DETERMINANTS OF CASH CROP PRODUCTIVITY IN ETHIOPIA: A CASE OF SMALL SCALE COFFEE PRODUCERS IN MANA WOREDA, JIMMA ZONE

A THESIS SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES OF JIMMA UNIVERSITY, COLLEGE OF BUSINESS AND ECONOMICS IN PARTIAL FULFILLMENTS OF THE REQUIREMENT FOR THE AWARD OF DEGREE OF MASTER IN DEVELOPMENTAL ECONOMICS (MSC)

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CERTIFICATE

This is to certify that the thesis entities "Determinants of Cash Crop Productivity in Ethiopia: A Case of Small Scale Coffee producers in Mana Woreda, Jimma Zone", Submitted to Jimma University for award of Degree of Masters in Development Economics (MSC) and is a record of bonafide research work carried out by Mr. Tamiru Gabusho Ayana, under our guidance and supervision

Therefore we hereby declare that no part of this thesis has been submitted to any other university or institutions for the award of any degree of diploma.

Main Adviser's Name *Date* *signature*

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Internal Examiner's Name *Date**Signature*

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DECLARATION

I hereby declare that this thesis entitled *"Determinants of Cash Crop Productivity in Ethiopia: A Case of Small Scale Coffee producers in Mana Woreda, Jimma Zone",* has been Carried out by me under the guidance and supervision of Mr. Yilikal Wassie and Mr. Minyahil Alemu.

The thesis is original and has not been submitted for the award of degree of diploma to any university or institutions.

Researcher's Name Date Signature

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Determinants of Cash Crop Productivity in Ethiopia: A Case of Small Scale rural Coffee Producers in Mana Woreda, Jimma Zone.

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ABBREVATIONSAND ACRONYMS

ADLI Agricultural Development Led Industrialization

CCI Crop Commercialization Index

EAFCA East Africa Fine Coffee Association

FGD Focus Group Discussions

GDP Gross Domestic Productions

GTP Growth and Transformation Plan

LDC Less Developing Country

MOA Ministry of Agricultures

MOFED Ministry of Finance and Economic Development

NBE National Bank of Ethiopia

NEPAD New Economic Plan and Agricultural Development

NGO Non Governmental Organizations

OLS Ordinary Least Square

PASDEP Plan for Accelerated and Sustainable Development to End Poverty

SDPRP Sustainable Development and Poverty Reduction Program

SNNP Southern Nation and Nationality People

SSA Sub Saharan Africa

USDA United States Department ofAgriculture

VIF Variation Inflation Factor

Table of Contents Pages

List of Tables

List of Figures

Abstract

In Ethiopia there have been numbers of farming strategies reform by government to improve productivity of small scale cash crop productions to increase GDP. However implementation of it does not give Eigen effects on rural production. For causes agricultural coffee productivity in Mana district, Jimma zone were inadequate and farm characterized by poor productivity. This study aimed to examine determinants of productivity in Ethiopia, a case of small scale coffee producers in Mana woreda. This study used primary and secondary sources of data to address research hypothesis and the sampling techniques that study used was multistage sampling which researcher applies sample determination general formula of Yemanes (1967). The study employed probit model to identify determinants of coffee farmers' productivity in area and used cob Douglas production function to analysis level of productivity. The finding of thise study show, kola areas were suitable to coffee productivity than dega and woinadega areas with the same identified factors having large numbers of effectively determinant factors to productivity where in dega the least. So for dega and woinedega areas to incidence of factors to low productivity resulted call for urgent intervention to curbs this problem. In line with gender, age, education level, family size, land size, market distance, farm technology input, credit access and climate change, was identified as significant determinants of coffee productivity in Mana farm area. Explanatory variables related to effecient and ineffecient productivity have been identified and tested by diagnostic tests. In general, this study provide evidence that certain demographic and socioeconomic variables play key role in determining productivity in all rural areas of Mana woreda. Thus coffee productivity policies based on those factors should ingredients to increase productivity and targeted groups should involve in efforts that could address identified problem.

