ASSESSMENT OF EFFICIENT UTILIZATION OF PRODUCTION INPUTS AMONG WOMEN RICE FARMERS IN NIGER STATE, NIGERIA

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ABSTRACT

The study assessed the efficient utilization of production inputs among women rice farmers in Niger State, Nigeria. A multi-stage sampling procedure was used to select 195 women rice farmers and data collected through structured questionnaire were analysed using frequency distribution, means, percentages, Cobb-Douglass production function and resource-use efficiency model. Results obtained show that respondents in the study area were mostly in their productive age (36 years, averagely), married (86.7%) with formal education (63.6%) and household size of 6 persons averagely. The respondents mostly utilized fertilizer ($\overline{X}$=142.6kg/ha), seed ($\overline{X}$=31.4kg/ha) and agrochemicals ($\overline{X}$=1.3 litres/ha). The farmlands were relatively small with mean of 1.2 hectares and mean labour usage of 53 man-days in rice production. The efficient utilization of production inputs was influenced by Labour (1.67), fertilizers (2.17), seed (-2.91) and agrochemicals (-1.68) with MVP to MPC ratios less than unity for land (0.31), labour (0.16) and agrochemicals (0.20), equal to unity for seed (1) and greater than unity for fertilizer application (1.5). Tobit regression analysis result on the determinants of efficient utilization of production inputs showed that formal education (2.14), household size (-2.07), extension contact (1.66), goal of farming (-1.84) and access to credit (1.72) significantly influenced efficient utilization of production inputs. The pseudo R^2 value of 0.5260, thus implying that the model had strong explanatory power for this analysis. However, women participation in rice production were constrained by high costs of production inputs ($\overline{X}$=2.64), inadequate inputs supply ($\overline{X}$=2.55), difficulty in accessing loans by women farmers ($\overline{X}$=2.53), poor transport network ($\overline{X}$=2.48), lack of transport facilities ($\overline{X}$=2.47) and pest and diseases ($\overline{X}$=2.45 ranked among the top six (6) prominent constraint faced by the women in the study area. The production resources in the study area were found not to be efficiently utilized since most of the production inputs were either over or under-utilized. It is therefore recommended that for optimal use of resources in rice production, quantities of fertilizer application should be increased while land, labour and agrochemicals should be reduced.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background of the study

Women's work in agriculture has become more visible as their involvement in agricultural production has deepened in response to the economic opportunities in commercial agriculture and the rising need for them to provide for the household. Rural women play significant role in the production of food and cash crops and manage agricultural operations, involving crops, livestock and fish farming and are considered as part of the agricultural labour force (Food and Agriculture Organization (FAO), 2011). Rural women are also known to be involved in all farming operations such as planting, tinning, weeding, fertilizer application, harvesting, storing, processing and marketing. However, despite their increased involvement in agriculture, significant differences have been identified in the level of productivity of men and women (Lastarria-corhiel, 2006).

Agricultural inputs are the key considerations in the production of food for better livelihood. Rural households negotiate their livelihoods by obtaining access to agricultural inputs; land, labour and capital which lead to enhanced family wellbeing and sustainable use of these inputs (Anaglo *et al*., 2014). Without access to these (as is usual with rural women farmers), it is unlikely that production and income earning capacities can be improved on a sustainable basis. Adequate access to agricultural inputs among women farmers is needful if food production rates are to be enhanced in Nigeria especially given the increasing deficit in the food demand and supply gap in the country resulting from population growth exceeding food production growth (Satyavathi *et al.,* 2010). There is an increasing recognition that ownership, access and control over crop production resources constitutes critical elements in the determination of the well-being of farm households.

Rice (*Oryza spp*) is a cereal crop which has become a staple food of considerable importance in many African countries, where its consumption among urban and rural poor households has increased considerably (West African Rice Development Association (WARDA), 2010). Rice is the second most important cereal crop in the world after wheat in terms of production (Okali, 2011). Nigeria ranks the highest as both producer and consumer of rice in the West Africa sub-region (Beke, 2011). Nigeria has a rich history of rice production and consumption, as indigenous rice species (*Oryza glaberima*) have been grown in Nigeria for years (WARDA, 2010). Rice has overtime developed into a major staple crop in the Nigerian diet, with a demand profile cutting across all regions. A variety of other factors have also cont ributed to this increased demand including rapid urbanization, acceleration in the population growth rate, increase in per capita income, and changes in family occupational structures (Damola, 2010).

Rural women farmers are important for increasing rice production and productivity. The role of women in Nigeria economic sector cannot be over emphasized. Women are the real driving force of the nation's economy and are therefore crucial to the sustainable development of the country (Satyavathi *et al.,* 2010). Although, rural women in some parts of Nigeria worked side by side with men in agricultural production with some marked division of labour among them. The role that women play and their position in meeting the challenges of agricultural production and development are quite dominant and prominent. Women have been the core subject of gender and 'gender issues' has been widely used to refer to disadvantages faced by women in the field of agriculture despite the theoretical meaning of gender as roles of males and females (Okali, 2011).

According to Bill and Melinda Gates Foundation (2012), women in sub-Saharan Africa constituted about 80% of the farm labour with better efficiency. Efficiency in today's farming enterprise is a very important factor for productivity growth. In an economy where opportunities to use new technologies are limited. Efficiency study will indicate the possibility to increase productivity by reducing inefficiency without necessarily developing new technologies or increasing the resource base (Damola, 2010).

1.2 Statement of the Research Problem

Rural women have featured prominently in rice production enterprise, specifically; up to 70% of the rice produced in Africa comes from women (FAO, 2011). In Nigeria, women are considered 'work-horse' in rice production. They are responsible for 60% of the National produce (NBS, 2016). In Niger State, rice is traditionally regarded as a product of women. Women living in this area are having high knowledge about traditional farming methods of rice production. However, low productivity coupled with stiff competition posed by importers over the years has restrained the women farmers from earning significant returns from their investment and this has created rice production deficit (Merem *et al*., 2017). To minimize the effect of the rice production shortfalls on state demand, several efforts have been made by successive governments together with donor partners in a form of implemented projects to increase rice production.

In spite of all efforts, national and state average of rice production is relatively low compared to the expected annual yield. The gap between achievable yields under best farming practices and actual yields of rice ranges from 5.7 to 7 million metric tonnes (National Bureau of Statistics (NBS), 2016). By implication, rice importation in Niger State is still on the high side (545,700 metric tonnes yearly). This result has left so much to be desired on women's effort in rice production hence calls for the need to increase production using productivity enhancing approach such as the use of improved rice seed, fertilizer and reduce technical

inefficiency. Effort to increase rice productivity and decrease resource-use inefficiency over the years has proved ineffective due to limiting factors such as: inadequate institutional support (access to credit, research and extension), inappropriate production system, inadequate basic infrastructures, production risk and inefficiency on the part of the farmers (Yiadom-Boakye *et al*., 2013).

In the mist of rice production challenges, national and state ministry of agriculture has outlined projections to double rice cultivation to reduce importation. The central question is; can women rice farmers improve on their technical efficiency to reduce production risk and help increase rice output? Over the years, many researchers and policy makers in Nigeria have focused their attention on the impact that technologies adoption have on increasing farm productivity and income (Ani, 2004; Fabiyi, 2007; Damisa and Yohanna, 2007; Ragasa *et al*., 2013). Thus, little literature exists on the efficiency of rural women utilization of production resources in rice farming. In light of this assertion, this study seeks to assess rural women efficiency in the utilization of rice production inputs in Niger State, Nigeria. Thus, the study aimed to answer the following research questions:

i. what are the socio-economic characteristics of women rice farmers in the study area?
ii. what are the extent of production inputs utilized by women rice farmers in the study area?
iii. what is the efficient utilization of production inputs among women rice farmers in the study area?
iv. what are the determinants of efficient utilization of production inputs among women rice farmers in the study area?
v. what are the constraints associated with utilization of rice production inputs in the study area?

1.3 Aim and Objectives of the study

The aim of this study is to assess the efficient utilization of production inputs among women rice farmer in Niger State.

The specific objectives were to:

i. describe the socio-economic characteristics of women rice farmers in the study area;
ii. examine the extent of production inputs utilized by women rice farmers in the study area;
iii. determine the efficient utilization of production inputs among women rice farmers;
iv. examine the determinants of efficient utilization of production inputs among women rice farmers;
v. examine the constraint associated with utilization of production inputs among women rice farmers

1.4 Hypothesis of the study

The null hypothesis that was tested for this study were;

$H0_1$: there is no significant relationship between selected socio-economic characteristics of women rice farmers and efficiency of inputs utilization in rice production.

1.5 Justification of the Study

Investments in rice sector have been rising over the years as government and donor partners' commitment to finance rice projects to increase productivity surges on. The ability of women rice farmers to increase productivity and reduce national imports depends on their level of technical efficiency as well as the knowledge and ability to reduce risk associated with inputs utilization. Thus, the study will help to identify the relevant variables within the socioeconomic, institutional and managerial factors that can improve the efficiency of rice farmers in the study area.

To this end, the study seeks to assess rural women's efficiency in the utilization of rice production inputs in Niger State, Nigeria. Therefore, description of the socio-economic characteristics of women rice farmers will provide guide to relevant authorities for the development of relevant policies that are in line with farmers' social needs which will contribute to women efficiency in resources utilization. The result on the extent of inputs utilization and determinants of the extent of inputs utilization will serve as a veritable tool for policy makers and input suppliers in formulating policies that will favour women in accessing and utilizing production inputs.

Furthermore, the result on the efficiency of input utilization will also assist women in the study area to identify the need for effective and efficient utilization of production inputs in other to increase their productivity. The findings on the constraints to efficient utilization of production resources will also be useful to agricultural project/programme planners and implementers, donor agencies, project/programme supervising agencies, researchers and the general public in providing accessible solutions that could enhance women rice farmers' productivity. Generally, the empirical results will serve as reference to other researchers by providing a basis upon which further studies can be conducted and as such a contribution to the existing knowledge of the subject matter.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Socio-economic Factors Influencing Efficient Utilization of Production Inputs

Farmers' socio-economic characteristics are among the most common variables associated with input adoption behaviour. It plays an important role in creating awareness and knowledge as they influence decision and level of input utilization for agricultural production (Barungi *et al.,* 2013). Some of the socioeconomic characteristics of the farmers which may affect their level of input utilization and efficiency include: age, gender, education, land ownership, farm size, types of labour, access to farm inputs, access to credit, access to extension services, farming experience and household size. For this study, the following characteristics were reviewed:

2.1.1 Age

The age of farming household heads was observed to have an inverse relationship with the productivity of farmers in the studies of Di Falco and Bulte (2011). Thus, as the household head grows older the chances of utilizing a new technology becomes slimmer and less efficient. However, this assertion is inconclusive as evident by the study of Oyesola *et al*. (2011) which revealed efficient of production inputs decline with increase in age. Similarly, most studies conducted outside the country have found a negative effect of age to adoption of production resources (Marenya *et al*., 2007, Mugwe *et al*., 2009; Kassie *et al*., 2015). However, some studies have shown a positive correlation, while others have found age to be insignificant. This implies that, the influence of age on inputs utilization is inconclusive (Knowler and Bradshaw, 2007) and warrants a more nuanced study.

