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Effect of Education and Gender on Farm Productivity of Cocoa Farmers in Nigeria

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Declaration

I hereby declare that I have done this thesis entitled "**Effect of Education and Gender on Farm Productivity of Cocoa Farmers in Nigeria**" independently, all texts in this thesis are original, and all the sources have been quoted and acknowledged by means of complete references and according to Citation rules of the FTA.

In Prague 2022

Abdulmolik Awwal

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Abstract

Education and equal opportunity for different gender is expected to increase managerial skills, labour productivity, capital utilization and access to information that will lead to the adoption of agricultural innovation with comparative advantages that will turn to increase agricultural productivity. The objective of the study was to assess the effect of education and gender on cocoa farmers' productivity. The questionnaire survey was conducted with 120 cocoa farmers of Ondo State, Nigeria using purposive and convenient sampling methods. Multiple linear regression and t-tests were used for the analysis. The result revealed that there is no productivity difference between the cocoa farms managed by male and female farmers. The results further show that education affects the farmer's farm productivity positively as it affects both the farm yield and farm income. This indicates the importance of giving priority to farmers with a low level of education via extension programme design to reduce the productivity inequality between farmers with low and high level of education that will facilitate access to agricultural information, capital such as credit, land and other agricultural inputs as well as resource utilization and farm management policies.

Keywords: Farm yield, farm income, cocoa farmers, education, gender, Nigeria.

Table of Contents

List of Tables

List of Figures

Figure Page

List of Appendices

1.0 Introduction and Literature Review

1.1 Introduction

Improving agricultural production capacity in developing countries through productivity increase is an important policy goal as agriculture represents an important sector in the economy. The agricultural sector provides livelihood directly and indirectly to a sizeable portion of the population of all developing countries, especially in rural areas where poverty is more pronounced (FAO 2021). Thus, a growing agricultural sector contributes to both overall growth and poverty alleviation. Agricultural productivity is one of the important and long-term issues. Challenges have evolved over time; farm production has continued to rise as producers utilize technology and modernized practices because of financial capability and education to ensure that the food and raw material needs of a growing global population are achieved (FRBK 2021).

Gender equality is a basic human right. It is one of the main United Nations Millennium Development Goals (MDGs), which have been commonly accepted as a framework for measuring development progress. There are eight Millennium Development Goals and four are related to gender which includes achieving universal primary education; promoting gender equality; and the empowerment of women; reducing infant and child mortality; and improving maternal health. However, the term "empowerment" is a broad concept used differently by various authors, depending on the context or circumstance (Quisumbing et al. 2014). To come to a mutual understanding applicable across multiple domains and disciplines, Kabeer (2001) defines empowerment as expansion of people's ability to make strategic life choices, particularly in contexts where this ability had been denied to them.

Agriculture is one of the main sectors of the Nigeria economy and major contributors to Nigeria GDP. Agriculture accounts for 24.18% of Nigeria 2014 non-oil GDP (CBN 2016). 70% of the workforce in Nigeria is still involved in farming and farm related activities. (Ogen 2007). However, one of the major problems facing agricultural productivity and development in this region is low education and illiteracy especially among females farmers (Ajani 2008) and has over the years posed great challenges to the agricultural development and productivity. Hence, the need for the study to ascertain the impact of education on gender on agricultural productivity. Cocoa production in Nigeria is undertaken mostly by small scale farmers with low formal education (Oluyole et al. 2013). These farmers therefore face difficulties of for example

expansion, combating farm diseases, farm mechanization. etc. and as a result, the productivity is low (Fountain 2020). Despite these challenges, cocoa used to be the highest source of foreign exchange earning in Nigeria before the oil boom in the 70s. The vast contributions of cocoa to the nation's economic development have been reported by many authors (Abang 1984 and Folayan et al 2006). It was also reported by Egbugara (1990) that about 60% of the population is engaged in agriculture in one form or the other and this has consequently influenced the agriculture educational policy and practices of the country. However, the need for increased productivity in agricultural sector of Nigerian economy can be achieved through effective agricultural education.

Agriculture is one of the ancient occupations of the human beings. People have engaged in this occupation. Agriculture is 'the art of cultivating the land. 'It involves tilling the land, protecting the plants, and growing crops for the benefit of people. About two thirds of the world population are concentrated in rural areas, which are agriculture-oriented areas (World Bank, 2005). Therefore, in respect to poverty eradication and raising the welfare standards of the population; more focus should be on agricultural activities. Agriculture is also crucial to economic growth: in 2018, it accounted for 4% of global gross domestic product (GDP) and in some developing countries, it can account for more than 25% of GDP (World Bank 2021). Education is expected to affect agricultural productivity in diverse ways. For example, education affects the adoption of farming innovations' adoption and information accessibility (Hollifield and Donnermeyer 2003; Yongshan and Yonghe 2019). Neglecting the large 'gender gap' that continues in agricultural productivity and development in most countries carries great costs (Ali 2015; Peterman et al. 2014; UNWomen 2015). It has been estimated that closing the gender gap in agriculture would raise total agricultural output in developing countries by 2.5 to 4 percent and would reduce the number of hungry people by 12 to 17 percent globally, the equivalent of 100 to 150 million people (FAO 2011).

In recent years there is an interest in both programmatic and research on the role of young women in agriculture and rural economies, which was built on the hypothesis that investments in the "future generation" of farmers will cause a spill over effects on households, communities, and the intergenerational transmission of poverty reduction (Kirk et al. 2011; Bertini 2011). The interest and focus on young women were motivated by the lower levels of years of schooling and resources and the huge levels of domestic work and security concerns as compared to boys of their same socioeconomic status. Though, still it is very little is known

about the challenges and opportunities for adolescents in agriculture, as well as how to successfully manage the conflicting trade-offs between traditional schooling, marriage, and labour force participation, there have been promising interventions ranging from agricultural training, legal rights and inheritance interventions, and asset transfers to both girls and boys across diverse countries (Bertini 2011; Bandiera et al. 2010; Catino et al. 2011). For example, Erulkar and Muthengi (2009) evaluated the Berhane Hewan project aimed at delay of child marriage through girls' groups and asset transfers includes livestock, the result of the authors showed improvements in years of schooling and delays in age at marriage. However, youth are not the only important demo-graphic set group to be consider along the life cycle in agriculture. In Kenya, young Luo women, who learned how to farm under the guidance of their mothers-in-law, defer much of the decision making about their farms to their mothers-in-law and do not obtain the rights to farm independently until they have had children (Quisumbing & Pandolfelli 2014).

This suggests that while older, actively farming women may have more assets and resources to draw upon to better respond to extension messages, interventions that target younger female farmers need to be aware of the differential constraints they may face (Quisumbing et al. 2014). Older women particularly grandmothers may also be an untapped resource for spreading extension messages owing to their status in the society, although this is, of course, relative, and subject to context specific. A study in Guatemala (Kevane and Wydick 2001) also found that gender differences in the ability to expand family-owned enterprises were highly correlated with the life cycle. Young male entrepreneurs were more aggressive in generating employment than older male entrepreneurs, but older women generate more employment than young women or older men. Older women may therefore be good targets for microenterprise funds, not only because they can expand the enterprise, but also because preferences would tend toward welfare of grandchildren. As varying demographic shifts take place across the globe, life-cycle heterogeneities of people will become increasingly important considerations in agricultural programming (Quisumbing et al. 2010).

1.2 Literature Review

This chapter brings an overview of cocoa production, its socio-economic importance, problems associated with it, causes of the problems, effect of education and gender, on agricultural productivity and the theories that guide the relationship. Furthermore, agricultural

productivity and its indicators, cocoa productivity in Nigeria, the concept of gender and its implication in agriculture. Finally, the chapter will discuss the previous major findings in the literature on the association between farmers' education, gender, and farm productivity. Issues will be summarized by studying relevant scientific literature resources, mainly from scientific articles of electronic resources i.e e-database like Web of Science, Research gate and Science Direct. Many useful information and case studies have been gained from reports and resources of the Food and Agricultural Organization (FAO) and Statistical data were obtained from the free and open-accessed of Nigerian Bureau of Statistics (NBS) database.

Agricultural education could enhance the productivity of farmers when they have access to it. This could be achieved through well-equipped adult literacy scheme designed for old farmers and to encourage agricultural education at all levels of education to enhance optimum knowledge and boost productivity (Baig & Aldosari 2010). Cocoa is one of the major cash crops with significant impact on the contribution of agricultural sector to the Nigerian economy.

1.2.1. Importance of Education in Agriculture

Education may affect agricultural productivity in several and different ways. The importance of education as a driving factor for agricultural productivity growth can be dated back to the early 1960s (Griliches 1963). Within the context of technology adoption, past literature documented that education not only will positively impact farmers' adoption of new technology, but it will also affect their innovative ability and technical efficiency (Fuglie & Kascak 2001; Daberkowet al. 2003; Daberkow & McBride 2003; Knight et al. 2003; Pierpaoli et al. 2013; Luh et al. 2014). At macro level studies, education as one of the determinants of cross-country comparison in agricultural productivity as it has been subject to substantial consideration in the past. There was a concerted efforts by researchers for example, Hayami (1969) and Hayami and Ruttan (1970), later by the work of Kawagoe and Hayami (1985), highlighted the key role of education and human capital on agricultural productivity growth.

