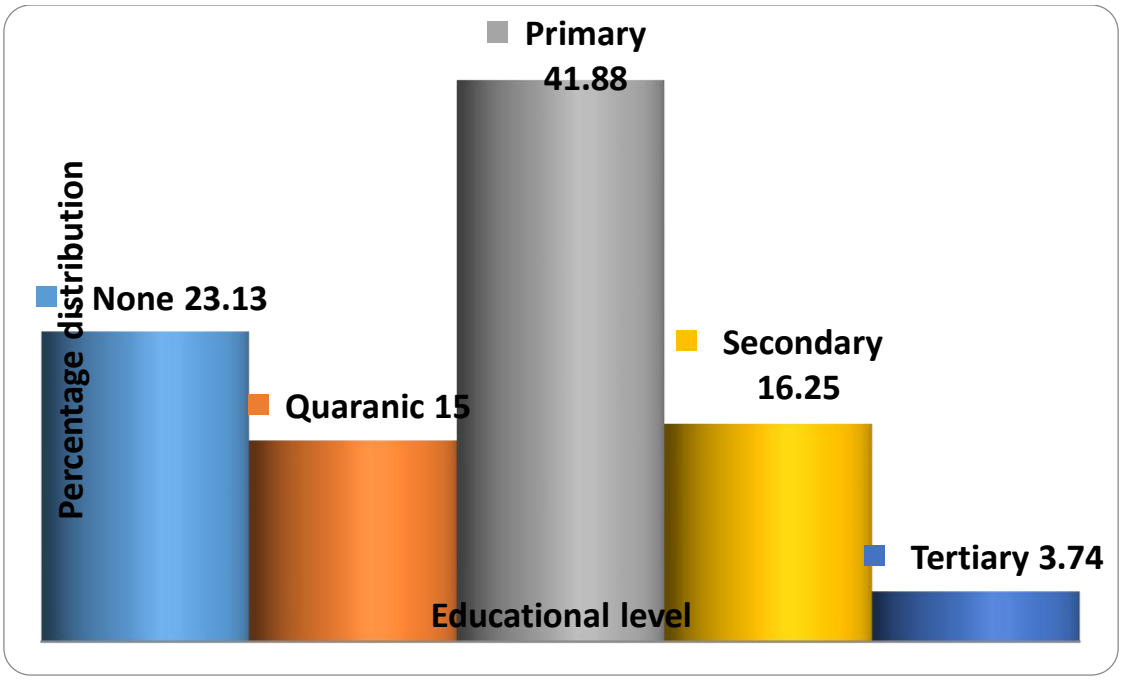

Fig 3.2: Distribution of respondents according to their level of education

3.2 Rice Processing Techniques in the Study Area

The result presented in Table 3.2 showed the type of rice processing techniques employed by the women rice processors in the study area. The dry processing technique ranked first above others, as 90.63% of the respondents indicated that they use this method. This was followed by parboiling, and steaming techniques as 80% and 65.63% of the respondents respectively indicated that they use these techniques. The wet processing technique was the least used as it ranked 4th as only 14.38% of them indicated that they use the method.

Table 3.2: Rice Processing Techniques in the Study Area

Rice processing technique	*Frequency	Percentage	Ranking
Dry processing	145	90.63	1st
Parboiling	128	80.00	2nd
Steaming	105	65.63	3rd
Wet processing	23	14.38	4th

Source: Field survey 2019

3.3 Perceived Impact of IFAD-VCDP Promoted Modern Rice Processing Techniques on the Livelihood of Women Rice Processors in the Study Area

The primary aim of the funded intervention programmes/projects is to improve the livelihood of the target beneficiaries. IFAD-VCDP is one of many donor agencies with a mandate to improve the livelihoods of rural farmers and other agro-based enterprise operators in Niger State and Nigeria as a whole. The result presented in Table 4.3.1 showed the perception of the respondents on the impact of IFAD-VCDP intervention on their livelihood and specifically on their financial status, source of water, distance to the water source, and source of energy. For the respondents' financial status, the result showed that 48.75% and 30.63%, which constitute the majority were struggling and barely comfortable respectively before the intervention. However, after receiving intervention, majority of them, 68.75% and 27.50% indicated that they had become comfortable and very comfortable, respectively. This could be attributed to the positive impact of IFAD-VCDP on the processing activities.