2.1.2 Education

Education is associated with input utilization efficiency because it is believed to increase farmers' ability to obtain, and analyze information that helps farmers to make appropriate

decision. In almost every efficiency study, education of the farmer is considered to positively influence the farmer's likelihood of adopting a new technology or practice because farmers with better education have more exposure to new ideas and information, and thus have better knowledge to effectively analyze and use available information (Prokopy*et al*. 2008; Kassie *et al*., 2013).

Meanwhile, most studies consider education in terms of number of years of formal education, the categorization of education by Baumgart-Getz *et al*. (2012) seems more appropriate: in contrast to formal education, it reflects knowledge farmers attain through other means such as extension programmes, workshops, and field days. Solomon (2008) indicated positive relationship between education and efficient utilization of production inputs. Similarly, findings by Yengoh (2010) indicated that education enhances productivity and efficiency among farming households in the humid forest, dry savannah, and moist savannah agro-ecological zones of Nigeria. However, a study conducted by Asnake *et al.* (2005) in Ethiopia showed that education had no significant effect on the adoption of improved farming inputs.

2.1.3 Gender

The connection between input utilization, agricultural productivity and gender were well dominated in the studies of Ogundele and Okoruwa (2006). The study observed that the contribution of female farmers to agricultural productivity was highly significant. Ebanyat *et al.* (2010) and Barungi *et al.* (2013) offered evidence of gender differentials in agricultural productivity in Nigeria with women's productivity arising from their weak bargaining position within the family and in the labour market. Further support for this gender bias in Africa derives from the fact that women have far less access to land and other productive inputs.

2.1.4 Marital status

Marital status here refers to the category the woman farmer belongs in terms of whether she is single, married, divorced, separated, or widowed. According to Alimi *et al*. (2016) each marital status determines access, control and ownership of agricultural productive resources. The study, therefore, expects variations in access, control and ownership of agricultural resources as a result of differences in marital status.

2.1.5 Household size

Households with more adults are more likely to use improved management practices since many of these practices are labour intensive (Kassie *et al*., 2013). Hence, household heads are the final decision makers regarding choice of technologies and farm inputs utilization. Similarly, as the household size increases, the likelihood of expanding farming size and by implication utilizing more inputs is expected to be high as evident in the study of Marenya and Barrett (2007).

2.1.6 Farming experience

Years of farming experience is another factor that enhances efficiency among farming households. Years of farming experience in Nigeria increases as age of farmers increases. Age in farming experience is therefore positively correlated with the efficiency of the farmers. Older farmers have also been observed to have higher productivity than younger farmers. For example, Lambrecht *et al.* (2014) observed that productivity in the humid forest and moist savannah agro-ecological zones of Nigeria was positively associated with more experience in farming. Also, Kassie *et al.* (2015) reported that the economic efficiency level of farmers was significantly affected by farming experience.

2.1.7 Land ownership

Land related variables influence farmers' adoption behaviour, as land holding is an important unit where agricultural activities take place. Secure land tenure has been widely demonstrated

to play a critical role in influencing farmers' willingness to invest in rice production (Kassie *et al*., 2013). Concerning land holdings, different studies reported its effect positively. For example, a study conducted by Teshome *et al*. (2014) reported that land ownership and farm size contributed positively in farmers' efficient utilization of improved production resources. Kamau *et al.* (2014) showed that farmers that owned parcels of land on which they farmed were more productive than non-landowning farming households. This is because they were ready to make huge investments on such land through the use of new technological packages to enhance productivity levels. In relation to land management, it is argued that 'assurance effect' of secure land tenure provides a guarantee to farmers to invest in both short and long-term soil management practices (Grimm and Klasen, 2014) because it eliminates threats of appropriation.

2.1.8 Farm size

Odongo and Muhua (2015) using the profit function equation found that small farms attained higher productivity levels than larger farms in a study conducted in Tanzania. Therefore, they came up with a contrary conclusion which shows large and small farms that exhibits equal levels of productivity. Mugwe *et al*. (2009), however, observed that large farms were more efficient than small farms in farm inputs utilization. Equally, Pulido and Bocco (2014) showed that larger farm size owners were much more motivated to use improved farm management practices in other to enhance their productivity.

2.1.9 Annual income

It is regularly theorized that the use of any production input requires sufficient financial well-being, particularly if new equipment is needed (Knowler and Bradshaw, 2007; Knowler, 2015). Annual income was used as one of the proxies for economic status which was envisaged to have a positive effect on input use behaviour (Knowler, 2015). This hypothesis is premised on the argument that lack of cash or access to cash may deter smallholder farmers

from adopting new technologies that require initial investments. Several analyses of the role of income and farm profitability on adoption have revealed a positive influence (Knowler and Bradshaw, 2007; Prokopy*et al*., 2008; Baumgart-Getz *et al*., 2012). In addition, Ebrahim (2006) in his study found that total annual income earnings had positive and significant correlation with adoption.

2.2 Institutional Factors Influencing Efficient Utilization of Rice Production Inputs

2.2.1 Cooperative membership

Different studies have several reports concerning social participation (cooperative) and its effect on efficient input utilization. For example; Prokopy *et al*. (2008) indicated that people who are quick to use an innovation may be characterized by having active participation in many organizations. Kassie *et al*. (2015) also found that participation in cooperative societies contributed positively and significantly to the use of improved farming practices and Ebrahim (2006) revealed social participation to have contributed positively to the use of new diary technologies. Similarly, Dereje (2006) and Rahmeto (2007) reported that social participation had significant and positive relationship with adoption.

2.2.2 Extension contact

Farmers in rural households have various connections and sources for sharing and receiving new ideas and information to improve farming (Di Falco and Bulte, 2011). The relationship between farmers' access to extension services and use has been repeatedly reported as positive and significant by many authors. For instance, Knowler (2015) showed that extension contact affected the use of new technologies positively and significantly. Similarly, Mondal *et al.* (2014) found that there is positive and significant relation between extension contact and utilization of maize verities and Integrated Striga Management, respectively. Equally, Prokopy *et al*. (2008) reported that, frequency of contact with extension workers positively and significantly affected farmers' adoption decision. Likewise, Rahmeto (2007)

also reported that frequency of contact with extension agent positively and significantly contributed to adoption.

Furthermore, literature on efficiency of production technologies suggests that farmers' engagement with extension agents plays a significant role in influencing their behaviour towards adoption (Knowler*et al*., 2007; Greiner *et al*., 2009; Baumgartz-Getz *et al*., 2012; Kassie *et al*., 2015). Therefore, studies on the role of extension contact in influencing the use of technologies mainly focus on the structural component of social capital in terms of farmer organization (formal and informal) and the relationships that exist there-in.

2.2.3 Credit access

Access to credit and savings play an important role in efficient utilization of rice production inputs (Sanginga and Woomer, 2009). Credit access facilitates purchase of inputs especially improved local seed varieties, organic fertilizers and labour (Geta *et al*., 2013; Teklewold *et al*., 2013). Capital and risk constraints are key factors that limit the efficient utilization of rice production inputs by small scale farmers. In line with this, studies conducted by different authors such as Kansiime and Wambugu (2014) also found that the use of credit had positive and significant influence on the use and intensity of adoption of the technologies.

2.3 Review of the Factors Influencing Rice Production

According to Damola (2010), factors influencing rice production include; lack of rice development policies, inadequate irrigation, low impact technologies, inadequate agricultural input supply system, delay in disseminating improved seeds, inadequate and weak agricultural extension, and poor accessibility to institutional credits, among others. The factors militating against the level of rice production in Nigeria according to Ismaila, (2010), includes; climate factors (rainfall, temperature and solar radiation), edaphic factors,

migration, government policies, use of local varieties, predominance of weeds, pest and diseases.

Alarima *et al*. (2011) enumerated land acquisition and tenure economics, information, communication and training techniques and mechanical factors as production constraints to rice farmers in Nigeria. However, the problems were found to be interwoven and influence each other. As constraints of land tenure persist, farmers are bound to be confronted with production inputs and technology constraints. Lack of adequate information was found to be related to economic input and production constraints of the farmers. Therefore, addressing these problems will lead to increase in the extent of adoption of rice production technology and ultimately rice productivity in Nigeria.

According to Ekeleme *et al*. (2008) the major factors influencing rice production are drought, poor soil fertility and pest attack. Drought is a major constraint to rice production because it requires a lot of water for optimum growth and yield. Rice requires about 1200mm to 1600mm of rainfall evenly distributed throughout its growing period. Pests, especially birds and striga attacks are the major constraints militating against rice production in Nigeria. Marketing is being attributed to be one of the key factors influencing the level of rice production in Nigeria (Lenis *et al*., 2009). The major reason for this problem seems to be the low quality of the local rice produced by most small farmers, which most times face low market prices despite the production cost incurred.

However, when different rice varieties are brought and advertised to farmers without proper education about the appropriate input application and management strategy associated with the various crops farmers who are averse to risk taking, accept the different varieties, planting all of them on small sections of their small plots of land without adequate training on the separation of the various varieties. Thus, during harvesting, rice varieties are often mixed,

reducing the aesthetic value of the local rice compared with the consistence of imported rice and thus lowering the price received from rice millers, if they are even willing to buy it (Lenis *et al*., 2009).

2.4 Empirical Review of the Efficiency of Inputs Utilization among Women Farmers

Ahmadu and Erhabor (2012) studied the determinants of technical efficiency of rice farmers in Taraba State, Nigeria using stochastic frontier production function. The results showed that the determinants of the farmers' technical efficiency were age, gender, family size, level of education and farming experience. Other important factors influencing efficiency of input utilization, according to Ogunniyi and Oladejo (2011) includes gender, which does have effect on technical efficiency, as females are more restricted in terms of access to inputs. Lower yields produced by women in these areas may be attributed to lower levels of inputs and less financial stability than men.

According to Mussa *et al*. (2012), analysis of resource use efficiency in smallholder mixed crop-livestock agricultural systems in Ethiopia suggested that smallholder farmers were resource use inefficient in the production of major crops with mean technical, allocative, and economic efficiency level of 0.74, 0.68 and 0.50, respectively. This study also supported the view that large family size, and membership of relevant associations leads to higher levels of resource use inefficiency. Otitoju and Arene (2010) in the study "constraints and determinants of technical efficiency in medium-scale soybean production in Benue State, Nigeria" observed that the average technical efficiency was about 73%. The determinants of technical efficiency which were statistically significant were sex, age and experience. Sex and age had an inverse relationship with technical inefficiencies of the farmers while experience had a direct relationship.

Oluwatayo *et al*. (2008) in a study on resource use efficiency of maize farmers in rural Nigeria; evidence from Ekiti State found out that the technical efficiency index shows that the farmers were 68% efficient in their use of resources. This calls for improving the efficiency of maize farmers in the study area. In a study conducted by Brodrick (2014) on exploring the potential of cassava for agricultural growth and economic development in Nigeria, it was revealed that education, farm size, age, extension contacts, family sizes, marital status were found to be the major factors that determine the level of efficiency in input utilization. Ayinde *et al*. (2011) revealed in a study on efficiency of resources used in Hybrid and open-pollinated maize production in Giwa local government area of Kaduna State, Nigeria, that all the resources used in the production of hybrid and open – pollinated maize were not efficiently utilized.

2.4.1 Concept of Efficiency

Efficiency is a very important factor of productivity growth, especially in developing agricultural economics, where resources are meagre and opportunities for developing and adopting better technologies are dwindling. Jayamaha and Mula (2011) define efficiency in terms of the comparison of two components (inputs and outputs), with the highest productivity level from each input level referred to as the 'efficient situation'. This has led to the introduction of frontier production functions which estimate the maximum output as a function of inputs.