Many studies investigated the effect of education on agricultural productivity on different agricultural produce. For example, Arega and Manyong (2007) analyzed the effects of education on agricultural productivity under traditional and improved technology in northern Nigeria. They reported that farmer education has significant positive effects of education on improved cowpea production. Appleton and Balihuta (1996) studied the relationship between education and agricultural productivity in Uganda and reported that although education appears to have positively affected agricultural productivity, the effect magnitude is probably lower

than those in urban non-agricultural wage employment. Using the same data. The author further explains that by comparison, the estimates imply that having one worker with complete primary schooling would raise crop production by 13% and for complete secondary school is by 18% for complete secondary school. Some studies argued that the effect of education is not linear but there is a threshold for education to be influential to agricultural productivity change.

Luh (2017) studied the effect of education across some Asian countries and reported that variations in the ratio of the educated population do not always constitute a plausible explanation for the observed pattern of growth for economies where productivity experienced deterioration in the early periods and then gradually levelled off. But the author finally concluded that, for economies where agricultural productivity exhibits obvious improvements throughout the entire time span, education constitutes a major determinant of the change in productivity. A Study in India reveals a strong significant effect of education on productivity the authors and move further to explain a strong threshold effect of education on-farm productivity by having the insignificant influence of average years of schooling of farming household's members. And very low level of significance for years of schooling of the farmer, while 10 years of schooling or more resulted to highly significant impact of education on agricultural productivity (Paltasingh and Goyari 2018).

Among the several factors which tend to hinder constructive efforts in modernizing agricultural practices is the lack of adequate formal education on the part of the farmers (Ammani & Ogunyinka 2011). With proper formal education, farmers participate in policy formulation, plans or programs which are designed to meet their needs by the government (Zakaria 2017). They have instead depended solely on the information handed down to them from above. A sizable number of these farmers have developed some apathy toward accepting any idea which they consider foreign, while others tend to look toward the extension agents for answers to all their problems and coupled with insufficiency of innovations which are aimed at solving the farmers problems, one would scarcely notice any impact in the farming practices (Rodriguez et al. 2009) With the lack of basic or no education, individuals are concentrating their attention on the cultivation of food items as rice, yams and cassava and raising of livestock for subsistence farming, while others are laying foundations for their children by engaging in extensive establishment of permanent crops and mechanization (Bamiduro & Gbadeyan 2011).

1.2.2. Measurement of Impact of Education on Agricultural Productivity

There is no general agreement so far among the experts who have studied the effect of farmers' education on-farm productivity. Several studies (Abdulai & Huffman 2014; Asadullah & Rahman 2009; Azhar 1991; Chaudhri 1979; Duraisamy 1992; Pudasaini 1983; Ram 1980; Young & Deng 1999) reported a significant impact of education in complementing and augmentation of agricultural productivity. On the other hand, some studies (Battese and Coelli 1995; Coelli et al., 2002; Kalirajan & Shand 1985; Llewellyn and Williams 1996; Narayanamoorthy 2000; Wadud and White 2000) did not find any significant impact of education on farm's productivity and efficiency. Some studies (e.g., Hasnah & Coelli 2004) found even a significant negative impact of education on-farm efficiency. Again, studies like Lockheed et al. (1980), Phillips (1994), and Tilak (1993) reported mixed results.

The possible reasons for the inconclusive empirical results of the impact of education on agricultural productivity arise mainly due to four issues (i) how to quantify the variable "education", (ii) whose education needs to be considered, (iii) where it matters, and (iv) whom it matters to? the former two issues are related to the construction of the variable "education" used in empirical models. The latter are concerned with the importance of formal education in varying farm environments and to different farmers in the same environment. The first two issues are discussed at length and breadth by Lockheed et al. (1980) and Phillips (1994). On the question of how education should be measured, different methods were used to measure the variable education. For example some authors considered years of schooling attained or completed by a farmer (Asadullah and Rahman 2009; Asfaw and Admassie 2004; Chaudhri 1979; Hojo 2004; Jamison and Lau 1982; Narayanamoorthy 2000; Reimers and Klasen 2013; Rahman et al. 2012), but some authors mooted a threshold for education and used the dummy variable showing attainment of that threshold level of certain years of schooling (Hojo 2004; Huang and Luh 2009; Jamison and Moock 1984; Moock 1973) Again, the number of grades attended was also taken in some studies like Haller (1972) or sometimes a simple indicator of literacy was used (Sharma 1974).

To the question of "whose education matters" in agricultural development studies, we find different studies taking the education of different family members like education of the head of the farming household, average education of the household, maximum education of any member of the household, and minimum level of education of any household member above 14 years of age. These two issues of how the variable education is measured and whose education matter are well taken up in many studies (see Alene and Manyong 2007; Asadullah

and Rahman 2009; Hojo 2004) as they incorporated more than one measure of education in the empirical model that covers both household heads education as well as the education level of other members. Again, in those studies, education is defined as years of schooling or a dummy variable showing a minimum threshold level.

The third important reason for how the variable education is measured and whose education matters is attributed to the wrong assumption of a homogeneous farming environment that all farmers operate in. Schultz (1975) argued that education plays a significant role in modernized farm environments rather than the traditional ones. The ability to deal with the disequilibria caused by the adoption of modern technology is largely a function of farmers' education. Thus, more educated farmers adjust better and quicker than the less educated or illiterate farmers (Ali and Byerlee 1991; Hojo 2004). However, most studies assumed that farmers operate in a uniform farm environment. So, the effects of conventional and non-conventional inputs on-farm productivity are independent of the type of farm environment (Appleton and Balihuta 1996; Jamison and Moock 1984; Moock 1981).

This again leads to another issue (that is, the fourth reason) that even in the same farm environment, as Alene and Manyong (2007) argued farmers are not exposed to a homogeneous technology. Some farmers are adopters of modern technology while others are not. In their study, they found a significant impact of farmer education on the adoption decision of modern cowpea varieties and thereby on-farm productivity of adopters in Nigeria. Thus, as they argue "the failure to account for differences in technology available to farmers, even in the same farm environment, is likely to confound the true effects of education on agricultural productivity" (Alene and Manyong 2007). So, the empirical specifications and subsequent analyses without taking care of all these issues fully may provide incredible and confounding results. Hence, many studies found insignificant or even negative impact of education on agricultural productivity.

1.2.3. Agricultural Productivity and its Indicators

Agricultural productions are mostly measured by weight or volume. A question arises on how to combine different agricultural products in the best way since summing over weights or volumes is not very meaningful. One approach when dealing with crops is to convert them to a common physical unit, such as wheat units (Hayami and Ruttan 1985; Block 1994). More commonly, aggregate output in agriculture is measured in monetary units as the sum of the value of all production in the agricultural sector minus the value of intermediate inputs

originating within the agricultural sector. Both cash and non-cash transactions such as barter systems to final products should be included. This is referred to as "final output" and differs from agricultural GDP by not subtracting out the value of non-agricultural inputs (Rao, 1993). In other words, the final output is the amount of agricultural output available for the rest of the economy, while agricultural GDP measures the net contribution of agriculture to the GDP of a country (FAO 2021).

Productivity measures are divided into partial or total measures. The partial measures are the amount of output per unit of a particular input. Commonly used partial measures are yield (output per farm unit area), labour productivity (output per economically active person (EAP) or per agricultural person-hour). Farm yield is usually used to assess the success of production practices. Labour productivity is often used as a means of comparing the productivity of sectors within or across economies (FAO 2021). It is also used as an indicator of rural welfare or living standards since it reflects the ability to acquire income through the sale of agricultural goods or agricultural production (Block 1995). Other method used to measure farm productivity are:

1.2.3.1. Gaps in Actual vs. Potential Yields

Gaps in actual vs. potential crop yields are assessed by compassion between the yields obtained from demonstration plots and yields obtained by other farmers in the project location (Patrick 1997). The crop cut and farmer estimation techniques are adequate for calculating and estimating average demonstration plot yields, however, since the samples are too small. Instead, a complete harvesting is far more accurate and statistically efficient (Casley & Kumar 1988). Moreover, though it would not work for large numbers of areas, complete harvesting is practicable for the relatively few demonstration plots at issue (Murphy et al. 1991).

The problem related to this measurement is the comparison will have been done by two different methods (i.e., complete harvest vs. farmer estimation) and estimated yield gaps will likely be influenced also by differences in heterogenous biases between the two measurement methods. It will be important, in interpreting absolute values of yield gaps, to keep and consider these different biases in mind. On the way, it may be reasonable to assume that differences in measurement biases remain constant and therefore do not affect changes in yield gaps over time (Patrick 1997).