Similarly, the major source of water for most of the respondents was stream/river (47.50%) and protected well (50.63%), respectively, before IFAD intervention. After the intervention, an overwhelming majority of the respondents (99.38%) had access to borehole water because IFAD provided boreholes provided at a distance less than 100m from the processing plants in both study areas. This implies a positive impact of IFAD-VCDP intervention on the respondents.

Furthermore, most of the respondents (91.3%) had to trek more than 200m to have access to water before the intervention. However, the distance had significantly reduced as the majority of them (88.75%) now had water close to them within just 100m. This may not be unconnected with the provision of borehole water by IFAD-VCDP in the beneficiaries' communities. This also implies a positive impact of the intervention on the livelihood of the women rice processors in the study area.

The majority (94.38%) of the respondents relied on firewood as the major source of energy for their rice processing activities before IFAD intervention. However, after the IFAD-VCDP intervention with the provision of modern processing tools and also training on modern rice processing techniques, a handful of the women processors (21.25%) now use charcoal and (23.75%) use petrol, diesel, and biodiesel as sources of energy for their processing activities. This could be attributed to the positive intervention of IFAD-VCDP on the livelihood of the respondents because IFAD-VCDP provided milling machines that use petrol, diesel, and biodiesel as fuel.

Table 3.3.1 Perceived impact of IFAD-VCDP promoted processing techniques on the livelihood of the respondents

Area of livelihood	Before IFAD-VCDP intervention	After IFAD-VCDP intervention
Finance		
Struggling	78 (48.75)	-
Barely comfortable	49 (30.63)	5 (3.13)
Indifference	25 (15.63)	1 (0.62)
Comfortable	7 (4.37)	110 (68.75)
Very comfortable	1 (0.62)	44 (27.50)
Source of water		
Stream/River	76 (47.50)	-
Rain	2 (1.25)	-
Protected well	81 (50.63)	1 (0.62)
Pump	1 (0.62)	-
Borehole	-	159 (99.38)
Distance to the source of water		
Less than 100m	23 (14.38)	142 (88.75)
101m to 200m	42 (26.25)	18 (11.25)
201m to 300m	48 (30.00)	

301m to 400m	11 (6.87)	
Above 400m	36 (22.50)	
Source of energy		
Firewood	151 (94.38)	88 (55.00)
Charcoal	3 (1.88)	34 (21.25)
Fuel	6 (3.75)	38 (23.75)

Source: Field survey 2019

The result presented in Table 3.3.2 showed the estimated average value of the quantity of rice processed per day by the respondents before and after IFAD-VCDP intervention in the area. It revealed that the mean difference of 490.30kg was recorded and statistically significant at 1% level of significance. This implies that there is a 5% increase in the quantity of rice processed by the women from 372.33kg/day to 872.63kg/day. This increase could be attributed to the impact of IFAD-VCDP promoted modern rice techniques on women rice processors.

Table 3.3.2: Impact of IFAD-VCDP promoted processing machines on the livelihood of the respondents

Indicator	**Mean value (kg/day)**	**t-value**
Quantity of rice processed before IFAD-VCDP	372.33	
Quantity of rice processed after IFAD-VCDP	872.63	
Difference	490.30	4.39***

Source: Field survey 2019

The result presented in Table 3.3.3 showed that in terms of perceived benefits, the respondents ranked improved rice price and marketability the highest (78.13%) while the subsidised cost of processing equipment ranked the second (72.50%). This implies that the matching grant mechanism has really improved the beneficiaries' processing activities, while the provision of destoners ranked the third (67.50%), indicating that the availability of modern processing equipment has improved the processing activities of the beneficiaries.

Table 3.3.3: Respondents' benefits from the IFAD-VCDP intervention in rice processing in the study area

Factors	*Frequency	Percentage	Rank
Improved rice price and marketability	125	78.13	1st
Subsidized cost of processing equipment	116	72.50	2nd
Provision of de-stoners	108	67.50	3rd
Provision of parboilers	71	44.38	4th
Provision of polisher	4	2.50	5th
Provision of rice colour sorter and graders	1	0.63	6th

Source: Field survey 2019

As shown in Table 3.3.4, the majority (90.63%) of the respondents received training on rice quality and marketing programmes, while 64.38% received training on modern rice equipment usage and (51.88%) received training on pollution in rice systems.