Freid *et al.* (2008) also defined efficiency as a comparison between observed and optimal value of output and input. Efficiency increases if more outputs are generated without changing inputs, or if the same outputs are generated with lesser number of inputs. According to Freid *et al*. (2008), limited resources can be used for production through efficiency measurement. The importance of efficiency was highlighted to include: Firstly, it is a success indicator and performance measure by which production units are evaluated. Secondly, the

exploring of hypothesis relating to the sources of efficiency differential can only be possible by measuring efficiency and separating its effects from the effects of the production environment. Thirdly, identification of sources of inefficiency is important to the public and private organisation policies designed to enhance performance (Ajibefun, 2008).

In general, efficiency shows the inputs – output relationship of the production function which defines the possible combinations of inputs and the resulting outputs (Hollingsworth and Peacock, 2008). It is a measure of the ratio of output to input.

2.4.1.1 Technical efficiency

Technical efficiency refers to the ability of a firm to achieve maximum possible output with available resources. It measures the ratio of output and it is concerned with the ability to utilize the best practice in order to use lesser amount of a set of input in producing the best output. The human capital variables (i.e. age, education, farming experience, institutional and socio-economic variables) could influence a farmer. These factors are considered as a major influence of technical efficiency (Bashin and Akpalu, 2001).

2.4.1.2 Allocative efficiency

Refers to the ability to contrive an optimal allocation of a given resources. Similarly, allocative efficiency is said to be the choice of an optimum combination of input consistently with the relative factor price maximum or absolute (Inoni, 2007).

2.4.1.3 Economic efficiency

It is a product of technical and allocative efficiency. This therefore implies that measurement of all allocative and technical efficiency is pre-requisite to attainment of economic efficiency. Empirical literature shows that it can be measured from a production function or profit approach (Inoni, 2007).

2.5 Review of the constraints to Efficient Utilization of Production Inputs

The primary production challenges for women rice farmers are weeds, soil health fertility and increasing incidence of weather volatility (Oyesola *et al*., 2011). Weed pressure is an issue for all growers and requires regional solutions and adaptive management (Adesope *et al*., 2012). Equally, managing for soil health and lack of access to organic fertilizer inputs is an ongoing management challenge and barrier to improving healthy rice production. Furthermore, Bwambale (2015) discloses that the most important constraint perceived by the farmers in crop production processes were short life of bio cultures, non-availability of culture in time and non-availability of seed/variety resistant to diseases/insect nematodes.

Equally, Badodiya *et al.* (2011) reported various constraints faced by the farmers on the Adoption of Organic Farming Practices and found that high cost of inputs ranked first followed by difficult methods for preparation (2), lack of inputs and raw materials (3), poor financial conditions (4), non-availability of loans in time (5), lack of proper trainings at grass root level (6), non-availability of appropriate literature (7).

Owolabi *et al*., (2011) studied the assessment of Women's farmers' access to agricultural extension, inputs and credit facility in Sabon-Gari Local Government Area of Kaduna State, Nigeria and identified the constraints encountered by rural women in the utilization of agricultural inputs to include lack of credit facilities, high procurement price of farm inputs, inadequate input supply, illiteracy and lack of contact with extension agents. Chidiebere *et al*., (2019) analyzed the profitability of rice production in different production systems in Ebonyi State, Nigeria and identified low productivity, pests and diseases, inadequa te post-harvest knowledge and handling, inadequate storage facilities, variability in prices of rice, poor access to markets, poor access to production credit, poor market information, lack of favourable government policy and lack of timely access to improved rice seed as the major constraints faced by rice farmers in the study area.

Kagbu *et al*. (2016) studied adoption of recommended rice production practices among women rice farmers in Nasarawa State, Nigeria and identified the major constraints encountered by women rice farmers in the study area to be unavailability of credit facilities, poor marketing system and unstable price as well as inadequate extension contacts. Similarly, rice growers also face marketing challenges such as distance to markets, clear and transparent pricing, strong relationships throughout the supply chain and markets for all grains (not just cash crops) in rotation (Oyesola *et al*., 2011). Meanwhile, Loganandhan *et al.* (2015), classified the problems perceived by the women rice farmers in continuing utilization of production inputs as;

i. Weed pressure

ii. Weather/climate change (chronic humidity, extreme rain events, drought)

iii. High costs of production

iv. Difficulty of disease and pest management

v. Poor rice farmers' networking in sharing production knowledge

vi. Limited technical and financial support for rice producers

vii. Loss of conventional farm network

viii. Opaque value chain – lack of communication on planting dates, yields, prices, market demand

ix. Few forums for relationship building between rice farmers and buyers

x. Distance to input produce markets

xi. Lack of storage facilities

xii. Limited market for non-cash crops in rotation

xiii. Traditional extension services are less focused on large scale rice production

xiv. Difficulty in accessing loans for large scale rice production

2.6 Theoretical Framework

Various studies have been conducted to understand factors that motivate women farmers to efficiently utilize rice production inputs (Pannell *et al.*, 2006; and Baumgart-Getz, 2008). In addition, theoretical frameworks have been used to understand and explain the adoption behaviour of farmers including the diffusion of innovations (Rogers, 2003), planned behaviour and reasoned action, social learning and production theory model (Fishbein and Ajzen, 2010).

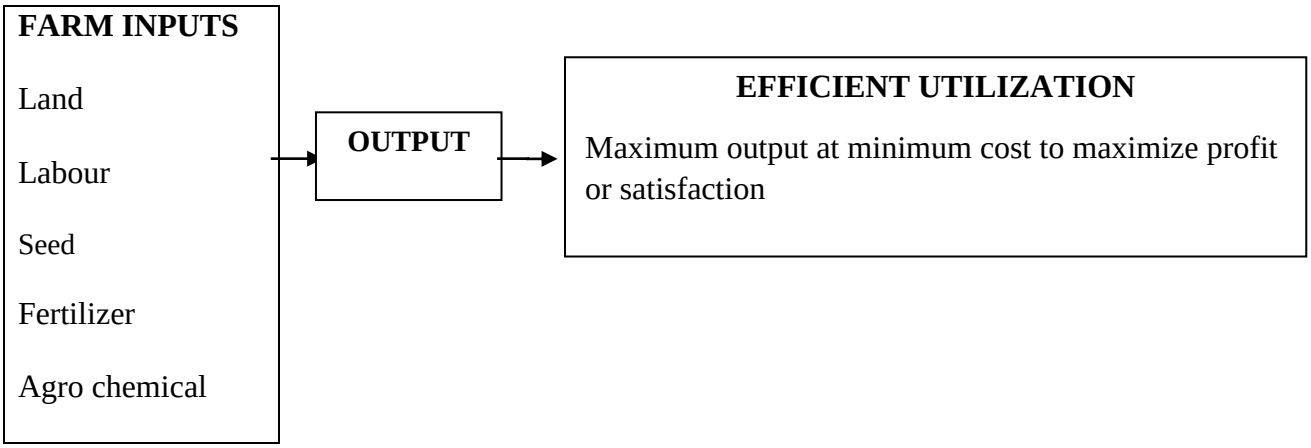
However, in spite of all these studies and theoretical frameworks used, there remains a lack of consensus on which elements could be the primary drivers of input use efficiency. Besides, efforts to relate farmers' attitudes and behaviour to personal, contextual and farm attributes have largely failed (Bwambale, 2015).Therefore, it can be argued that farmer's decision-making to utilize rice production input efficiently is a complex process contingent on multiple factors: biophysical, economic, social and psychological (Bwambale, 2015). These can only be understood by using a holistic approach that integrates farmer characteristics, farm attributes, contextual factors and farmer perceptions about the specific inputs that they consider utilizing.

2.6.1 Production Theory

Production is the process of transforming inputs such as capital, labour, and land into goods and services called output. These resources can be organized into firm or producing unit whose ultimate objectives may be profit maximization, output maximization, cost minimization or utility maximization or combination of the four. Efficiency of production according to Inoni (2007) can be divided into technical, allocative and economic efficiencies. Economic efficiency embodies both technical and allocative efficiencies, once the issues of technical inefficiency have been removed from the question of choosing between the set of

technically efficient alternative methods of production, allocative efficiency comes to fore front. A farmer is allocatively efficient if production inputs are allocated according to their relative prices (Inoni, 2007).

In traditional economic theory, efficiency is generally assumed as an outcome of price-taking competitive behaviour. In this context, assuming no uncertainty, a production function shows the maximum level of output that can be obtained from given input and prevailing technology (Paul and Kolawole, 2008). However, variation in maximum output can also occur either as a result of stochastic effects (such as good or bad weather, measurement error and so on). It can also be attributed to the fact that firms may be operating at various levels of inefficiency due to mismanagement, poor incentives structure and imperfect competitive behaviour, inappropriate input level, or combination of these factors (Paul and Kolawole, 2008). Production process can be represented diagrammatically as:



Source: Sinei (2000)

Figure 2.1: Graphical representation of production theory.

This diagrammatic representation shows the flow of resources into the farm: these resources are allocated as input mixed and managed to produce rice.

2.6.2 Theory of planned behaviour

Theory of planned behaviour recently extended to the model of Reasoned Action Approach by Fishbein and Ajzen (2010). It is another approach that has been used to understand the decision-making process on the utilization of production inputs (Reimer *et al*., 2012). This theory explains human behaviour as a result of three factors: attitude (the degree to which execution of the behaviour is evaluated positively or negatively); subjective norm (the perceived social pressure to engage or not to engage in the behavior), and perceived behavioral control (which predicts the behavioral intention) (Reimer *et al*., 2012).

This theory posits that the attitude towards the behavior, the subjective norms and the perception of behavioral control lead to a positive or negative intention to perform the behavior (Ajzen *et al.*, 2007) and have varying levels of influence depending on the behavior being adopted (Reimer *et al*., 2012). The three factors (subjective norm, perceived behavioral control and attitude), are informed by individuals' beliefs stemming from various sources, and are partly a function of personal attributes and past experiences (Reimer *et al*., 2012).

However, this theory takes a reductionist approach which does not embrace the role of social learning, yet it is very instrumental in understanding the decision-making process (Ajzen *et al.*,2007). This has led to adoption of behavioral models that help to explain how human behavior and self-efficacy enhance adoption.

2.7 Conceptual Framework

The conceptual framework of the study specifies the indicators for dependent, independent and the intervening variables. The flow of relationships between the variables that define rural women's utilization of agricultural input for food production is clearly presented. From the independent variables, the specification for the conceptual schema originates from the assumption that the personal attributes of rural women farmers determine their access, control

and ownership of agricultural productive inputs. Furthermore, the cultural setting that prevails in the community can determine the level of empowerment of rural women farmers. In the same view, the prevailing laws in the community influence access, control and ownership of productive resources by rural women farmers. On the other hand, if interventions are made by institutions in favour of gender equality and women empowerment agenda especially through policies, limiting factors to the empowerment of rural women farmers can be tackled.