1.2.3.2. Changes in Yield Variability

This method involves a measuring crop yield that need more than the normal five-year project lifespan, the method is built on the opinion that measuring whether projects have reduced the variability of yields from year to year will be impossible within the five-year project period (Patrick 1997). This is because the changes during the project will need to be set in the context of a farmer's production before and after the project. Thus, several years of both pre-activity and post-activity (or follow-on activity) yield data will need to be collected among targeted farmers in the project area (Patrick 1997). Methods for collecting yield data during and after the activity will have to be consistent with the methods used for collecting the pre-activity.

1.2.3.3. Values of Crop Production

This method considers increases in the physical value of household crop productivity which it may be one of the best ways to reflect the overall and ultimate impacts of farm and other agricultural activities on the welfare of households, assuming that other sources of income are not significantly reduced because of the agricultural activities (Patrick 1997). This considered one of the best or not only but a better indicator than increased crop yields, this metho has an advantage of measuring the land and area planted is void and no need and the issue of intercropping does not arise at all. On the other way, the method has its own demerits such as i) identifying good and appropriate transaction level prices for non-marketed crops especially ornamental, aesthetics and other medicinal for households use ii) adjusting for price inflation; and iii) accounting for crop by-products, including inputs to other household production processes which serve as exogenous factors that will affect values as they do yields (Patrick 1997).

1.2.3.4. Number of Months of Food Stocks

This method involves of taking into consideration the months of food self-provisions as a proxy for the crop yield and value of production indicators. The limitation of this method is that it should be used as a productivity indicator only in the subsistence system of agriculture, however, where production is mostly for home consumption and households do not make significant sales or purchases in the market. It should cover both grain, roots, and tubers, if commonly consumed (Patrick 1999; Casley & Lury 1981).

1.2.3.5. Measuring Crop Storage Losses

The losses after harvest have several causes and take many forms and modes. In this method all the sources of post-harvest loss addressed in this guide is what occurs during storage by farm households the losses from other sources such as threshing, transport, milling, etc., are not considered Patrick (1997). Activities to these losses, therefore, relate to farmer storage practices or construction of innovated and improved farm household grain storage techniques and facilities. Little work has been done on developing methods to assess on-farm storage losses in developing countries, however, a significant portion of food is estimated to be lost during storage continues (FAO 2020). This is partly because storage loss is difficult to measure even for those skilled in the area (Patrick 1997).

1.2.4. Agricultural Productivity of Cocoa Farmers in Nigeria

Cocoa crops grow well in tropical climate conditions and production is therefore dominated by countries in the tropical regions, but the consumption is mostly by countries in temperate regions of the world (Food and agribusiness 2017). West Africa is a major producer accounting for approximately 70% of global production which fluctuates annually with climatic variations. Nigeria is the third-largest producer of cocoa in the world and the crop is sometimes farmed on a large scale in Nigeria, the cocoa sector is dominated by small-scale farmers and remains a critical source of livelihood for rural communities in states where the crop is produced. In south-west Nigeria, cocoa-producing states include Ogun state (our study area) where farmers either operate on the inherited farmland or operate a sharecropping arrangement in which two-thirds of the produce accrues to the landowner who also contributes to the purchase of farming input (Food and agribusiness 2017).

Nigerian annual cocoa yields for are estimated at an average range between 300 and 350,000 MT (Food and agribusiness 2017).

Table 1: Yield, area harvested and production of cocoa in Nigeria

	2000	2002	2004	2006	2008	2010	2012	2013	2014
Yield/ hectare	0.3499	0.3515	0.3879	0.4393	0.2720	0.3137	0.3018	0.2948	0.1804
Area harvested/ hectare	96,600	1,030,000	1,062,000	1,104,000	1,349,130	1,272,430	1,269,136	1,244,755	1,374,399
Production	338,000	362,000	412,000	485,000	367,020	399,200	383,000	367,000	248,000

Source: Food and agribusiness 2017

1.2.5. Concept of Gender

The concepts of "sex" and "gender" can be confusing to students, scholars, researchers, and practitioners alike, this happened because they mostly used inconsistently and interchangeably, when, in fact, studies indicated that they refer to two distinct concepts. Sex refers to the innate biological categories of male or female and is thus a fixed category rooted in biological differences, in contrast, gender refers to the social roles and identities associated with what it means to be a man or a woman in each society or context (Quisumbing et al. 2014).

Gender issue is deeply concerned across a variety of scales within food systems, at the household and community level and extending through to international organizations such as the Food and Agriculture Organization of the United Nations and the Global Forum for Rural Advisory Services (e.g., Zuckerman 2007; Kangmennaang et al. 2017). However, gender has been neglected in discussions of agricultural sustainability (Slätmo et al. 2017) and gender inequality remains a significant barrier to the development of inclusive, genuinely sustainable forms of agriculture.

1.2.5.1. Gender in Agriculture

Women play an important and variety of roles in agriculture, but they are constrained by many issues from social to economic limitations such as unequal access to land, capital, farm inputs and other productive resources, in relation their male farmers counterpart and there is insufficient information about the roles and resources of women and men. Closing these gender gaps would be good both for women and for agriculture (Quisumbing et al. 2014). Therefore, gender roles and responsibilities may be shaped by religious, ethnic, economic, and cultural factors and are a key determinant of the distribution of responsibilities and resources between men and women (Moser 1989).

Based on the above, gender roles are socially, rather than biologically, they are not fixed as sex and is subject to change based on changing norms, resources, policies, and contexts (Quisumbing et al. 2014). Every society is marked by gender differences, but these vary widely by culture and can be modify and change dramatically over time. A further complication is that "gender" and "women" are often used interchangeably. Gender refers to relations between men and women, not an exclusive focus on women (Moser 1989).

In much of agricultural development, the focus has been on men, so achieving gender equality requires giving greater attention to women. However, the importance of relations between women and men, as well as the differential roles, resources, and responsibilities of women and men of different ages, ethnicity, and social class need to be kept in mind in both analysis and programming (Quisumbing et al. 2014).

In most developing countries, women are mostly involved in small-scale agriculture systems, often in informal or unpaid activities, these trends towards agricultural feminization are prominent in all regions (FAO 2011). The increase in women's responsibilities in agriculture is caused by increasing diversification out of family farming, which is being driven by socio-demographic pressures and land fragmentation (FAO 2011). The growth of jobs in other sectors and significant male out-migration from rural areas is another factor that is increasing women's workload (Slavchevska et al. 2016). Evidence also highlighted the fact that increasing equal gender relations within households and communities' settings contribute to agricultural and rural development, including gains in productivity and nutrition (Farnworth et al. 2013).

The women produce more than half of the world's food, as they produce between 60 % and 80 % of food crops in developing countries (Mehra and Rojas 2008). Studies reported that women produce more than half of the locally grown food in developing countries and as much as 80 % in Africa" (Momsen 1991). Few persons would argue against the estimate that women are responsible for 60-80 % of the agricultural labor supplied on the continent of Africa and half of the world's food and, in developing countries, between 60 and 80 % of food crops, grow from seeds that are planted by a woman's hand" (Gupta 2009).

Gender equality is a generally accepted fundamental human right among the members of the United Nation states, the importance of gender equality is mentioned, enumerated, and highlighted in its prominence in the United Nations Millennium Development Goals (MDGs), which have been commonly accepted as a framework and blueprint for measuring development progress (Quisumbing et al. 2014). Among the eight goals, four are directly related to gender that i) achieving universal primary education, ii) promoting gender equality and the empowerment of women, iii) reducing infant and child mortality, and iv) improving maternal health. Improvement in these four gender gaps

which tend to favor males has also been seen to contribute to women's empowerment (Quisumbing et al. 2014).

The word gender means more than sex. It is culturally ascribed as a role performed by either of the sexes. Aina (2002) viewed the issue of gender as a process by which individuals are born into biological categories of female and male. This could become the social categories of women and men through the acquisition of locally defined attributes of femininity and masculinity. Also, in the recent years, the topic gender especially women participating in the development has become prominent with the inclusion of women in the governance and business. This is due to the establishment of Women in Agriculture (WIA) as a component of Agricultural Development programme (ADP), Better Life for Rural Women Programme (BLP), Family Support Programme (FSP), and Family Economic Advancement Programme (FEAP). It has been pointed out that there is no quantitative and qualitative information about female and female farming (ILO, 1981). Therefore, rural women are usually excluded from development planning. The issue of gender inequality in Nigeria is rooted in the traditional and cultural practices of the society. These include the values and norms that are related to women's reproductive functions that clearly underline gender division of labour (Akanji 1997). Socio-economic indicators of Nigerian data show that even though women account for forty-nine percent of the population, they only form thirty-nine percent of the total labour force. Most of the women, who are accounted for, in statistics, are found in the agricultural and the informal sector of the national economy. This indicates that more than seventy percent of the rural population depended wholly on smallholder agriculture for food and income (Akanji 1999).

1.2.5.2. Gender Land Control and Credit

Lack of land ownership and tenure security deeply limit women's access to credit (figure 1), which affect their adaptive capacity of largescale innovation negatively. way. Without legal land title, they cannot finance agriculture innovations that can affect their productivity. It also means that women have little access to services that could help facilitate investments to obtain new technologies, improve their natural resource management practices, and adopt more efficient and productive cropping, which could help them address the degradation of natural resources (World Bank 2009).