Table 3.3.4: Type of training received by the rice processors in the study area

Type of training	*Frequency	Percentage	Rank
Rice quality and marketing programmes	145	90.63	1st
Modern rice equipment usage	103	64.38	2nd
Pollution in rice systems	83	51.88	3rd
Controlling rice diseases through rice quality management	35	21.88	4th

Source: Field survey 2019

3.4 Factors Affecting the Level of Adoption of Modern Rice Processing Techniques

The result presented Table 4.4 revealed that majority (98.75%) of the respondents complained of lack of electricity, while 56.25% complained of lack of finance for various inputs, this, of course, will slow down processors to easily adopt modern rice processing technologies. Therefore, increased access to finance should be a major part of efforts aimed at promoting the adoption of modern processing technologies. Only very few (38.75%) complained of lack of expertise on the repair of machinery while 20% and 16.88% of the respondents complained of inadequate storage facilities and poor water supply respectively.

Table 3.4: Factors affecting modern rice processing techniques in the study area

Factors	*Frequency	Percentage	Mean rank
Lack of electricity	158	98.75	1st
Inadequate finance	90	56.25	2nd
Lack of expertise	62	38.75	3rd
Inadequate storage facilities	32	20.00	4th
Poor water supply	27	16.88	5th

CHAPTER FOUR

4.0 SUMMARY, CONCLUSION AND RECOMMENDATIONS

4.1 SUMMARY

This study assessed the impact of the IFAD-VCDP promoted modern rice processing techniques on the livelihood of women rice processors and climate change mitigation in Niger State, Nigeria. The study analysed the socio-economic characteristics of women rice processors in the selected LGAs, the modern rice processing techniques in the study area, the level of adoption of these modern rice processing techniques by women rice processors and the perceived impact of IFAD-VCDP on the livelihood of women rice processors and climate mitigation.

A purposive sampling technique was adopted, and the Yamane method of data collection was used to determine the selected 165 respondents. Both primary and secondary sources of data were used for data collection, and descriptive and inferential statistics were used as methods of analysis. The results showed that most of the respondents were between ages 31-40 years with the mean age of about 37 years, and most have their household sizes between 6-10 persons. 83.75% of the women rice processors were married, and 61.87% had at least primary education. The results also showed great positive impact on the position of the respondents especially on their financial status, source of water, distance to water and source of energy through IFAD-VCDP intervention as 99.38% now have access to borehole water. 68.75% and 27.50% of the respondents indicated that they are now financially comfortable and very comfortable, respectively. A handful of the women processors (21.25%) now use charcoal and (23.75%) use petrol, diesel and biodiesel as sources of energy for their processing activities. However, some of the women have not fully adopted the modern processing techniques as most (55.00%) of them still make use of firewood as their source of energy. This calls for more awareness and follow-up training on the modern processing techniques in the beneficiaries' communities.

Consequently, lack of electricity and inadequate finance for various inputs slow down rice processors to easily adopt modern rice processing technologies.

4.2 **Conclusion**

It was concluded from this study that IFAD-VCDP intervention through the provision of infrastructures and modern rice processing equipment had increased the quantity and quality of milled rice. It is a formidable step towards reducing poverty and hunger in Niger State, especially with rapid population growth rates. This is based on the fact that IFAD-VCDP intervention in the study area has a positive and significant impact on poverty reduction. Also, the modern rice processing machines (solar dryers and biofuel milling machines) and tools (smart climate readers) provided by IFAD-VCDP has led to climate change mitigation.

4.3 **Recommendations**

The creation of awareness and persuading rural women rice processors to practice more of false bottom techniques and the use of modern processing equipment would lead to an increase in processing and income will reduce poverty. Women rice processors can only adopt modern agricultural technologies if they are aware of the availability and benefits of these technologies and their inherent characteristics (Adegbola and Gardebroek, 2007).