From the analytical framework, women farmers' input utilization behaviour in rice prodution is shaped by both the perceptual and behavioural factors. The perceptual factors are mainly a combination of farmers' personal attributes (e.g. education, age, gender and household size), the economic variable which includes characteristics of the farm (e.g. farm size and tenure system) and contextual aspects (e.g. access to credit, income, labour, agro-chemicals, fertilizer and market for both the inputs and farm produce) all of which determines rice farmers' utilization decision of production inputs. Other factors (communication and socio-psychodynamic variables) geared toward information seeking are mainly behavioural factors influencing rate of utilization. The behavioral factors are shaped by farmers' knowledge, attitude, subjective culture and perceived behavioral response.

Therefore, age and experience are important attributes that determine efficiency in the utilization of a new technology. Older women tend to be more efficient in the utilization of rice production inputs more than the younger women. This is probably as a result of the farming experience that older women must have acquired over time from trial and errors in long time production of rice. As a farmer grows older, he/she has generally been exposed to more ideas, information and production practices thereby, being more efficient and accurate in judgment of expected benefits. This, in turn, facilitates the potential to increase utilization of production inputs.

Similarly, educated females with larger household and farm size tend to form positive attitude toward increasing their utilization of rice production inputs. Suggesting that in this part of the country, family labour and commercial rice farmers have strong bargaining position within the rural farming enterprise. In terms of education, literate farmers are considered to positively influence the likelihood of using a new technology or input because farmers with better education have more exposure to new ideas and information, and thus have better knowledge to effectively analyze and use available information.

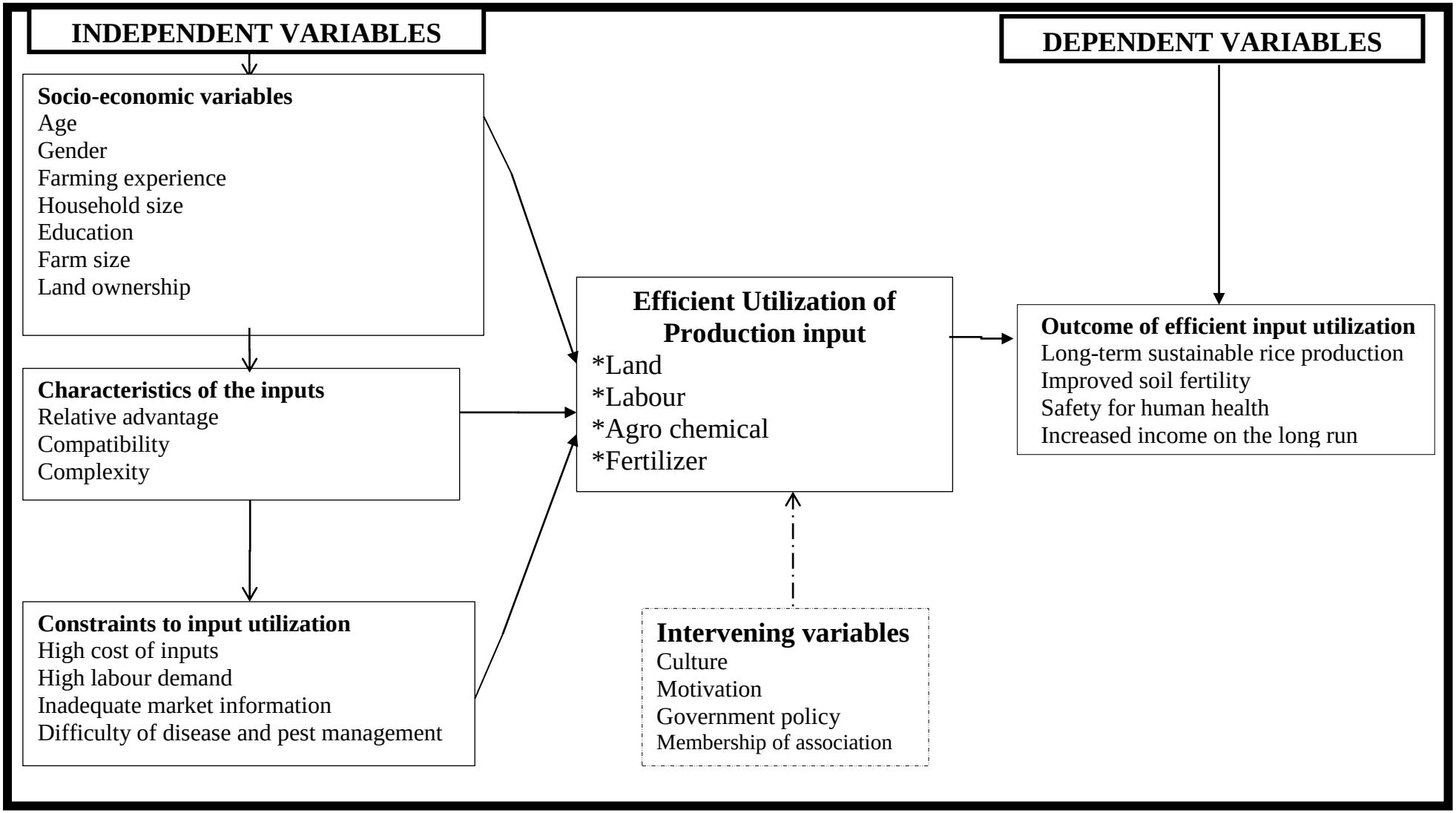


Figure 2.2. Conceptual framework
Source: Adopted and modified from Abdullahi (2019)

Other factors involving economic variables; access to credit, income, land, labour, agro-chemicals, fertilizer and market for both inputs and farm produce can influence the rate of utilization of production inputs in a positive manner. Lack of family labour coupled with family liquidity constraints to hiring labour can greatly affect the utilization of rice farming inputs. Similarly, credit access facilitates increase in production since it aids the purchase of inputs especially if linked to well-developed input supply and market access infrastructures.

Likewise, the characteristics of the inputs involving relative advantage, compatibility and complexity could be the most important attributes influencing their utilization rate due to its emphasis in understanding utilization in relation to the theory of income goals. In this theory, the decision to utilize production inputs increases when the farmer perceived the input to be better than the existing practice it might replace. Also, synchronization (compatibility) of a new technology with an existing one increases the chances of utilization since it makes the new technology relatively familiar.

Equally, input utilization increases when the farmers have complete understanding of the application and actual use of the input (complexity). If potential farmers consider an innovation to be complex, its rate of utilization tends to be low. Finally, favourable attitude of the farmers will facilitate increase in the utilization of production inputs thus enhance long term sustainable rice production in the area. However, when the farmers encounter more problems in the course of utilizing a production input, its rate of utilization may drop.

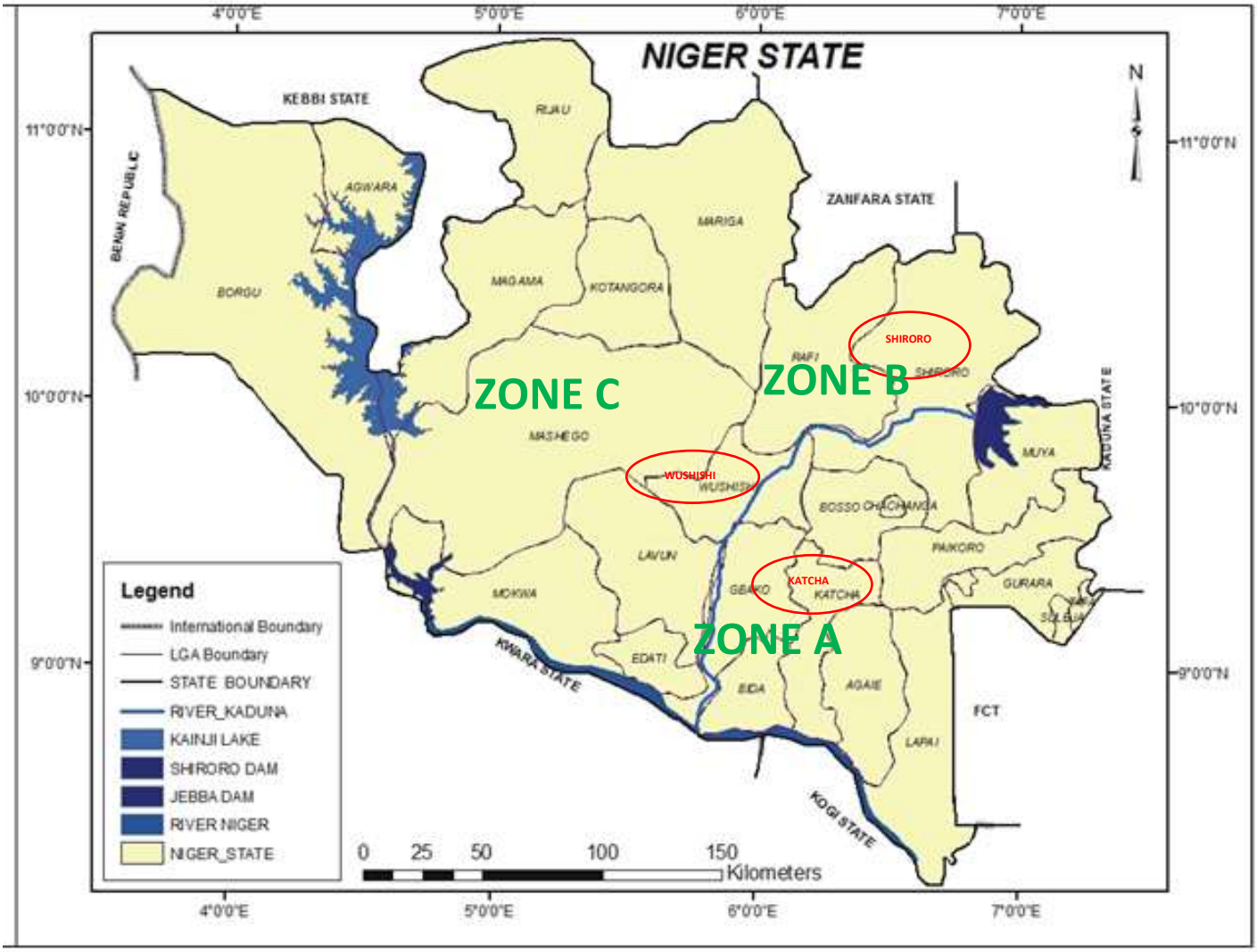
CHAPTER THREE

3.0 METHODOLOGY

3.1 Study Area

The study was conducted in Niger State. Niger State is one of the 36 States of the federation, located in the North Central geo – political zone of the country. It was created out of the former North Western State and became an autonomous State on 3rd February, 1976, with her headquarters located in Minna. The State lies between Latitudes $8^{o}20^{1}$ – $11^{o}30^{1}$ North of the Equator and Longitudes $3^{o}30^{1}$ – $7^{o}20^{1}$ East of the Greenwich Meridian line with a land mass of about 86,000 square kilometres (8.6 million hectares). Niger State has an estimated human population of about 3,950,249 (National Population Census (NPC), 2006), which was projected to be about 5,230,121 in 2018 with an annual growth rate of 2.7% (World Bank, 2018). It is bounded to the North-East by Kaduna State, to the South-East by the Federal Capital Territory, and to the North, West, South –West and South by Zamfara, Kebbi, Kogi and Kwara States respectively. Niger State also shares an international boundary with republic of Benin in the North-West (Niger State Agricultural Mechanization Department Authority (NAMDA), 2014).