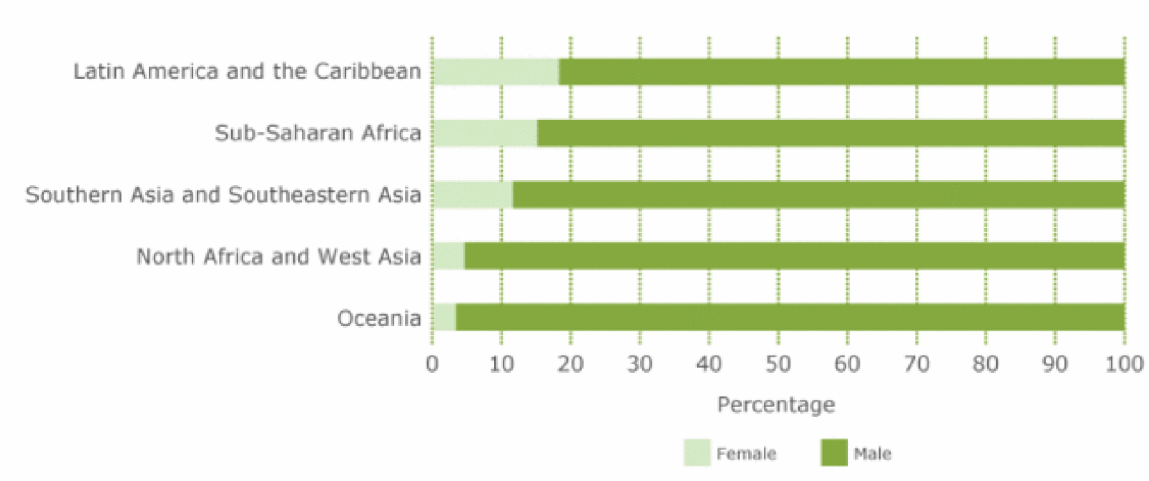

Figure 1: Share of male and female agricultural land holders in developing regions
Source: FAO 2011.

Land constraint has been reported to cause low productivity of women in agriculture. For example, a study shows that the proportion of households that are reported as female-headed varies from 3.1 % in China to 38 % in Nicaragua. Yet, in each country, the value of crops produced by female-headed households is less than the expected if male and female headed households produced the same number of crops. This is, at least in part, because female-headed households are typically smaller (in numbers of people) and have less access to resources (including land and labor) than male-headed households.
However, the study ignores the food produced by women living in male-headed households but given that female-headed households produce proportionately less amounts of crop output and attributed that to less access to land and other productive resources (Doss 2014). He further mentioned that even in the country with the highest level of female-headed households like Nicaragua, to reach the 60 % threshold, women would have to produce 57 % of the food in male-headed households. While this is not outside the realm of possibility, it would be a surprisingly high number. Another way to assign output to men and women is to allocate it to the owner of the plot of land. In Bosnia-Herzegovenia, 16 % of plots were reported as owned by women. Of the total value of crops produced, 16 % were grown on plots owned by women (Quisumbing et al. 2014).

1.2.5.3. Access to Extension and Related Services

Inadequate access to information is another important. impediment that affects the women' farm productivity negatively. In 2011, out of 97 countries surveyed, only 5% of

extension services were directed to female women and only 15% of extension personnel were female (FAO 2011). The root causes of this phenomenon are many such as cultures reason, in some communities, women working in agriculture were banned from engaging with these services (FAO 2011). In some countries, the staff of advisory service providers is biased against farmers who do not have access to credit and have less education. Extension agents tend to focus on resource-rich farmers, then women, who typically have poorer access to resources (Elias et al. 2015).

A greater number of women are engaged directly in smallholder agriculture as farm managers and workers on their own families' farms, ranging b of the rural women population in Sub-Saharan Africa and 6.9 % in Europe and South Asia, the residual, which is a significant proportion, consists either of wage earners in agriculture, self-employed persons in non-agricultural rural enterprises, non-agricultural wage earners, and "non-active or not reported (Quisumbing et al. 2014). The large number of rural women classified as either non-active or not reported (up to 64 % of the female population in South Asia, and above 50 % both in Latin America and the Middle East and North Africa region) reflects the fact that much of women's work in rural areas is informal or unpaid and still goes unrecorded (Fontana and Paciello 2010).

Analysis of agricultural value chains explores the barriers that women faced in accessing high value markets for cocoa and coffee in Ghana and Uganda, based on microlevel household data analysis (Quisumbing et al. 2014). Study examined whether the constraints faced by women arise from discrimination in input and output markets for cash crops or arise owing to constraints in assets and other resources (Fontana and Paciello 2010). While female farmers in both countries are as productive as male farmers and receive competitive prices to those received by men counterpart when they farm with equal resources and sell their crops in the same way, they rarely have similar access to assets and markets as men, which has consequences for the choice of production technology and marketing channel. They find that women cocoa farmers in Ghana have limited access to liquidity, which induces them to adopt suboptimal production technologies. In Uganda, the low quantities sell at the market, and the lack of access to bicycles, limit female coffee farmers to marketing channels that have low transaction costs, but which receive lower prices (Fontana and Paciello 2010). The authors conclude with recommendations for improving women's access to high-value markets.

1.2.5.4 Measurement of Relation between Gender and Agriculture

The study method on how to establish a gender relation are complex and context specific. The distribution of privileges and rights, resources, assets and responsibilities among men and women is not constant across cultures and contexts. As this distribution is a product of social settings, not biological factors, characterizing gender gaps in productivity, understanding their consequences, and evaluating how they are affected by interventions need to go beyond simple quantitative indicators and analysis (Quisumbing et al. 2014). To be able to understand how gender relations affect outcomes related to agriculture and food security, and are themselves affected by the social, institutional, and political context of a particular society, agricultural researchers and policy analysts must take into consideration of how gender and agriculture affect the livelihood and income strategies of men and women. Furthermore, because the well-being of men and women in rural areas cannot be measured only using indices of agricultural productivity, nor only with money metric indicators such as income and consumption, there must be greater attention to other dimensions such as status, self-esteem, power within and outside the household, access to institutional services that cannot easily be measured using standard household surveys (Quisumbing et al. 2014).

However, while detailed qualitative studies are useful in exploring these complexities, they often do not provide a picture of how widespread these patterns may be. Quantitative indicators therefore play an important role in presenting data that can be more readily compared across regions, socioeconomic categories, or over time. Understanding gender relations in agriculture requires bringing together different sources of information and different methods of analysis. Traditionally, information on biological variables related to yields, disease resistance, and growth of plant and animal species are generated by agricultural research centers. Information on labor force participation in agriculture, overall production by crop, cropping patterns, and agricultural incomes are routinely collected by the agricultural statistics system, which, until recently, has not collected information on a sex-disaggregated basis. Economists aiming to study relationships among farmer characteristics, access to and use of inputs, and agricultural productivity typically use quantitative household surveys. Yet, such instruments and methods rarely shed light on the complexity of gender relations since they are not designed to capture context- and culture-specific information. The fact that livelihood activities are so varied,

and often intermittent or non-commoditized, means that surveys are likely to pick up some activities and miss others. This is particularly the case where women's activities may be excluded from the formal sector or not considered as "real agricultural work" by local communities.

In contrast, Norton et al. (1994) argues, that gender relations have been a long-standing area of inquiry of the social sciences outside of economics, particularly anthropology. Although the inter-household's differentiation was studied, described, analyzed, and widely accepted in the field of anthropology from the mid-1970s, it took at least a decade for mainstream development economists to start discussing that (Jackson 2005). Part of the reluctance of economists to draw from anthropological methods arose from the limited geographical coverage of most ethnographic studies, and therefore, the inability to come up with statistically representative results that were "generalizable" across wider areas than one's own study villages. But the costs of not paying attention to detailed and context-specific research would be likelihood of missing out on precisely the most important factors affecting gender relations.

Subsequently, studies in the early 80s that suggested that men and women systematically spend income under their control in different ways, motivated economists to challenge the traditional model of household behaviour and to propose alternative models that bear closer resemblance to reality. The motivational economists have added to the evidence rejecting the traditional paradigm of the unitary model of household behavior that considered households as one entity, in favor of the collective model, which allows for differences of opinion regarding economic decisions among household members. Because testing such models requires sex-disaggregated data on factors affecting bargaining power as well as on outcomes of household decision making, and because formulating the appropriate model of household bargaining must be based on a better understanding of culture and its context, increased efforts have been taken by quantitative studies of social scientists to collect more sex-disaggregated data and to use both qualitative and quantitative methods of analysis.

This is consistent with the more general movement toward mixed methods (qualitative-quantitative) research in the social sciences, for example, in poverty appraisals (Kanbur 2003 and Kanbur and Shaffer 2007) and in evaluation of social programs (Adato 2008; Maluccio et al. 2010). By using data from a variety of sources and qualitative and

quantitative methods, it is possible to cover a wide range of issues and topics relatively efficiently. Rather than seeing this as a second-best solution, such a combined approach can provide a more convincing analysis than any single method (Adato and Meinzen-Dick 2007). Adato and Meinzen-Dick (2002) argue that people respond differently to quantitative and qualitative information; numbers are required to convince some audiences, while others will be unimpressed by numbers, but relate more to in-depth and contextual information gathered using qualitative techniques. Triangulation, where several types of data are used in a single study and used to cross-check and compare results, enables any weaknesses in one method to be offset by the strengths of another (Jick 1979).