Key words:*Agricultural Productivity, Cob Douglas, Coffee, Diagnostics, Probit*

CHAPTER ONE

1. INTRODUCTION

1.1 Background of Study

According to before by Barrios *et al., (*2013), agriculture is the main stream of do business and manufacturing development in favor of African country. However, feeding inhabitants of Sub-Saharan African becoming challenges on mass country'. Schools debates to African crop rising.

Majorityof Ethiopian rural population (83.8%) were considered to largest African countries having populations 73.9 million. For case agriculture is economic foundation of populations. Contribution of agriculture to GDP in Ethiopia is more than other Sub-Saharan Africa having 40 percent contributions(Barrios *et al.*, 2013).

The contribution of agricultural sector to GDP of Ethiopia is accountedfor a greater share than other sectors (MoFED, 2012). Agricultural Development-Led Industrialization (ADLI) of long term policy which at early stage of development, agricultural sector is predicted to play a most important in growth of the economy (MoFED, 2002). At this phase agriculture is considering being engine growth to feed large magnitude of population and this is a source of input to industries. In early stages of economic growth of Ethiopia major economic activities are related to agriculture which has growth linkage with other sectors. In line with these arguments there is considerable body of literature that favors the thought to agricultural growth as locomotive of enlargement and irrigation-led technological changes are key drivers' growth of productivity of agricultural sector in Asia.

The Ethiopia final goal of ADLI policy is for industry to guide. Accordingly to the ministry of agriculture and rural development (2010), 11.7million smallholder represents 95 percent of agricultural GDP share (MoARD, 2010). This is agricultural sector is the source of livelihood for 85% of population which includes majority of poor and contributes to economic growth. As indicated plan for Sustainable development and poverty reduction programs focus is to ensure food security. Ethiopia is 5th largest global producer of Arabic coffee beans in world, and economic agriculture has ensuring quality of life and sustainable development of the rural areas contributions. It provides for 85 % of labor force employment opportunities and accounts for over 43 % of the GDP and about 70 % of export revenue in 2013.

The sustainable development and poverty reduction program (SDPRP) for accelerated and sustained development to end poverty (PASDEP) has growth and transformation plans (GTP I and GTP II) of strategy. Focus of government in agricultural sector through different strategies forrural communities to provide produce food throughout a year (Bihon, 2015).

Agricultural growth needs well-timed adequate supplies of necessary farm inputs. Farmers in Ethiopia use off-farm income as a principal means for achieving their goal of productivity. The investment power of bulk of Ethiopian farmers is low, poor farm household cannot pay to meet increased demand for purchase of better seeds, recommended quantity of fertilizer, hiring of farm machinery. Lack of finance is reason for low productivity in agriculture (Tessema, 2015). The decline productivity in agricultural sector has related factors which highly responsible for rural population live in poverty trap now a day. Ethiopia is endowed with enormous genetic diversity and different coffee type tastes. Ethiopia in general and study area in particular has different agro-climate for coffee productions. Oromia regional state share cash crop in Ethiopia with considerable modern technology to farmers related regional agricultural research centers in 2001/02.

1.2. Statement of the Problem

As specific economic sector Ethiopian government committed to rapid growth of agricultural crops. At present economy is dominated low-productivity agricultural cash crops on potentially highly productive land, labor resources bulk live in rural area,although many people's are isolated from requisites for productivity. Thereforea direction of development that increases productivity of cash crops of the sector investigates determinant factors affect crop productivity in rural areas. In Ethiopia different cash crop focused researches conducted.

The evidence is from last researcher's work on same topics on determinants of rural cash crop productivity such as Yishak (2017) uses cross-sectional data to analyze rural farm household's cash crop production yield in Wolayta zone. His result revealed factors such sex, farm sizes, livestock ownership, oxen ownership, education, leadership, cash income, and market distance were key determinant farmers' participation in productions. So from researchers work what others understand was even listed factors determine crop productivity, it did not identified in where agro-climatic area affected with the same identified factors cross-sectional analysis since aim of study was analysis productivity differences context.