The State is made up of twenty-five (25) Local Government Areas (LGAs) with three main ethnic groups namely Nupe, Gbagyi and Hausa. However, other tribes such as Kadara, Kamuku, Yoruba, and Igbo are also inhabitants. The climate in the State is sub-tropical (Guinea Savannah) with distinct dry and wet seasons. The raining season commences in April/May and ends in October/November with annual rainfall between 1,000mm to 1,600mm. Major crops grown in the State include yam, cassava, cowpea, sorghum, maize and rice with natural and rich vegetation for grazing and forestry (NAMDA, 2014).



Source: Lawal (2011)
Figure 3.1: Map of Niger State showing selected LGA from the three Agricultural Zones.

3.2 Sampling procedure and Sample Size

A multi-stage sampling technique was used for this study. The agricultural structure of Niger State is divided into three zones (zone I, zone II and zone III) (Niger State Agriculture Mechanization and Development Authority (NAMDA), 2014). The first stage involved purposive selection of one (1) Local Government Area (LGA) from each of the zones to make up a total of three (3) Local Government Areas (LGAs) due to preponderance of women involvement in rice production. The second stage involved random selection of three villages in

each of the selected Local Government Areas (LGAs) to get a total of nine (9) villages. In the third stage, Taro Yamane's formula at 5% precision level was used to obtain an adequate sample size from the sample frame of registered women rice farmers obtained from NAMDA. This gives a total sample size of one hundred and ninety-five (195) women rice farmers that was used as respondents in this study. Taro Yamane's Formula as adopted by Ajayi *et al*. (2016) is given as:

$$n = \frac{N}{1+N(e)2} \quad (3.1)$$

Where:

n = Sample size

N = Finite Population

e = Level of tolerable error (5% precision level)

1 = Constant

Table 3.1: Summary of sampling procedures for the study

Agricultural Zones	Selected LGAs	Selected Villages	Sample Frame	Sample Size
Zone I	Katcha	Badeggi	50	26
		Katcha	45	24
		Gbakogi	37	20
Zone II	Shiroro	Baha	36	19
		Gussoro	43	23
		Paigado	33	17
Zone III	Wushishi	Maito	50	26
		Kanko	38	20
		Agwa	37	20
Total	**3**	**9**	**369**	**195**

Source: Niger State Agricultural and Mechanization Development Authority (NAMDA) (2014)

3.3 Method of Data Collection

Primary data were used for the study. A structured questionnaire was used to collect the necessary information from the respondents. Data were collected on the socio-economic characteristics of women rice farmers, the extent of women rice farmer's utilization of rice production inputs, determinants of efficient inputs utilization in rice production, and constraints associated with utilization of production inputs among women rice farmers' in the study area. Resident extension agents as well as trained enumerators were involved in the data collection process. The period of data collection lasted for 2–3months, 2019.

3.4.1 Validity and reliability of data collection instrument

Validity of research instrument is the extent to which what to be measured is actually being measured by a given scale or index. It is an important attribute of a research instrument and is specific for a given situation. Therefore, the instrument (questionnaire) used for data collection was subjected to face and content validity test by professionals in the field of agricultural extension and rural development.

Furthermore, the extent of consistency and precision (accuracy) with which the instrument measures and produces the same result time over time was determined. In this study, the instrument was subjected to test-retest method. Therefore, few respondents were randomly selected from the study area and after a period of time (about two weeks), the exercise was repeated on the same respondents to obtain scores for the specific objectives. The total scores for each exercise was summed up and subjected to Pearson's Product Moment Correlation (PPMC) analysis. A reliability co-efficients (r) of 0.76 and 0.77 were obtained in the first and second tests, respectively. Therefore, the instrument is reliable in achieving the said objectives.

3.5 Measurement of Variables

(A) Socio-economic and institutional characteristics of the women farmers involved in rice production measured are:

Age of the farmers: Farmers were asked to give their ages in years. The actual age (years) mentioned was used to determine the age of farmers.

Level of Education: It was measured as the number of years the respondent had spent in School thus; No formal (0), Primary (1-6 years), secondary (7-12 years) and Tertiary (above 12years)

Marital status: The respondents were asked to indicate their marital status and nominal values was assigned to each of the categories: Married =1, Single=2, Widow =3, Divorce =4.

Household size: This was measured as the total number of people living within the household at the time of the study.

Years of Farming Experience: Respondents were asked to specify the actual number of years they are spent in rice farming.

Farm size: this was measured in hectare(s) as the total size of the farm land used for rice production.

Annual income: It was measured as the total amount realized by the farmer both from rice farming and other occupation in Naira.

Production volume: was measured as the total rice output in last cropping season (kg)

Amount of credit accessed: It was measured as the total amount of credit accessed by the farmer for rice production in the last cropping season (2019).

Type of labour: It was measured as dummy variable where using family labour is assigned (1) and hired labour is assigned (0).

Goal of farming: this was measured under the categories of rice produced for family consumption (1), otherwise (0)

Cooperative membership: It was measured as dummy variable where being a member is assigned (1) and not a member is assigned zero (0).

Extension contact: respondents were asked to indicate the numbers of times they have been visited by extension agents in the last one year (2019).

(B) The extent of production inputs utilized by women rice farmers in the study area was measured using the unit value of the total quantity of production input used in the last cropping season. Thus:

(i) Land: Size of land used for rice production (ha).

(ii) Labour: Total man-days used for rice production (man-days)

(iii) Fertilizer: Quantity of fertilizer utilized in rice production (Kg)

(iv) Agro chemical: of agrochemical utilized in rice production (litres).

(v) Improved Seed: Quantity of seed utilized in rice production (Kg).

(C) Constraints encountered by women rice farmers in the utilization of rice production inputs was measured using a 3-point Likert rating scale of Very Severe Constraints (VSC) = 3, Severe Constraints (SC) = 2 and Not Severe Constraint (NSC) = 1. Thus, mean scores ≥2 implies severe constraint to utilization of rice production inputs, while mean scores < 2 implies not severe constraint to utilization of rice production inputs.

3.6 Method of Data Analysis

Descriptive and inferential statistics were used to analyse the data collected in line with the stated objectives of the study. The descriptive statistics involved mean, frequency distributions

and percentages, while the inferential statistics involved the use of multiple regression analysis and resource use efficiency ratio.

Objectives i, ii and v

These objectives were achieved using the descriptive statistics such as frequency count, percentages and mean. However, to measure the extent of production inputs utilized 3-point Likert rating scale was used such as High Extent (3), Moderate Extent (2) and Low Extent (1). Likewise, 3-point Likert rating type scale was used to measure the severity of constraints as Very Severe (3), Severe (2), and Not Severe (1)

Objectives iii

This objective was achieved using multiple regression analysis and resource-use efficiency model

Objectives iv

This objective was achieved using Tobit regression model

3.6 Model Specification

3.6.1 Multiple regression model

The choice of functional form in an empirical study is of prime importance, since the functional form can significantly affect the results. A flexible functional form is generally preferred, since it does not impose general restrictions on the parameters nor on the technical relationships among inputs. In this study therefore, the production technology was assumed to be characterized by a Cobb-Douglas production function. The specification is admittedly restrictive in terms of the maintained properties of the underlying production technology.

However, as interest rests on efficiency measurement and not on the analysis of the general structure of the production technology, the Cobb-Douglas production function is assumed to

provide an adequate representation of the production technology (Shehu, 2013). Furthermore, self-dual nature of the Cobb-Douglas production function and its cost function provide a computational advantage in observing estimates of technical and allocative efficiency. For the investigation of technical, allocative and economic efficiency, a Cobb-Douglas production function of the following form was estimated.

$$\ln Yi = \beta o + \Sigma \beta i \ln Xi_j + \varepsilon i \quad (3.2)$$

While the explicit form is written as;

$$l_n Yi = a + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 l_n X_3 + \beta_4 l_n X_4 + \beta_5 l_n X_5 + e \quad (3.3)$$

Where:

Yi = Output of rice farmers in kilogram of the ith farmer

$\beta_1 - \beta_5$ = Parameters to be estimated

$X_1 - X_5$ = independent variables.

Where;

X_1 = Farmland (hectares)

X_2 = labour (mandays)

X_3 = Fertilizer (kilogram)

X_4 = Seed (kilogram)

X_5 = Agrochemicals (Litres)

Ln = Natural logarithm,

εi = error term,

βo = constant.

The error term εi is defined as:

$$\varepsilon i = vi + ui \quad (3.4)$$

The random variables vi and ui in equation (3) are assumed to have the properties specified for the corresponding unobservable random variables in the frontier production function model.

3.6.2 Tobit regression model

The Tobit regression model is written as follows:

$$Effici^* = \beta' Xi + ui \quad (3.5)$$

Where;

*Effici** is the latent value of efficiency scores. If the observed value of efficiency score is denoted by *Effic*, then

$$Effici = L1_i, \text{ if } Effici \leq L1_i \quad (3.6)$$

$$Effici^*, \text{ if } L1_i < Effici^* \leq L_i \quad (3.7)$$

$L2_i$, if $Effici > L2_i$

Where; $L1_i$ and $L2_i$ are the lower and upper limits respectively: that means 0 and 1. The Xis are the determinants of efficiency, while u_i are identically and independently distributed random error N $(0, \sigma^2)$.

The implicit form of the Tobit regression model is given as:

$$Y = f(X_1, X_2, X_3, X_4, \ldots\ldots\ldots\ldots X_7)$$

The general explicit form is expressed as below:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 \ldots\ldots \beta_7 X_7 + e$$

Y = Efficient Utilization of rice Production Inputs (Resource-use efficiency ratio)

X_1 = Formal education (year)

X_2 = Household size (number)

X_3 = Farming experience (year)

X_4 = Extension contact (number)

X_5 = Goal of Farming (household consumption = 1)

X_6 = Access to inputs (yes=1, otherwise=0)

X_7 = Access to credit (Naira)

a = Intercept

e = error term

3.6.3 Resource use efficiency ratio

Resource use efficiency ratio (r) was used to analyse the efficiency of input utilization among women rice farmers in the study area as stated in objective five (v). The efficiency model is given as:

$$r = MVP/MFC \quad (3.8)$$

Where;

MVP = Marginal Value Product

MFC = Marginal Factor Cost

r = Resources-use

The MVP will be estimated thus,

$$MVP = MPP*Py \quad (3.9)$$

Where;

MPP = Marginal Physical Product

Py = Price of Output

While the MPP is given as:

$$MPP = \frac{b\check{y}}{x} \quad (3.10)$$

Where;

b = Regression coefficient,

$\check{y}$ = Mean of output

x = Mean of input

Decision rule for the resources-use efficiency ratio is that:

If r = 1: it implies that resource is optimally utilized

If r > 1: it implies that resource is under-utilized

If r < 1: it implies that resource is over-utilized

3.7 Test of Hypotheses

Hypothesis 1 was tested using the t-values from the Tobit regression analysis.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Socio-economic Characteristics of the Farmers

This section describes the socio-economic characteristics of farmers in the study area. The socio-economic characteristics considered for the study are age, marital status, household size, level of education, farming experience, source of labour and goal of farming.

4.1.1 Age of respondents

The results in Table 4.1 revealed that majority (76.4%) of the respondents were between the ages of 25-44 years with an average age of 36 years. This implied that rice farming is being practised among young farmers. This finding is consistent with the findings of Ibitoye *et al.*(2012), who found that rice farmers belong to the young age classes, who are physically fit to withstand the stress and risks involved in rice production, and are more mentally alert to embrace new techniques of rice production.