An assessment of 57 mixed method studies identified five purposes for mixing methods (Adato and Meinzen-Dick 2007) provided i) triangulation seeking convergence of results; ii) complementary examining overlapping and different aspects of a phenomenon; iii) initiation discovering paradoxes, contradictions, fresh perspectives; iv) development using the methods sequentially, such that results from the first method inform the use of the second method; and v) expansion and adding breadth scope to a project. Because the scope for the use of integrated qualitative and quantitative approaches is quite broad.

1.2.5.5 Gender in Rural Areas and Agriculture in Nigeria

In rural Nigeria, a patriarchal structure of society is prevalent. Men's role is generally more highly valued and rewarded than women's roles. Women bear the primary responsibility for childcare and domestic work, while men are responsible for providing the family livelihood that makes them the head of the household, thus women can only be household heads when they become a widow or are divorced (Ufuoma et al. 2010). Female participation in political activities and public governance is limited in most rural areas. Women are among the poorest groups in rural Nigeria with limited access to land, capital, including credit (due to lack of collateral) and education.

About 10% of registered farmers in Nigeria are women and only 7% of them own land, 30% have access to agricultural loans, and 15% have a bank account (FAO 2018). Even though women have access to land, men receive double the share of a woman during inheritance (FAO 2018). In the southern part (our study area), access is determined by the influence of the husband in the rural community and the position of the wife in

polygamous household settings (e.g., first wife, second wife, etc. or mother of the first male child) (Ufuoma et al. 2010). The average land size owned by women in northeastern Nigeria is 0.8 ha compared to 7.5 ha by men (FAO 2018).

Women make up to 60% of the labour force in the informal sector and 70% agricultural farm labour (Ufuoma et al. 2010; Kanpmann 1999; Kwesiga 1998). Mining, hunting, and black smithery are occupations predominantly occupied by men while gathering of non-timber forest products, weaving, tailoring traditional clothes, trading of cosmetics and jewelry as well as craft making are occupations predominantly occupied by women. Women are also involved in the marketing of agricultural products, and decision-making for the pricing of goods, while men dominate in most activities involving hard work, such as land preparation, transport, and wholesale selling (FAO 2018). Merely 6% of extension staff are female (FAO 2018).

Both sexes participate in agriculture with some crops attached to gender and some level of division of farming operations. For example, staple food and cash crops such as maize, rice, sorghum, millet, groundnut, sesame, cowpea, and cotton are predominantly produced by men while spices and vegetables such as peppers, ginger, cloves, onion, amaranths, sorrel etc. are produced by women. Men are responsible for ploughing, planting, weeding, and rearing large ruminants, and women are responsible for harvesting, threshing, processing, rearing of small ruminants and poultry production (FAO 2018; Ufuoma et al. 2010).

1.2.5.6 Policies supporting rural women

Despite their significant contribution to agricultural labor that promotes national food security, women did not get any formal recognition by way of a policy pronouncement to encourage, protect and facilitate their access to inputs and services until 1986. In 1986, a government policy directive was developed to establish the Women in Agriculture (WIA) component of Agricultural Development Programs (ADPs) that were responsible for grassroots extension and advisory services in all states of Nigeria (FAO 2018). To integrate them into national agricultural development, via the mainstreaming of women into the ADPs system, to enable them equal access to agricultural inputs, credit, loans, and extension services (FAO 2018).

The instruments used to achieve the stated objectives were the provision of input subsidies using women extension agents to reach women farmers as the solution to the gender segregation of the area and organizing and mobilizing women into cooperatives to achieve economies of scale in production, resource sourcing and marketing (FAO, 2018). The programs under the policy helped create awareness of the importance of women in agricultural production, promoted capacity-building for women to adopt new production and processing technologies, and fostered collaboration with research institutes to promote labour saving devices for women. However, it was observed and confirmed by ADP WIA officials that the WIA programme never achieved the stated objectives, even with World Bank support for the ADPs. Basically, because the targeted number of female extension agents (EA) was never performed in most states; the critically needed commitment to funding and the political will to back the policy with appropriate legislation were never provided, especially after the termination of World Bank support to the ADPs; no prominent policy existed to provide for women's access to land and production inputs (FAO 2018).

In 1990, women's development strategies were implemented under the National Fadama development project with the partnership of the World Bank that aimed to sustainably increase the incomes of participating rural community dwellers. Target groups included the rural poor engaged in economic activities (farmers, pastoralists, fishers, nomads, traders, processors, hunters, and gatherers); disadvantaged groups (widows, the handicapped, the sick and other vulnerable groups, including people living with HIV/AIDS and unemployed youth) (World Bank 2008). The impact assessment of Fadama I and II revealed that women, the poor and other disadvantaged groups were given a voice through the project (FAO 2018). The instruments used were input subsidies and extension service provision. However, the programme was later replaced by the National Programme for Food Security (NPFS).

Another gender empowerment program was USAID MARKETS II that aimed to improve the performance, income, nutrition, and food security of poor rural farmers in an environmentally friendly manner in Nigeria. The key objectives included ensuring smallholder farmer's access to increased income, ready markets, better inputs, adequate finance, better water and pesticide management, appropriate technologies, and extension services. The program also included the goal of ensuring gender equality in food security,

so that both men and women have a significant influence on household spending (USAID 2017). The instruments used to achieve the objectives were: credit support, input subsidies; extension services (USAID 2017).

UNDP conducted various advocacy and awareness activities with several government ministries, departments, and agencies, to support initiatives aimed at promoting strategic engagement around the SDGs. For example, the UNDP supported the government-developed private sector engagement strategy which provided for and recommended the establishment of the first-ever private sector advisory group on SDGs, providing both technical and financial support towards ongoing efforts aimed at integrating the SDGs, particularly "No poverty", "Zero hunger", "Gender equity" and "Life on land", into national and state-level policies, plans and budgets (UNDP 2017).
There is no cross-cutting approach, but there are important lessons to be learned from policies, programs, and interventions aimed at closing the gender gap in agriculture. Many of the approaches to meeting women's needs are like those to address the needs of other resource-constrained, small-scale farmers and rural people in general. However, there are additional cultural and behavioral factors that need to be considered in efforts to increase gender equality. Gender aware agricultural policy decisions and development interventions must be based on up-to-date, reliable, and context-specific information. Despite the wealth of evidence that has emerged from recently commissioned work, the information base on which gender-sensitive policy decisions can be made needs to be continuously built.

2.0 Objective of the Study

Education is expected to increase managerial skills, labour productivity, capital utilization and access to information that will lead to the adoption of agricultural innovation with comparative advantages that will turn to increase agricultural productivity, and when access to productive agricultural resources is not evenly distributed across gender, this may affect the productivity of neglected gender group. Based on this, the broad objective of the study was to assess the effect of education and gender on cocoa farmers productivity.

The specific objectives are.

i. To analyse the effect of farmers' education on-farm on the productivity of cocoa.

ii. To investigate the effect of gender on-farm productivity of cocoa.

The study tested the following hypotheses.

i. H_1: Farmers' education has a statistically significant effect on cocoa farm productivity

ii. H_1: Gender has a statistically significant effect on cocoa farm productivity.

3.0 Methodology

3.1 Study Area

The study was conducted in Ondo State, the state is in southwest Nigeria, lies between longitudes 4"30" and 6" East of the Greenwich Meridian, 5"45" and 8" 15" North of the Equator with the land area of 14,788.723 square kilometres, lies entirely in the tropical climate. It is bounded in the North by Ekiti/Kogi State; in the east by Edo state; in the west by Oyo and Ogun states and in the south by the Atlantic Ocean. The population of the state is 3,460,877 comprising 1,745.057 Male and 1,715,820 female (2006 census) and the projected population of 4,883,792 comprising 2,462,525 male, 2,421,267 female (NBS, 2019). A high forest zone (or rain forest) is found in the southern part of the state, while the northern part is predominantly sub-savannah forest, a tropical with two distinctive seasons: the rainy season (April-October) and the Dry season (November-March). The temperature throughout the year ranges between 21°C-29°C and high relative humidity. The annual rainfall varies from 2,000mm in the southern parts to 1150mm in the northern areas, with extensive fertile soil good for agriculture with sub-savannah forest suitable that is suitable for cattle grazing in the Northern part, and wide forest resources, variety of timber species e.g. Teak, Gmelina, Mansonia and the state is the largest producer of cocoa in Nigeria, other cash crops grown in the state include rubber, cashew, palm oil (MEPB, 2020).