The recommendations are as follows:

1. There should be more training and creation of public awareness on the availability, benefits, and adoption of modern rice processing techniques.

2. More climate-smart technologies and efficient fuels should be encouraged and used in rice processing sectors.

3. Rice colour sorters, graders, and polishers should be made available for women rice processors to further increase the quality of locally made rice in Niger State.

4. Adequate financing should be made for women rice processors through cooperatives and associations.

5. More partnerships should be established by both federal and state governments that can benefit livelihood programs in Nigeria.

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APPENDIX: QUESTIONNAIRE DESIGN

Dear respondent,

I am Adeola Adelayo Adediran, a Master's degree student at the Center for Sustainable Development (CESDEV), University of Ibadan, Nigeria. I am currently carrying out a research project on the impact of IFAD-VCDP promoted modern rice processing techniques on the livelihood of women processors and climate change mitigation in Niger state. I seek your opinion on the questions below. You are not required to give your name. The information you give will remain confidential and will not be revealed to a third party. Thank you for your response.

Adeola Adediran
Matric No: 208810

Section A: Demographic and Socioeconomic Characteristics of the Respondent

1. Age in years …….

2. Education level completed

☐ Primary School ☐ Secondary School ☐ Polytechnic/ College of Education

☐ University ☐ None

☐ Others, please specify ……

3. Marital status ☐ Married ☐ Single ☐ Divorced ☐ Separated ☐Widow/Widower

4. Household Size ☐ 1-3 ☐ 4-6 ☐ 7-9 ☐ More than 9

5. Do you belong to a co-operative society? Yes ☐ No ☐

Section B: Accessing Modern Rice Processing Techniques in Area and Impact on Climate Change Mitigation.

6. Which of the primary ways of processing rice have you adopted? (Please tick as many options are as applicable)

☐ Dry processing ☐ Wet processing ☐ Parboiling

☐ Others, please specify ……

7. What quantity of rice were you processing per day before IFAD intervention?

☐ < or = 25 kg ☐ 50 kg ☐ > 50kg

8. What quantity of rice are you processing per day after IFAD intervention?

☐ < or = 25 kg ☐ 50 kg ☐ > 50kg

9. What was your primary source of water supply for rice processing before IFAD intervention?
☐ Protected Well water ☐ Borehole ☐ Stream or River ☐ Rain ☐ Pump
10. What is your primary source of water supply for rice processing after IFAD intervention?
☐ Protected Well water ☐ Borehole ☐ Stream or River ☐ Rain ☐ Pump
11. What was your primary source of energy for rice processing before IFAD intervention?

☐ Firewood ☐ Charcoal ☐ Kerosene ☐ Fuel ☐ Brigitte

☐ Others, please specify ……

12. What is your primary source of energy for rice processing after IFAD intervention?

☐ Firewood ☐ Charcoal ☐ Kerosene ☐ Fuel ☐ Brigitte

☐ Others, please specify ……

13. Do you have enough water for rice processing? ☐ Yes ☐ No

14. How far was the major source of water to the processing plant before IFAD intervention?

☐ < 100 meters ☐ < 200 meters ☐ < 300 meters ☐< 400 meters

☐ 500m – 1 km ☐ > 1 km

15. How far is the major source of water to the processing plant after IFAD intervention?

☐ < 100 meters ☐ < 200 meters ☐ < 300 meters ☐< 400 meters

☐ 500m – 1 km ☐ > 1 km

16. Do you pay for electricity? ☐ Yes ☐ No

17. Do you have sufficient electricity for rice processing? ☐ Yes ☐ No

18. For how many hours do you have electricity supply per day? ☐ <4 hours ☐ 6-8hours

☐ 12 hours ☐ > 12 hours

19. How clean and suitable for consumption is the rice that you process?

☐ Extremely clean ☐ Very clean ☐ Somewhat clean ☐ Not so clean

☐ Not at all clean

20. Have you suffered from any of the following diseases in the last three years?

☐ Diabetes ☐ Diarrhea ☐ Hepatitis ☐ Cholera ☐ Dysentery ☐ Typhoid Fever

21. What is the size of land available for you to carry out agricultural processing activities?

☐ < 1 hectare ☐ 2-3 hectares ☐ > 3 hectares

22. What is the main fuel used in IFAD-promoted modern machines for rice processing?

☐ Diesel ☐ Petrol ☐ Biodiesel ☐ Natural Gas

23. How often do you buy fuel for rice processing? ☐ Never ☐ Always ☐ Sometimes ☐ Barely

24. On a scale of 1-5, how would you rate the heat and energy intensity of the use of IFAD-promoted modern machines? (Note: 1 = Poor, 2 = Fair, 3 = Good, 4 = Very Good, 5= Excellent)