4.1.1.2. Marital status of respondents

The result further revealed that majority (86.7%) of the respondents were married and this comes along with responsibilities to the family. More than half (52.3%) of the respondents indicated that feeding their family is their major goal for venturing in to rice farming. This result agrees with the findings of Oladoja *et al.* (2008), who pointed out that marriage is highly cherished among the local farmers' communities. He asserts that marriage confers some level of responsibility and commitment on individual who are married. Marrying more than one wife is common in rural settings mostly to ensure supply of additional family labour or to raise the status of the farmer in a local setting. Because, additional responsibilities are attached to marriage, especially feeding provision of food.

Table 4.1: Socio-economic characteristics of the farmers (n=195)

Variables	Frequency	Percentage	Mean
Age			
Below 25(yrs)	13	6.7	36
25-34	75	38.5	
35-44	74	37.9	
45-54	29	14.9	
Above 54	4	2.1	
Marital Status			
Single	5	2.6	
Married	169	86.7	
Divorce	9	4.6	
Widow	12	6.2	
Household Size(Number)			
4 and below	56	28.7	6
5-9	124	63.6	
10-14	12	6.2	
Above 14	3	1.5	
Level of Education(yrs)			
No-formal (0)	71	36.4	5
Primary (1-6)	82	42.1	
Secondary (7-12)	34	17.4	
Tertiary (above 12)	8	4.1	
Farming Experience(yrs)			
6 and below	104	53.3	9
7-13	51	26.2	
14-20	19	9.7	
21-27	18	9.2	
Above 27	3	1.5	
Source of Labour			
Hired	13	6.6	
Family	182	93.4	
Goal of Farming			
Commercial	93	47.7	
Family consumption	102	52.3	

Source: Field Survey, 2020

4.1.1.3. Household of respondents

The result in table 4.1 revealed that, farmers had a fairly large household size with a mean value of six (6) members per household in the study area. This has implications on the availability of family labour for farm work. Household size may determine the family labour at the disposal of a rice farmer since majority (93.4%) of the rice farmers indicated family to be their major source of labour. This agrees with the finding of Adeshina *et al.* (2020), who stated that family is recognized as a major source of labour supply as it determines the output which is very important when efficiency of farmers is discussed because it determines the dependency ratio, as well as consumption rate.

4.1.1.4. Educational status of respondents

The Table 4.1 further revealed that majority (63.6%) of the respondents had formal type of education such as primary, secondary and tertiary education while, 36.4% had no-formal education related to skills acquisition and training. Given this level of literacy, it is expected that education can indirectly influence the farmers' understanding of rice production and ways to maximize gains and this could affect farmers' chances of using improved inputs which can boost rice output. This finding is in line with that of Esiobu *et al*. (2014), who stated that an exposure to high level of education is an added advantage in terms of achieving high yield/output and marketing efficiency in production.

4.1.1.5. Farming experience of respondents

Furthermore, the mean years of farming experience of the respondents is 9 years as shown in Table 4.1. This implies that the managerial ability of the farmers can be inferred to be reasonably good since farming experience is used as a measure of management ability. The more experienced the farmer is, the more her ability to make farm decision in rice production

(Adeshina *et al.*, 2020). This agrees with the findings of Onubuogu *et al*. (2014) and Esiobu *et al*. (2014), who reported that farmers with more experience would have a better knowledge of efficient allocation of resources and market situation and are thus expected to run a more efficient and profitable enterprise.

4.1.1.6 Institutional variables assessed by Respondents

The institutional variables assessed by the farmers include extension services, cooperative membership and credit services as provided by the relevant institutions. The results in Table 4.2 revealed that half (50.8%) of the respondents had access to extension services during the last cropping season. The mean extension contact rate was a visit per farmer during the last cropping season, thus; implying low access to extension services by the rice farmers in the area. The poor access to extension services may probably be due to the cultural norms limiting women from interacting with men which tends to characterize the rural areas. This finding agrees with Aina (2006) and Esenu *et al*. (2005), who both reported that women are prevented from interacting directly with men other than close relatives, or when they feel awkward doing so thus limiting their participation in agricultural training and their ability to benefit from working with extension agents, most of whom are males.

Table 4.2: Institutional Variables Assessed by the Rice Farmers

Variables	Frequency	Percentage	Mean
Access to Extension			
No	96	49.2	1
Yes	99	50.8	
Membership of Cooperative			
No	114	58.5	
Yes	81	41.5	
Source of capital			
Otherwise	13	6.7	
Self-owned	182	93.3	
Access to Credit			
No	182	93.3	₦7,287
Yes	13	6.7	

Source: Field Survey, 2020

The Table 4.2 further revealed that 58.5% of the respondents didnot belong to any agricultural cooperative society. This implies that most of the women rice farmers produce as a solitary farmer without pulling their resources alongside other farmers. This result is in consonance with Prokopy *et al*. (2008), who not only observed low membership in cooperative society among the rural crop farmers but also reported that farmers who are quick to adopt an innovation may be characterized by having active participation in many organizations, lack of participation in cooperative has often led to low access to vital information about improved technologies.

Similarly, the availability of capital plays important role in farming as it will enable farmers purchase farm inputs and enjoy economies of scale. The result in Table 4.2 also indicated that majority of the respondents (93.3%) utilized, self-owned credit because of poor access to credit, while 6.7% that accessed credit had a negligible average sum of ₦7,287 to support their production. This implies that majority of the farmers in the study area relied on their personal

savings or gift from friends and relatives for production. This finding agrees with FAO (2016), who reported that low credit could perhaps be due to the financial regulation that encourages commercial banks to issue economic loan to rural farmers (especially women) who can't afford high collateral requirements and high interest rate.

4.1.2 Sources of information on rice production practices

Sources of information on rice production were presented in Table 4.3. The result shows that most of the information sources provided farmers with useful information on rice farming practices but not on a regular basis. It was noted that the women farmers regularly received information about rice farming practices through family and friends ($\bar{X}$ =2.53), as well as extension agents ($\bar{X}$ =2.51). The implication is that most of the respondents relied on interpersonal sources in accessing agricultural information, probably because of their regular availability and accessibility. This finding agrees with Tandi and Ngulube (2011) who stressed that interpersonal sources such as friends, family members and neighbours have all the time become the main providers of the agriculture information due to their credibility, reliability and most of all; they are trusted by the rural community. These findings are also supported by Mntambo (2007), who reported that farmer-to-farmer contacts enable farmers to exchange news and adopt new technology, especially from experienced fellow farmers.

Table 4.3: Sources of information on rice production practices

Sources of information	Regularly (%)	Occasionally (%)	Never (%)	Mean	Rank
Extension agent	131(67.2)	33(16.9)	31(15.9)	2.51*	2nd
Family and Friends	134(68.7)	25(12.8)	36(18.5)	2.53*	1st
Television	12(6.2)	74(37.9)	109(55.9)	1.50	5th
Radio	100(51.3)	78(40.0)	17(8.7)	2.43*	3rd
Cooperative society	83(42.6)	93(47.7)	19(9.7)	2.34*	4th
Workshops and seminars	7(3.6)	81(41.8)	106(54.6)	1.49	6th
Print media	7(3.6)	73(37.4)	115(59.0)	1.45	7th

Source: Field Survey, 2020

***= Significant, Decision rule: $\bar{X} \geq 2$=Regular source and $\bar{X} < 2$ =Occasional Source**

4.2 Production Inputs Utilized by Women Rice Farmers

The extent of utilization of production inputs is presented in Table 4.4. The result showed farmlands were relatively small with an average size of $\bar{X}$=1.2 hectares. This result indicates that, respondents were small scale farmers operating at subsistence level with less than 2hectares utilized for production. This finding is in line with Ogheneruemu *et al*. (2014), who reported that the involvement of women in farming operations may probably be due to the cultural and religious doctrines of the rural people (especially in Northern Nigeria) which tends to restrict women to household domestic chores. In most rural communities, women are not usually allowed to own land. Where women own land, they usually delegate its responsibility to their senior male children, brother or husband.

Similarly, the extent of labour utilization by women rice farmers in the study area was moderate ($\bar{X}$=53 man-days). This implies that the women farmers utilized 50 – 70 man-days for the cultivation of rice. The number of household members in the study area may be due to the polygamous nature of the rural people who tends to recognize household population as a symbol

of authority among farmers. Although, the larger the household size, the higher the demand for food by each person within the household. This result agrees with the findings of Marenya and Barrett (2007) who found that as the household size increases, the likelihood of expanding cultivated farm land is expected to be high among rural crop farmers.

Table 4.4: Extent of Production Inputs Utilized by Women Rice Farmers

Inputs	Frequency	Percentage	Mean
Land (Hectare)			
Low (2ha and below)	191	97.9	1.15
Moderate (2.1-5Ha)	4	2.1	
High (5ha and above)	0	0	
Labour (man days)			
Low (below 50days)	80	41.7	52.46
Moderate (50-70days)	97	50.5	
High (above 70days)	15	7.8	
Fertilizer (Kilogram)			
Low (less than 150kg)	121	62.1	142.59
moderate (150-300kg)	50	25.6	
High (above 300kg)	24	12.3	
Seed (Kilogram)			
Low (less than 30kg)	140	71.8	31.40
Moderate (30-80kg)	52	26.7	
High (above 80kg)	3	1.5	
Agrochemicals (Litres)			
Low (2 litres and below)	159	81.5	1.30
Moderate (3-5litres)	29	14.9	
High (above 5litres)	7	3.6	

Source: Field Survey, 2020

The Table further revealed that fertilizer ($\bar{X}$ =142.6kg/ha), seed ($\bar{X}$ =31.4kg/ha) and Agrochemicals ($\bar{X}$ =1.3 litres/ha) all had low extent of utilization. This implies that the respondents in the study area majorly (62.1%) utilized less than 150kg/ha of fertilizers, 71.8% utilized less than 30kg/ha of seed and 81.5% utilized below 2 litres/ha of Agrochemicals. These conforms to the finding of the FAO (2011) who observed that there is a wide gender gap in

agricultural technologies that leads to gender inequalities in access to and adoption of new technologies; thus, the use of purchased inputs depends on the availability and accessibility of complementary assets such as land, credit, education and labour. The result also agrees with the findings of (FAO, 2010) which indicated male-headed households show much wider use of fertilizers than their female counterparts in many countries.

4.3 Efficiency of Inputs Utilization

The Cobb-Douglass production function was employed to empirically analyse the cross-sectional data sampled from the rice farmers. The Cobb-Douglass production function estimates the elasticity of the various inputs used in rice production. The elasticities indicate the scale of production of the various inputs. If the elasticity is greater than one, it indicates an increasing return to scale, if less than one, it indicates a decreasing return to scale. However, if it is equal to one the function is said to exhibit a constant return to scale. To this end, an increasing return to scale implies that when all other variables are held constant, a unit increase in one of them results in more than proportionate increase in output. On the other hand, a decreasing return to scale implies that a unit increase in one variable with the others held constant results in a less than proportionate increase in output. For a constant return to scale, with all other inputs held constant a unit increase in one will result in a proportionate increase in output. Thus, the result from Table 4.5 shows that R^2 of (0.2190), implying that about 22% of variations that occurred in output, or the women rice farmers were explained by the independent variables included in the model. While the remaining (78%) were due to other extraneous variables not included in the model and error in measurement of some variables. The F was significant at 1% level of probability thus, indicating the goodness of fit of the overall model. Overall, four (4) variables labour, fertilizers, seed and Agrochemicals out of 5 were established to be statistically influencing the output of rice

produced by women farmers. The coefficient of labour was 0.270 and positively significant at (10%). This connotes that when the number of man-days used increases by 1 unit, holding other variable inputs constant, the output would increase by about 27%. This may be due to the fact that rice production is labour intensive as most operations are done manually which resulted into increase in the number of individuals to increase production.