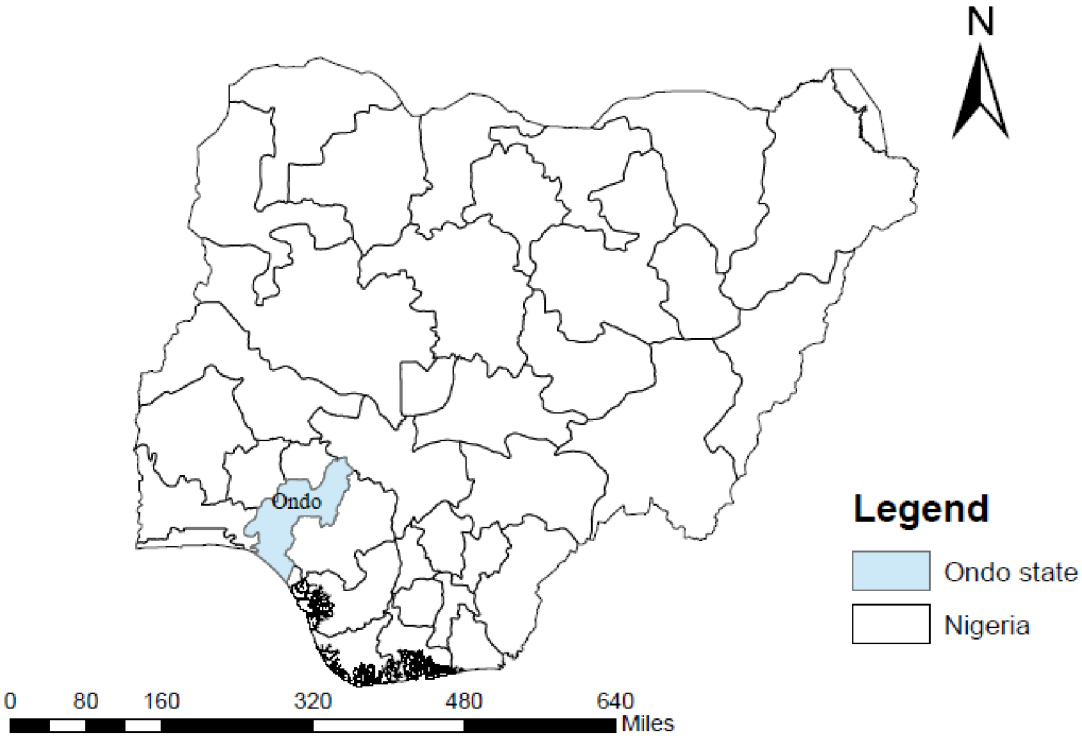

Figure 2: Map of Nigerian showing Ondo state

Ondo state was selected for the study because it is the largest producer of cocoa in the country (Cocoa & Palm Kernel) (Ministry of planning and budget Ondo state 2009). Akure and Oke Igbo Local Government Areas (LGAs) were selected conveniently from the 18 LGAs of the state. Sixty cocoa farmers were purposively selected to make sure relevant information on cocoa production can be found from the respondents, this forms a one hundred and twenty (120) farmers as the study sample.65% of the state produce revenue is from Agriculture (Cocoa & Palm Kernel) ministry of planning and budget Ondo state 2009. Hence, Ondo state has become the leading cocoa producing state in the country.

3.2 Data Collection

A primary data was collected through face-to-face survey by the researcher in Yoruba language and translated into English with the help of extension agents of the LGAs between April to May 2021. The semi-structured questionnaires were used to capture the demographic, farm and institutional characteristics of the selected cocoa

farmers and the quantity of cocoa beans per hectare obtained from their farms as well as the market prices.

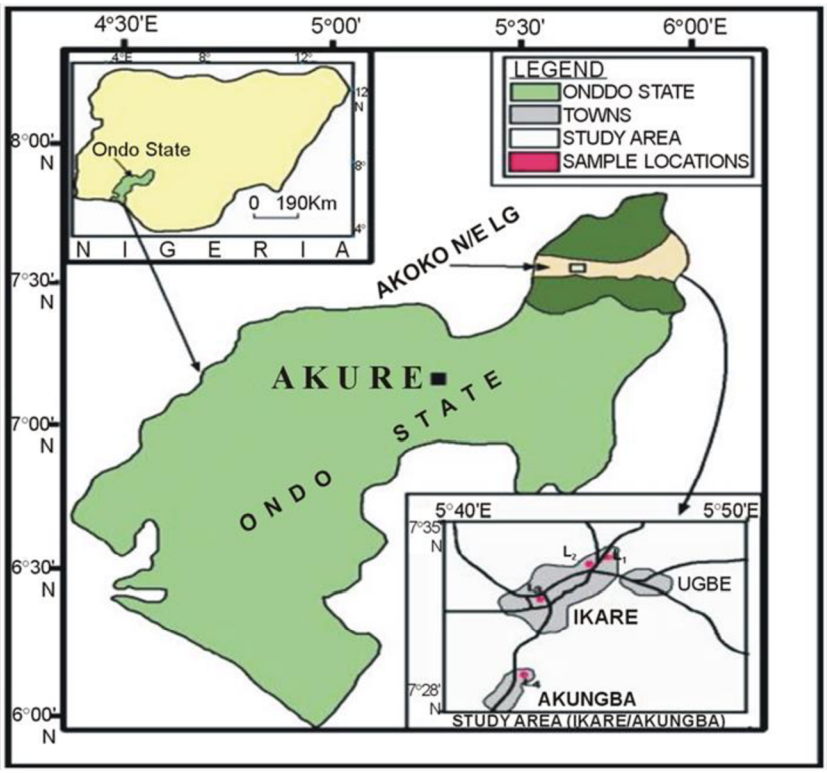

Figure 3: Map of Ondo state showing the study site

3.3 Data Analysis

Descriptive statistics were used in describing the data collected.

Two Linear regression models were employed to achieve the first objective 1 (effect of education on farm productivity of cocoa farmers).

The regression model in its specific format is.

$$y = \alpha + \beta_1 X_1 + \ldots + X_n \beta_n + \varepsilon \qquad \text{... (equation 1)}$$

y = farm productivity (farm yield/ha in kg for model 1 and farm income in Naira/ha for model 2)

α = regression constant

$\beta_1 - \beta_n$= regression coefficients (table 1)

ε= error term

X_1= Primary education (1/0)

X_2= Secondary education (1/0)

X_3= Tertiary education (1/0)

X_4= Gender (Tertiary=1, otherwise= 0)

X_5= Age (years)

X_6= Household size (number of people)

X_7= Farming experience (years)

X_8= Farm size (hectare)

X_9= Cooperative membership (1/0)

X_{10}= Extension contacts (1/0)

X_{11}= Access to credit (1/0)

Table 2: Description of the variables (N=120)

Variable	*Description*	*Min*	*Max*	*Mean*	*St. dev.*
Dependent variables					
Farm yield	In kilogram/ha	400	4,050	2,044.92	1,048.87
Farm income[1]	In Naira/ha	360,000	3,800,000	1,809,063.55	940,258.09
Independent treatment variables					
Primary	Primary=1, otherwise =0	0	1	0.35	0.48
Secondary	Secondary=1, otherwise =0	0	1	0.19	0.39
Tertiary	Tertiary=1, otherwise= 0	0	1	0.09	0.28
Gender	Male=1, female=0	0	1	0.89	0.31
Independent control variables					
Age	In years	23	73	48.35	10.57
Household size	Number of people	3	10	5.67	1.44
Farming experience	In years	1	40	15.43	8.45
Farm size	In hectare	1	10	5.11	2.72
Cooperative membership	Member=1 otherwise=0	0	1	0.27	0.45
Extension contacts	Access to extension=1, otherwise=0	0	1	0.30	0.46
Access to credit	Access to credit=1, otherwise= 0	0	1	0.01	0.12

Dollar=415 Naira, on 20/4/2022.

4.0 Result and Discussion

4.1 Socioeconomic Characteristics

Table 3 displays the socio-economic characteristics of cocoa farmers in Ondo state of Nigeria. Analyses of gender of farmers showed that majority (89.2%) of the farmers were male, while the remaining 10.8% were females. The result implied that cocoa farming in the study area is still primarily male dominated. This could be due to the cultural and religious background of most African communities that still put women's enterprise under their husbands' care as a form of submission. This supports the earlier survey result of (Bamire 2010) on the effects of tenure and land use factors on food security among rural households in the dry savannas of Nigeria, where majority (92.5%) of the respondents were males. According to Abidogun et al. (2019), cocoa production is highly dominated by men because of the tedious nature of operations involved in its production. This result also corroborates one of the findings of Muhammad-Lawal et al. (2009) and Oluwatusin (2014).

The results of marital status showed that 91.7% of them were married This implied that a high proportion of respondents had family responsibilities. In Nigeria to some extent, marital status determines the household size as it is expected of married farmers to have household members that would most of the time assist in farming activities. This agrees with findings by Ayoola and Odiaka (2004) and Oluyole et al. (2017) that majority of the rural work force were married.

As regards education, 64.2% of the cocoa farmers in the study area had formal education at varying levels. The remaining 35.8% had non-formal education. This implies that most cocoa farmers in the study areas were educated. Earlier findings made by Oluwatusin (2014) shows that most cocoa farmers were educated and can read and write. Thus, this could serve as an impetus in adopting cocoa production technologies and acquiring some of the required knowledge for adequate farm maintenance. This result suggested that most of the rural cocoa farmers could read and write in English language as it is observed among their counterpart in Ghana (Simon 2015).