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

SECTION C: Impact of the activities of IFAD-VCDP promoted modern rice processing techniques on the socio-economic status and livelihood of respondents.

25. In what way(s) has the IFAD-VCDP initiative contributed to the improvements in the rice processing in your household? (Please tick as many options as are applicable).

☐ Provided rice de-stoners ☐ Provided parboilers

☐ Provided manual sprayers ☐ Provided rice colour sorter and graders

☐ Subsidized cost of rice processing equipment ☐ Improved rice price and marketability

☐ Others, please specify ……

26. On a scale of 1-5, rate the quality of rice processed in your area since the IFAD-VCDP initiative started? (Note: 1 = Poor, 2 = Fair, 3 = Good, 4 = Very Good, 5= Excellent)

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

27. Have you received any training on how to improve rice processing? ☐ Yes ☐ No

27b. If yes, what type of training?

☐ Rice Quality and Marketing Programs ☐ Modern Rice Equipment Training

☐ Rice Pollution in Rice Systems Training ☐ Controlling Rice Diseases through Rice Quality Management Training

☐ Others, please specify ……

28. Have you benefitted from any modern rice processing technology developed? ☐ Yes ☐ No

29. Have you ever received any loan through the IFAD-VCDP initiative? ☐ Yes ☐ No

30. If yes, how long have you had access to the loan? ☐ 3years ☐ 4 years ☐ 5years ☐ 6 years

31. How financially comfortable were you before benefitting from the IFAD-VCDP initiative?

☐ Very Comfortable ☐ Comfortable ☐ Barely Comfortable ☐ Struggling ☐ I cannot say

32. How financially comfortable were you after benefitting from the IFAD-VCDP initiative?

☐ Very Comfortable ☐ Comfortable ☐ Barely Comfortable ☐ Struggling ☐ I cannot say

33. What is your perception of the impact of the IFAD-VCDP initiative in your community?

☐ Very good ☐ Good ☐ Not good ☐ I cannot say

34. On a scale of 1-5, how would you rate your experience with the IFAD-VCDP initiative and its impact on rice processing? (Note: 1 = Poor, 2 = Fair, 3 = Good, 4 = Very Good, 5= Excellent)

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Section D: Level of adoption of IFAD-promoted modern rice processing techniques by women processors.

35. How often do you use IFAD-promoted modern rice processing machines?

☐ Never ☐ Always ☐ Sometimes ☐ Barely

36. How often do you have access to IFAD-Promoted modern rice processing equipment?

☐ Never ☐ Always ☐ Sometimes ☐ Barely

37. Which of the factor(s) affect the use of modern machines for rice processing? (Please, tick as many options are as applicable)

☐ Lack of electricity ☐ Poor water supply ☐ Lack of expertise ☐ Lack of storage facilities

☐ Lack of finance

☐ Others, please specify ……

38. On a scale of 1-5, would you say the IFAD-promoted modern rice processing technologies are effective? (Note: 1 = Poor, 2 = Fair, 3 = Good, 4 = Very Good, 5= Excellent)

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

39. Do you package your product? ☐ Yes ☐ No

40. Do you have a certified product? ☐ Yes ☐ No

Section E: Climate Change Mitigation

41. Do you experience low temperatures in the drying process after parboiling/ steaming?

☐ Yes ☐ No

42. Do you experience high temperatures in the drying process after parboiling/ steaming?

☐ Yes ☐ No

43. Do you have access to smart weather readers? ☐ Yes ☐ No

44. If yes, how often do you use it in a week? ☐ All the time ☐ Sometimes ☐ Occasionally ☐ Barely