Table 4.5: Cobb-Douglass Function for the Factors Influencing Production

Variables	Coefficient	Standard error	T-value	p>|T|
Land	-0.0951954	0.089354	-1.07	0.288
Labor	0.2697952	0.161572	1.67*	0.097
Fertilizer	0.0738279	0.034013	2.17**	0.031
Seed	-0.0037902	0.001305	-2.91***	0.004
Agrochemicals	-0.0567498	0.033759	-1.68*	0.094
Constant	6.431139	0.591638	10.87***	0.000
Number	195			
Prob> F	0.0002***			
R-squared	0.2190			
Adjusted R-squared	0.0957			

Source: Field Survey, 2020

Similarly, the coefficient of fertiliser was (0.074) and positively significant at (5%). This implies that when the quantity of fertiliser used increases by (1kg), holding other variable inputs constant, and the output would increase by about (7.4%). fertilizer is one of the most critical inputs in rice production. Thus, in order to generate more output from rice by women in the study area. This finding conforms to the results of Ogundele and Okoruwa (2006) who stated that Fertilizer had a positive influence on yield and could be because rice responds highly to fertilizer application.

In addition, the study revealed that the coefficient of seed was -0.004 and negatively significant at (1%). This means that when the quantity of seeds used increases by 1kg, the output would

decrease by (0.4%), holding other variable inputs constant. Equally, the coefficient of Agrochemicals was (-0.057) and statistically significant at (10%). This means that when the quantity of Agrochemicals used increases by 1litre, the output would decrease by (5.7%), holding other variable inputs constant. Use of seed negatively influencing rice output could be that they were overusing seeds, as it was observed that planting rice in rural areas is mostly by broadcasting method. This is in line with the findings of Amaechina and Eboh (2016), who found that seed application and Agrochemicals was negatively significant to rice output and that it could be attributed to poor seed management practices or farmers were using grains to plant but not seeds. Therefore, using additional quantities of seed may not mean much to output.

4.4. Resources-Use Efficiency Ratio

The estimated coefficients of the relevant independent variables were used to compute the marginal value products (MVP) and their corresponding marginal factor costs (MFC). The ratio of the MVP to MFC was used to determine the resources efficiency. The result in Table 4.6 reveals that comparison of ratio of MVP to MPC shows resulting ratios to be less than unity for land (0.31), labour (0.16) and Agrochemicals (0.2). This implies that a unit increase in each input would reduce the value of output, indicating that the inputs were over utilized otherwise known as diminishing return. This finding is in contrast with Shehu (2007), who revealed that for rain-fed rice husbandry, land, hired labour, and herbicides were underutilized. Furthermore, the table reveals that comparison of ratio of MVP to MPC shows resulting ratios to be equal to unity for seed utilized (1). This implies that a unit increase in seed used would lead to an equal and proportionate increase in the value of output, indicating that the input was optimally utilized. This agrees with the findings of Shehu (2007), who revealed that for the irrigated system of rice production seeds were optimally utilized, and therefore suggesting that other things being equal,

the higher the seed rate used the higher the crop population and subsequently high yield except where there is overcrowding leading to competition for available nutrients which will consequently lead to low yield.

Table 4.6: Resource Use Efficiency of Efficient Utilization of Production Inputs by Women

Variable	MPP	Py	MVP	PX	MFC	Ratio (r)	Remark
Land	208.26	240	51856.74	8000	1666080	0.031125	Over-utilization
Labour	11.25076	240	2700.182	1500	16876.1	0.16	Over--utilization
Agro chemical	1.158974	240	278.1538	1200	1390.77	0.2	Over-utilization
Seed	0.1603	240	38.472	240	38.472	1.0	Optimal utilization
fertilizer	4.13937	240	993.4488	160	662.299	1.5	Under-utilization

Source: Field Survey, 2020

MPP = marginal physical product, PY = price of output, MVP = marginal value product, PX = price of input, MFC = marginal factor cost, r = efficiency Ratio,

Decision rule: if r = 1: resource is optimally utilized, r > I: resource is under-utilized and r < I: resource is over-utilized.

Finally, the result in table 4.6 reveals that comparison of ratio of MVP to MPC shows resulting ratios to be greater than unity for fertilizer application (1.5). This implies that a unit increase in fertilizer application would reduce the value of rice output, indicating that the input was under-utilized. This might be due to inadequate fertilizer supply by government and financial constraints on the part of the farmers to purchase fertilizer. This agrees with the findings of Rahman *et al.* (2007), who stated that under-utilization of inputs by farmers can be attributed to lack of incentives to farmers for the use of improved technologies where most of them still use crude methods of production which contributes to using inputs below economic level and hence, low productivity.

4.5 Determinants of the Efficient Utilization of Production Inputs

This study employed Tobit Regression Model to determine factors influencing efficient utilization of production inputs among women rice farmers in the study area. The result from Table 4.7 showed Pseudo R^2 of 0.5260, implying that about 53% of variations that occur with farmers' efficiency were explained by the independent variables included in the model. While the remaining 47% were due to other exogenous variables not included in the model and error in measurement of some variables. The chi square (chi^2) was significant at 1% level of probability, thus, indicating the goodness of fit of the models. In all, five (5) variables out of seven (7) were established to be the determinants of farmers' efficiency of production inputs utilization among women rice farmers. Formal education (2.14), household size (-2.07), farming experience (-1.29), extension contact (1.66), goal of farming (-1.84) and access to credit (1.72) were found to be statistically significant in determining the efficient utilization of production inputs among women rice farmers.

In relation to formal education, the results came out as expected: the level of education of the women was found to be positive and significant at 5%. Education is an important determinant of farm-level efficiency. Well educated farmers tend to exhibit higher levels of efficiency. This is consistent with the findings of Laha and Kuri (2011), who reported positive and significant relationship between education and efficiency among farm households. With increased level of educational attainment, farmers' decision making in the use of inputs could be enhanced.

Similarly, the study established an inverse relationship between household size and efficient utilization of input at 5%. This implies that farmers with large household size are less technically efficient than those with small household size. This might be due to the fact that households with large family sizes tend to spend more on consumption goods. Thus, expenditure on rice yield

improvement like agrochemicals would be minimal. This is consistent with the findings of Mbanasor and Kalu (2008), who stated that availability of farm labour which to some extent depends on household size could negatively influence efficiency as a result of gross expenditure on the domestic needs of the household.

Table 4.7: Determinants of efficient utilization of production inputs among women

Variables	Coefficient	Standard error	t-value	p>|T|
Educational status	0.0334996	0.015645	2.14**	0.034
Household size	-0.0046277	0.002234	-2.07**	0.04
Farming experience	-0.0013713	0.00106	-1.29	0.197
Extension contact	0.0026621	0.001563	1.66*	0.099
Goal of farming	-0.000029	1.57E-05	-1.84*	0.067
Access to inputs	6.73E-06	6.38E-06	1.05	0.293
Access to credit	0.0167055	0.009723	1.72*	0.087
Constant	0.5953873	0.032756	18.18***	0.000
Number	195			
LR chi2 (7)	16.85***			
Prob> chi2	0.0144			
Pseudo R2	0.5260			

Source: Field Survey, 2020
Note: *implies significant at 10%, ** significant at 5% and ***significant at 1%

With regards to the number of visits by extension agents, extension contact was positively significant at 10%. The positive and significant value of extension contact could be that the extension agents were able to provide valuable information about where the farmers could afford to purchase quality inputs. This agrees with the findings of Evenson (2001) and Gautam (2000), who stated that access to extension service, enables farmers to receive education on agricultural innovations. A well-functioning agricultural extension system is pivotal to increasing the productivity of staple food crops and thus presents a credible avenue for moving millions of people out of poverty.

The result shows a negative but significant relationship between the goal of farming and efficiency of farm input at 10%. This shows that the probability of more farmers who produce food for family consumption utilized production inputs efficiently. This is because farmers who produce at subsistence level are usually low-income earners with relatively little farming resources and as such may not favour the use of heavy machines and agro-chemicals on their small farm land which will reduce cost to improve efficiency. This result is consistent with FAO (2001) report that majority of rural small holder farmers grow crops only at subsistence level of production and will only take to the market when the family's food requirement has been satisfied.

Finally, access to credit by women was found to be positive and significant at 10%. The significance of the variable suggests its importance for good performance by affording the farmers the purchasing power to procure inputs needed for rice production therefore increasing productivity. The result is in contrast to findings of Shehu (2010) who reported negative and significant relationship between credit and efficiency among women farmers, indicating that the negative sign could be as a result of little access to the incentive orchestrated by the cumbersome nature of the loan processing procedure and/or high transactional cost of borrowing, most especially from the formal sources.

4.6 Constraint associated with use of Production Inputs among Respondents

The challenges to the utilization of production inputs among women rice farmers in the study area as shown in Table 4.8 includes high costs of production inputs ($\bar{X}$ = 2.64), inadequate inputs supply ($\bar{X}$ = 2.55), difficulty in accessing loans ($\bar{X}$ = 2.53), poor transport network ($\bar{X}$ = 2.48), lack of transport facilities ($\bar{X}$= 2.47) and Pest and diseases ($\bar{X}$ = 2.45).

High costs of production input were the major constraint faced by farmers in the study area. Farmers revealed that the prices of important inputs for rice production such as fertilizers, pesticides and fuel for irrigation increased day-by-day. This led to high cost of production and reduced profits. These findings agree with Shimeles *et al.* (2018), who argued that high cost of input is often cited as the main reason farmers fail to adopt modern agricultural technologies. Hence, availability and access to subsidized input may close this gap.

Similarly, inadequate inputs supply was another constraint perceived by the women rice farmers in the study area. This is consistent with the findings of Shehu (2013) who stated that there was unavailability of appropriate machinery, such combine harvesters used when the land is wet leaving farmers to lose a lot of the paddy during harvesting when they use the manual method leading to low output.

Table 4.8: Constraint associated with use of production inputs among women

Constraints	NC	LSC	SC	WS	WM	Rank
Weed presence	39(19.9)	38(19.4)	118(60.2)	469.0	2.405	8th
High cost of production inputs	1(0.5)	69(35.2)	125(63.8)	514.0	2.636	1st
Lack of extension services	13(6.6)	82(41.8)	100(51.0)	477.0	2.446	7th
Low government support	45(23.0)	72(36.7)	78(39.8)	423.0	2.169	10th
Long distance to market	45(23.0)	79(40.3)	71(36.2)	416.0	2.133	11th
High labour demand	13(6.6)	145(74.0)	37(18.9)	414.0	2.123	12th
Lack of communication	45(23.0)	92(46.9)	58(29.6)	403.0	2.067	13th
Poor transport network	32(16.3)	37(18.9)	126(64.3)	484.0	2.482	4th
lack of transport facilities	11(5.6)	81(41.3)	103(52.6)	482.0	2.472	5th
Lack of storage facilities	57(29.1)	30(15.3)	108(55.1)	441.0	2.262	9th
Inadequate inputs supply	6(3.1)	75(38.3)	114(58.2)	498.0	2.554	2nd
Pest and diseases	9(4.6)	89(45.4)	97(49.5)	478.0	2.451	6th
Difficulty in accessing loan	3(15.3)	32(16.3)	113(67.9)	493.0	2.528	3rd

Source: Field Survey, 2020

Not Constraint (NC) = 1, Severe Constraint (SC) = 2 and Very Severe Constraint (VSC) = 3

Furthermore, difficulty in accessing loans is another constraint that militates against efficient utilization of inputs in rice cultivation. This problem might have been due to non-availability of credits, or high level of hierarchy and bureaucracy associated with loan assessment, etc. This finding is in line with the findings of Johl (2005), who stated that banks seldomly meet the minimum target of agricultural production credit, because the farm sector could not develop absorptive capacity corresponding to the liquidity available with the banks for agricultural production credit.