Furthermore, 87.5% of the farmers possessed a farmland while 11.7% farmed on leased land. Only 30.0% of the farmers were members of cooperative society while majority (30%) of them do not belong to any cooperative society. Similarly, majority

(98.3%) of the farmers do not have access to credit facilities and only 1.7% of them have access to credit. These findings are in consonant with Oke et al. (2019) who reported lack of access to credit as a major constraint faced by cocoa farmers in Nigeria. Most cocoa farmers rarely have access to credit, which makes it impossible to improve their productivity. Invariably, agricultural credit is essential to meet the required investment to increase Nigeria's cocoa productivity.

Table 3: Socio-economic characteristics of the cocoa farmers (N=120)

Variable	*Item*	*Frequency*	*Percentage*
Gender	Female	13	10.8
	Male	107	89.2
Marital status	Single	2	1.7
	Married	110	91.7
	Widow	2	1.7
	Divorce	6	5.0
Education	Non-formal	43	35.8
	Primary	43	35.8
	Secondary	23	19.2
	Tertiary	11	9.2
Land ownership	No	14	11.7
	Yes	105	87.5
Cooperative membership	No	84	70.0
	Yes	36	30.0
Access to credit	No	118	98.3
	Yes	2	1.7

4.2 Source of Farm Capital

The result of table 4 shows the cocoa farmers' sources of farm capital and livelihood activities. The results depict that most (99.2%) of the farmers do not receive any agricultural support from government. The 85.8% of farmers have no other source of income than farm income and 98.3% of them generated their agricultural capital through personal savings also, 58.3% of them keep livestock. This study supports the result of Kanu (2020) who also reported that majority of cocoa farmers had no access to

government support and majorly financed cocoa production through their personal savings.

Table 4: Source of Farm Input and Livelihood (N=120)

Variable	*Item*	*Frequency*	*Percentages*
Receiving government support	No	119	99.2
	Yes	1	0.8
Off-farm income generation	No	103	85.8
	Yes	17	14.2
Source of agricultural capital	Personal savings (yes)	117	98.3
	Cooperative(yes)	2	1.7
Livestock ownership	No	50	41.7
	Yes	70	58.3

4.3 Farm Output

Figure 4 presents the farm output distribution of cocoa farmers in Ondo state Nigeria in respective of the farm size (hectare) distribution. The 33% of farmers harvested 1,000-2,000 kg of cocoa annually from their farm and 24% of them obtained more than 3,000 kg of cocoa annually from their farm. The 22% of the cocoa farmers in Ondo state Nigeria harvested less than 1,000 kg annually from their farm and 19.9% obtained 2,001-3,000 kg annually. This result supports the findings of Oduwole (2001) who reported that cocoa production has dropped in recent times to about 26%. In Nigeria, which is likely due to climate change, aging of plantation, soil nutrient degradation (natural) and negligence of agricultural sector in favor of oil exploitation, internal and external price fluctuation, and excess exportation due to shortage of cocoa processing factories in Nigeria.

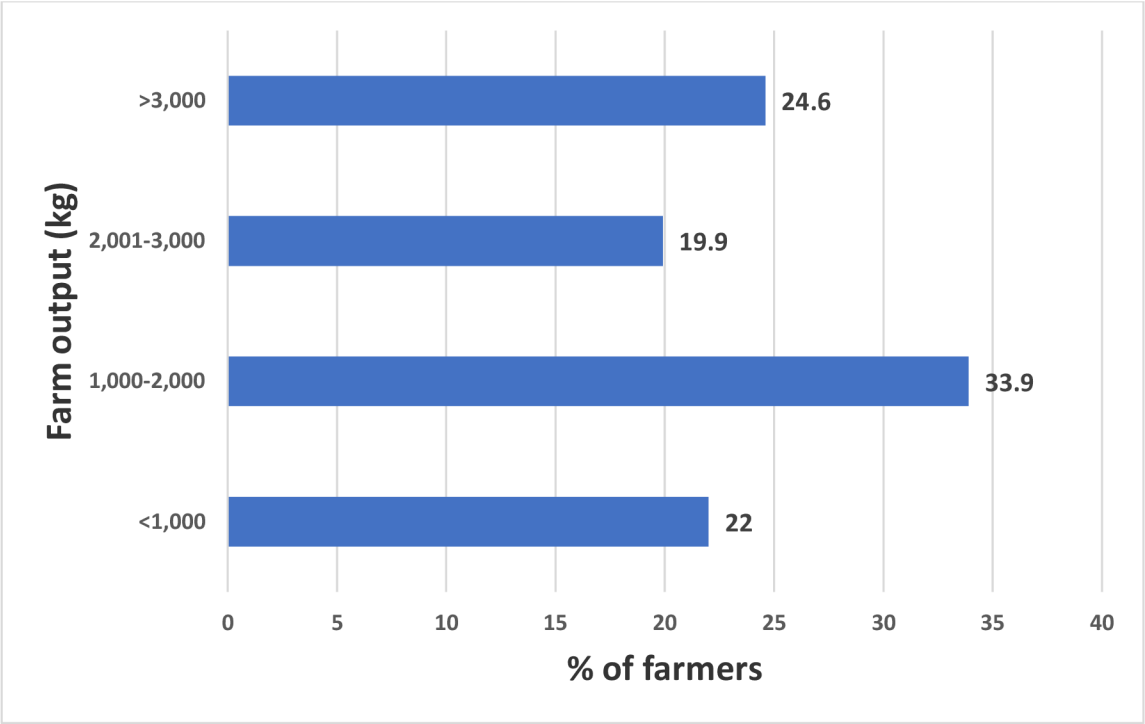

Figure 4: Annual farm output of cocoa farmers (N=120)

Results (table 5) indicated that the maximum farm size of cocoa farmers in the study area is 10 hectares, and the maximum cocoa price is 950 Naira/kg and the minimum of 800 Naira/kg. This shows that the difference in market price is not wide. The average yield obtained is about 400kg/ha with average cocoa farm income of 352,182 Naira/ha.

Table 5: Cocoa farmer's farm productivity

Variable	Minimum	Maximum	Mean
Farm size (ha)	1.00	10.00	5.11
Cocoa price (Naira/kg)	800.00	950.00	880.50
Yield (kg/ha)			399.98
Cocoa farm income (Naira/ha)			352,182.39

As literature indicated that education may influence the technology adoption rate of agricultural innovations and improved the management skills of a farmer, the result in table 6 display a descriptive result of cocoa farm productivity of farmers based on their level of education. The result shows that farmers with tertiary level of education obtained the highest farm yield and income from their farms, as they obtained 418.26kg/ha and

383,409.09Naiara/ha. While farmers with lowest cocoa farm productivity are farmers with no formal education as they obtained cocoa yield of 403.53kg/ha and cocoa farm income of 353,035.71Naira/ha. This indicates the role of farmers education on cocoa farm productivity because the productivity increases with the increasing level of education.

Table 6: Distribution of cocoa farm productivity based on education level

Education	*Cocoa farm yield (kg/ha)*	*Cocoa farm income (Naira/ha)*
No formal	403.53	353,035.71
Primary	412.62	366,963.45
Secondary	409.09	361,818.18
Tertiary	418.26	383,409.09

As we hypothesized that gender may affect the cocoa farm productivity of the farmers, table 7 display the descriptive result of cocoa farmers based on gender group. On the cocoa farm yield, the female farmers have a mean of 423.07kg/ha which is slightly higher than 407.55kg/ha yield of the male cocoa farmers, in the same way, the female cocoa farmers have the higher average of 363,076.92 Naira/ha compared to a 360,423.12 Naira/ha for the male cocoa farmers. This indicate that descriptively, there is not much difference of farm productivity between gender group of farmers.

Table 7: Gender and Cocoa Farm Productivity

Productivity	*Unit*	*Female (n=13)*		*Male (n=105)*	
		Mean	Std. dev.	Mean	Std. dev.
Cocoa farm yield	Kg/ha	423.07	38.81	407.55	34.64
Cocoa farm income	Naira/ha	363076.92	37875.25	360423.12	33864.29

4.4 Effect of Education and Gender on Farmers' Cocoa Farm Yield

Result of table 8 displays the effect of education and gender on cocoa farm productivity of farmers in Ondo state of Nigeria. The two Multiple Linear regression models were used to ascertain the effect of education and gender on farm productivity of farmers and

the productivity indicators used were farm yield in kilogram/hectare and farm income in Naira/hectare. The F-value of the model that tested the fitness of the models were significant at $p<0.01$, which mean that the independent variables imported into the two models are good to explain the variability of the dependent variable which is farm yield and farm income.

The R^2 value for the first model (cocoa farm yield) is 0.413, which implies that the independent variables used in the model explain the 41% of the farm yield of cocoa farmers in the study area and the other 59% are explain by the variables that were not included in the model such as climatic conditions and agronomical practices.

The education is expected to give farmer a managerial skill that help him to have a good plan and arrange the farming activities as well as taking rational decision in adoption of agricultural innovations and other farm related operations. Concerning first model (cocoa farm yield), the result depicts that, tertiary level of education statistically significant effect on cocoa farm yield of farmers with positive regression coefficient of 0.420. This implies that farmers with tertiary level of education have 42 percent higher farm yield compared to those with primary and secondary level of education. This is attributed to the above-mentioned reasons that make farmers with high level of education to have a higher yield compared to farmers with no or low level of education. This agrees with the studies of Arega and Manyong (2007) and Luh et al. (2014).

Regarding the effect of gender on cocoa farm yield, it has the positive regression coefficient of 0.078. This means that male cocoa farmers are getting 7.8% higher yield than their female cocoa farmers counterpart, however, the result is not statistically significant which is contrary to our prior expectations. The reason for not significant may attributed to the even distribution of agricultural productive resources, opportunities, rights, and privileges in the study area as it reflects on their farm productivity in table 7. This makes us failed to reject null hypothesis (H_0) which stated, “gender has no statistically significant effect on cocoa farm productivity”. The results of this study agree with many empirical studies (Saito et al. 1994; Adeleke et al. 2008) that women as farm managers are as efficient as men. However, other studies such as Adesina & Djato (1997), Doss (2001) and Yiadom-Boakye et al. (2012) argued that farm plots managed by women are less productive than plots managed by men.

Furthermore, farm size is expected to increase the farm yield when other farm inputs remain constant. Our result is consistent with the expectation as farm size has statistically significant effect on cocoa farm yield with a positive regression coefficient of 0.257. This means that a one hectare increase of farm size creates 25 percent increase on farmers' cocoa farm yield.

Table 8: Education and farm productivity (N=120)

Variable	**Farm yield (kilogram/ha)**			**Farm income (Naira)**		
	B	**Std. error**	**t-value**	**B**	**Std. error**	**t-value**
Education						
Primary	0.026	0.061	0.425	0.050	0.062	0.425
Secondary	-0.010	0.081	-0.129	0.010	0.083	0.129
Tertiary	0.420	0.106	3.960***	0.417	0.109	3.960***
Gender	0.078	0.083	0.948	0.113	0.085	1.329
Control variables						
Age	-0.001	0.004	-0.330	-0.002	0.004	-0.537
Household size	0.032	0.023	1.387	0.033	0.024	1.390
Farming experience	0.003	0.006	0.501	0.005	0.006	0.809
Farm size	0.257	0.013	19.255***	0.258	0.014	18.858***
Cooperative membership	-0.120	0.086	-1.394	-0.146	0.088	-1.657*
Extension contacts	0.136	0.084	1.620	0.153	0.086	1.788*
Access to credit	-0.091	0.182	-0.501	-0.025	0.187	-0.131
F-statistics	***0.000***			***0.000***		
R^2	***0.413***			***0.451***		

***p<0.05, ***p<0.001**

4.5 Effect of Education and Gender on Farmers' Cocoa Farm Income

The R^2 value of the second model (cocoa farm income) is 0.451, which means that the independent variables imported into the model explain the 45% of farm income of cocoa farmers and the rest were explained by the variables that were not included in the model such as climatic conditions and other agronomical practices. The tertiary education level has statistically significant effect on cocoa farm income with regression positive coefficient of 0.417. This means that farmers with a tertiary level of education have a 42 percent higher farm income than farmers with primary and secondary level of education. This result supports the findings of Oluyole and Sanusi (2009) whose study revealed positive relationship between education and farm productivity. They reported that the

more a farmer is formally educated, the more the efficiency. Hence, the more the outputs (Oluyole & Sanusi 2009).

Regarding the effect of gender on cocoa farm income of farmers, gender has a positive regression coefficient of 0.113. This indicates that male cocoa farmers are getting 11% higher cocoa farm income than their female cocoa farmers counterpart. However, the result is not statistically significant. This may be attributed to the equal access to farm productive resources irrespective of gender in the study area. This is contradictory to the studies of Fontana and Paciello (2010) and Elias et al. (2015). The probable reason for the contradictory finding is that farmers have an equal access to privileges, opportunity, and other agricultural productive resources in the study area.

Farm size has a statistically significant impact on cocoa farm income of farmers with positive regression coefficient of 0.258. This means that one hectare increase of farm size creates 25 percent increase on farm income of cocoa farmers in the study area. Cooperative has a statistically significant influence on cocoa farm income with negative regression coefficient of -0.146. This depicts that member of the cooperatives are likely to have 8 percent less farm income than non-cooperative members. This may be attributed to the fact that the cooperatives are not well functioning and the support from the cooperative is very rare in the study as only 1.7% sourced their farm capital from the cooperative (Table 4)

Extension services trainings are expected to upgrade farmers on agricultural management, innovations and other farm management practices that are expected to improve the farm's outputs. The result of the study goes in line with this expectation as extension has a statistically significant effect on cocoa farm income with positive regression coefficient of 0.086. This implies that farmers with access to extension services are having 8 percent farm income higher than those without access to extension services.

5.0 Conclusion and Recommendations

This study investigated the effect of education and gender on-farm productivity of cocoa farmers of Ondo state, Nigeria. Most of the farmers are male, married and most of them have a low level of education, majority have farmland and they are non-members of cooperative societies as well as don't have access to credit. Concerning farm capital, most of cocoa farmers have no access to government support and do not have an off-farm source of income and sourced their agricultural capital from personal savings. The study discovered that most of the cocoa producers are old people which means young ones are not encouraged, incorporated and adequately trained into cocoa production. Also, most of the producers were not educated which not only make interaction difficult between extension agent and farmer but also makes them receptive to taking risk. It also makes it easy for fake chemicals to be sold to the farmers

Our results show that education affects the farmers farm productivity positively, as it affects both the farm yield and farm income. This indicates the importance that the government and other non-governmental organizations to give priority in agricultural program design and implementation to farmers with low level of education. As this will reduce the income inequality between farmers with low- and high-level education. Based on this, the study accepted the alternative hypothesis which said that farmers' education has a statistically significant effect on cocoa farm productivity and failed to accept the null hypothesis that opposed the statistically significant effect of farmers' education on cocoa productivity. Conversely, gender has no statistically significant effect on cocoa farmers' productivity. Based on this, the study failed to reject the null hypothesis which stated that gender has no statistically significant effect on cocoa productivity of farmers.

As the farmers' education was found to affect the cocoa productivity of farmers due to efficient agricultural resource utilization, information access and understanding. Formulation of farm management and resource utilization education policies that will help cocoa farmers with low level to improve their farm management resource utilization in an efficient way will help in reducing the farm yield and income inequalities between the farmers with high and low education.

This study does not find any significant effect of gender on both the cocoa farm yield and the cocoa farm income of the farmers, despite the descriptive differences found in the descriptive analysis result.

5.1 Study Limitation

This study unveiled the effect of education and gender of cocoa farmers productivity in Ondo state of Nigeria. It found the significant effect of farmers' education on cocoa farm productivity and no significant effect of gender was found on cocoa farmers' productivity.

However, the result of this study was built on convenient sampling method, small sample size and limited representation of female gender which may not be good representation of cocoa farmers in Nigeria. Large and sufficient data that can represent a true picture of the study population should be considered in the future studies that will overcome the shortcomings of using small sample size.

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APPENDICES

Appendix 1: Study Questionnaire

The questionnaire was design to ascertain the impact assessment of agricultural education on farmers' productivity. Case study of cocoa production in Ondo State, southwest Nigeria. Your response will be treated confidentially.
Thank you.
Lawal Gbenga Samuel (Researcher)

(1) What is your gender
□Male
□Female

(2) How old are you? (years) ……

(4) Marital Status
□Single
□Married
□Widowed
□Divorced

(5) What is the size of your household? (Number of person) ……

(6) Number of children less than 15 years? ……..

(7) Number of household members more than 60 years? ……

(8) What are your years of formal education?.....

(9) What is your highest level of Education
□No formal education
□Primary
□Secondary
□Tertiary
□Others (Vocational& training)

(10) How long have you been in farming? (In years) ……

(11) Do you own a land? Yes☐ No☐

(13) What is the size of your farm under cultivation (in hectare)? ……..

(14) What is the approximate quantity of yield you obtained in the last farming season? (kg) .....

(15) What is the price of 1kg of cocoa in the last farming season (Monthly in ₦)? ……

(16) Are you a members' cooperatives?
□Yes
□No

(17) Do you have access extension contacts in the last farming season?
□Yes
□No

(18) If yes, how many times (number)?.....

(19) And from which organization?
Government extension agent☐
NGOs extension worker ☐
Farmers' cooperative ☐
Others (specify) ☐ ……

(20) Do you have access to credit
Yes ☐
No ☐

(21) Do you have off-farm income generating activities
Yes ☐
No ☐

(22) Did you receive any government support/training?
□Yes
□No

(23) What is your source of agricultural input/Capital?
□Personal savings
□Corporative
□Borrowing from friends & families
□Bank loans
□Others

(24) Do you have a livestock
Yes ☐
No ☐

Appendix 2: Data Collection Pictures


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