Equally, problems of poor road for transportation (2.47) and non-availability of transporting facilities from farmers' fields to the markets/home implies that access roads may be in a deplorable state in the study area. This problem would be worst during the rainy season. During the rainy season the roads get wet, potholes are formed, and they become un-motorable. This is in line with the findings of Fred *et al*. (2012) who indicated that the bad state of the access roads makes it difficult for farmers to cart the paddy from the fields to the main road so they have to employ casual labour to move these paddies from the farm to the roadside. This brings extra cost to them as they pay on per bag basis.

Lastly, the incidence of pest and diseases (2.45) such as birds are a nuisance to the farmers in the study area. These birds normally are problems to those farmers who do not start the season early. The control for these birds involves using scarecrows. The more the birds the more labour the farmer has to employ in order to curb the situation. This in the long run, increases the cost of the farmers. This agrees with the findings of Fred *et al.* (2012) who stated that the birds have the capability of making the farmer leave the farm. That is, they can make people so frustrated that all they are left to do is to neglect the farm.

4.7 Testing Hypothesis

The t–value of the Tobit regression estimate was used to test the null hypothesis that there is no significant relationship between the selected socio – economic characteristics of the women rice farmers and efficiency of input utilization in rice production. From results of the analysis presented in Table 4.9, formal education, extension contact and access to credit were found to be positively significant at 5% and 10% level of probability respectively, thus a unit increase in these variables may result to a proportionate increase in the efficiency of input utilization in rice production, while household size was found to be negatively significant, implying that women with smaller family size tends to be more efficient in input utilization in rice production.

Table 4.9: Relationship between socio–economic characteristics and farmer's efficiency

Variables	**Coefficient**	**T-value**	**Decision**
Education status	0.0334996	2.14**	Rejected
Household size	-0.0046277	-2.07**	Rejected
Farming experience	-0.0013713	-1.29	Accepted
Extension contact	0.0026621	1.66*	Rejected
Access to credit	0.0167055	1.72*	Rejected

Source: Field Survey, 2020
Note: *implies significant at 10%, ** significant at 5% and ***significant at 1%

Overall, the numbers of significant socio-economic variables were high thus; the null hypothesis which says there is no significant relationship between the selected socio–economic characteristics of the farmers' and efficiency of input utilization in rice production is hereby rejected. Level of education, household size, extension contact, access to credit were all rejected, while farming experience was accepted.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

This section provides summary, conclusion and recommendations to the major findings revealed in the result and discussion section

5.1 Conclusion

This study was designed to empirically assess the efficient utilization of production inputs among women rice farmers in Niger State. Specifically, the study sought to describe the socio-economic characteristics of women rice farmers in the study area, examine the extent of production inputs utilized by the women rice farmers, determine the efficient utilization of production inputs among women rice farmers, examine the determinants of efficient utilization of production inputs among women rice farmers, examine the constraint associated with utilization of production inputs among women rice farmers. A multi-stage sampling procedure was used to select 195female rice farmers and data collected through structured questionnaire were analysed using frequency distribution, means, percentages and Cobb-Douglass production function and resource-use efficiency model.

Results obtained shows that farmers in the study area were mostly married (86.7%) with formal education (63.6%) with mean age and household size of 36 years and six (6) persons respectively. Also, extension visit and credit among the farmers were, one (1) visit and ₦7,287, respectively. At the same time, farmers regularly acquire information about efficient utilization of production input through extension agents ($\bar{X}$=2.51), relatives and neighbours ($\bar{X}$=2.53). Equally, the result revealed that farmlands were relatively small ($\bar{X}$=1.2 hectares), they spent ($\bar{X}$=53 man-days) in production, utilized fertilizer ($\bar{X}$=142.6kg/ha), utilized a seed rate of

($\bar{X}$=31.4kg/ha) and used ($\bar{X}$=1.3 litres/ha) of Agrochemicals. This implies that the respondents in the study area had low extent of utilization.

Similarly, in relation to the efficient utilization of production inputs among women rice farmer, the Cobb-Douglass production function showed that labour, fertilizers, seed and agrochemicals significantly influenced the output of rice. Equally, ratio of MVP to MPC shows less than unity for land (0.31), labour (0.16) and agrochemicals (0.2), equal to unity for seed (1) and greater than unity for fertilizer application (1.5). Indicating that land, labour and agrochemicals were over utilized, seed rate was optimum and fertilizer application was underutilized.

In relation to the determinants of efficient utilization of production inputs among women rice farmers, Tobit Regression Model showed Pseudo R^2 of 0.5260, implying that about 53% of variations that occurred with farmers' efficiency were explained by the independent variables included in the models. The $\chi 2$ was significant at 1% level of probability, thus, indicating the goodness of fit of the overall models. The results from the Tobit model indicated that level of education, household size, farming experience, extension contact, goal of farming and access to credit were statistically significant in determining the efficient utilization of production inputs among women rice farmers.

Respondents indicated high costs of production inputs ($\bar{X}$=2.64), inadequate inputs supply ($\bar{X}$=2.55), Difficulty in accessing loans by women farmers ($\bar{X}$=2.53), poor transport network ($\bar{X}$=2.48), lack of transport facilities ($\bar{X}$=2.47) and pest and diseases ($\bar{X}$=2.45) as top six (6) constraints in the study area.

From the findings, it is obvious that majority of rural women were small-scale farmers and production resources were not efficiently utilized since most of the production inputs were either over or under-utilized thus restricting the optimum economic advantage for food security. Similarly, the inefficiency of the farmers may be directly and indirectly constrained by the high costs of production input, inadequate inputs supply and difficulty in accessing loans by the women.

5.2 Recommendations

From the findings of the study, several factors constrained efficient input utilization in rice production thus, the following recommendations are proffered;

i. In other to attain the optimal rice production level, fertilizer which was under-utilized should be increased while the units of land, labour and agrochemicals that were over-utilized should be reduced by the women farmers.

ii. Access to information and credit played leading roles in influencing women efficiency in rice production. Hence, extension organization and financial institutions should make regulations and policies that support women farmers' access to credit.

iii. From the study, it was observed that resource adjustment is paramount for increased productivity. The inefficiency in the use of some of these resources was as a result of inaccessibility and/or unavailability of production inputs. Therefore, enough quantities or the farm inputs should be made available at the right time and at affordable prices. Since farmers are price responsive in the use of these inputs, government should endeavour to remove all bottlenecks which affect the availability at the grass root especially fertilizer.

iv. More so, the activities of the extension agents should be revived. So that famers will make better technical decision and also help in allocating their production input effectively, this will make our local rice a good substitute for imported ones for better consumer patronage.

5.3 Contribution to Knowledge

Assessment of efficient utilization of production inputs among women rice farmers indicates that female time use in agriculture varies also by crop, production cycle, inputs availability and knowledge required to put inputs to use. Also, findings suggest returns to investing in female farmers could be gains from increasing women use of inputs, access to and control of inputs, women's inputs use would increase. Increased women's decision making, authority related to agricultural resources, management, production and income.

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APPENDIX I

DEPARTMENT OF AGRICULTURAL EXTENSION AND RURAL DEVELOPMENT,
SCHOOL OF AGRICULTURE AND AGRICULTURAL TECHNOLOGY,
FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA,
NIGER STATE, NIGERIA

RESEARCH QUESTIONNAIRE

Dear Sir/Madam,

I am a Masters student of the above-named institution currently undergoing research work titled: Adoption of organic farming practices among maize farmers in Niger State, Nigeria. This act is in partial fulfilment of the requirement for the award of MTECH CERTIFICATE. Therefore, please kindly supply the necessary information required to execute the study by answering the questions below. I assure you that all the information provided will be kept confidential and used strictly for academic purposes only.

Thank you for your anticipated co-operation and understanding.

Yusuf, Aishatu

Date of interview _____ Time of interview_____ Serial Num _____

State _____ Local Gov't _____ Community _____

SECTION A: SOCIO-ECONOMIC CHARACTERISTICS OF RESPONDENTS

1. Age _____

2. Marital Status: (a) Married ( ) (b) Single ( ) (c) Divorce ( ) (d) Widow ( )

3. Household size involved in rice production (numbers): _____

4. Do you have any form of formal education? Yes ( ) No( )

5. If yes, please state the total number of years spent in school _____

6. What is your major source of farm labour? (a) Family labour ( ) (b) Otherwise ( )

7. For how long have you been producing rice (Please specify years)? _____

8. What is your main goal for farming? (a) produce food for family( ) (b) Otherwise ( )

9. Do you have any access to extension services? Yes ( ) No( )

10. If yes, how many times were you visited during the last cropping season (specify) _____

11. Also, how many extension events concerning rice production were you involved during the last cropping season _____

12. Do you belong to any cooperative organization? Yes ( ) No( )

13. If yes, how many cooperative are you a member (Please specify) _____

14. What is your source of capital for rice production? (a) Self Owned ( ) (b) Otherwise ( )

15. Did you apply for agricultural credit during the last cropping season (regardless of the institution)? Yes ( ) No( )

16. If yes, how much did you receive as loan for rice production (Please specify) _____

17. How many kilometers is the distance of your farm to the source of production inputs?_____

18. What is your major occupation?----------(a) Farming( ) (b) Otherwise( )

19. Please indicate your major sources of information on rice production

Sources	**Regularly**	**Occasionally**	**Never**
Extension agents			
Family &Neighbors			
Television			
Radio			
Cooperative societies			
Workshops & Seminars			
Print media			

SECTION B: QUANTITY OF OUTPUT AND INPUTS IN RICE PRODUCTION

20. What is the extent of your annual farm Produce from rice production in the last cropping season?

Total bags produced	**Cost per bag**	**Total Income earned**

21. How much do you earn annually from off farm sources?----------

22. What is the extent of inputs utilized in rice production in last cropping season?

Rice production Inputs	**Unit/Quantity utilized**	**Cost per Unit (#)**	**Total cost incurred (#)**
Land			
Labour			
Fertilizer			
Seed			
Agro chemicals			

SECTION C: CONSTRAINTS TO RICE PRODUCTION

23. Please indicate the constraints faced in rice production in your area

Constraint to rice production	**VSC**	**SC**	**NC**
Weed presence			
High cost of production inputs			
Lack of extension services			
Low government support			
Long distance to market			
High labor demand			
Lack of communication			
Poor transport network			
lack of transport facilities			
Lack of storage facilities			
Inadequate inputs supply			
Pest and diseases			
Difficulty in accessing loan			

Very Severe Constraint (VSC) =3, Severe Constraint (SC) = 2, Not Constraint (NC) = 1