Similarly Birhanu (2014) uses OLS and probit model analysis to identify factors which reduce crop productivity in Tigray region by using cross-sectional survey. His result indicates gender, age, education levels, family size, draft animals, area and credit are significantly affect farm activity productivity. From his study policy-makers didn't understand where locations affected more since data analysis was stated with cross-sectionals, and to intervene to curb the problem.

Kegonde (2015) in Jimma zone of Oromia regional state using cross-sectional indicates agricultural production influenced by institutional factors, extension service, fertilizer, farmland, and off-farm income, experience of household participation.However recognition of determinant factors setback accounted for limited households influences from coffee production participation rather identify how each factors relation to productions of coffee producers and to participation of producers was influenced by same identified determinant factors.

In to critiques of last researchers studyit were uses OLS and probit regression model analysis not Cobb Douglas production model. However using OLS and probit were more important to analysis study, since determinant factors are different variables respect to different climates expected linear relations of dependent and independent variables with binary outcomes of variables on productivity. Although, if analysedwith cob Douglas production model it would be more appropriated.

Jimma zone is one from other Oromia regional state zones which have high potential cash crop produced area. In addition to having potential suppliers of cash crop based, however there is no adequate understanding information on determinants of rural small scale coffee productivity of farmers.

Finally the case leads researcher to conduct this study on determinant of cash crop productivity in Ethiopia: cases on small scale rural coffee producers in Mana woreda have different factors. As a result in Mana woreda there were suitable resources that comfortable for growing coffee. This could be giving opportunity for smallholder farmers in area to economic welfare. Because it has export potentialcrops to global market. However, potential opportunities were exist naturally some small holder farmers was not participating and productive in coffee productions in area. This indicates

external and internal factors affect households from participation and being productive to coffee farm activity. Additionally the extent to which farmers participate in coffee farm activities variedresulted unparalleled to available potential land resources to being yield productivity. Therefore determinant factors were identified in Mana woreda of rural agricultural farm to use actual potential resources, and this research was initiated for this cause.

1.3. Research Question

- ✓ What are major determinant factors affect small scale producers of crop productivity?
- ✓ Is empirical relationship of determinant factors and crop productivity of producers at small scale levels?
- ✓ Which identified factors affect more productions of coffee producers?

1.4. Objectives of the Study

1.4.1. General objective

The objective of thise study was to investigate main determinants of cash crop productivity in Ethiopia: a case of small scale coffee producers in Mana woreda, Jimma zone.

1.4.2. Specific objectives

- ✓ To identify determinants of small scale coffee farm productivity
- ✓ To examineeffect of determinants factors onsmall scalecoffee producers participations
- ✓ To compare determinant effecton small scale coffee farm productionof households

1.5. Significance of the Study

The significance of this study is important for policy-makers to understand determinant factors that could accelerate or reduce agricultural cash crop productivity at small scale farmers' levels to rural area in Mana woreda then provide solutions. Also for smallholder rural coffee farmers it will help to generate revenue incomes from more productivity yielded. Additionally it will help to increase share of agriculture to GDP of countries than other economic sectors. It also helpful for future

researchers specialize in this field area, further open to new researchers to which not covered by this study and used as documented materials.

1.6. Limitation of the Study

Limitations of research were lack of enthusiasm awareness of respondents wasin terms of the willingness of respondents to participate in this study for responses.

1.7. Scope of the Study

The study limited geographically to rural farm area of Mana woreda, periodically to production period of 2018 productivity and typically focused on agricultural production to coffee farmers in rural of Mana woreda. Despite possibility of existed small scale farm at town and urban of the study area to this study researchers have been exclude urban area and focused only to given rural areas.

1.8 Organization of the study

This paper is organized into five chapters. Chapter one introduces the background of the study, problem statement, objective of study, study hypothesis, significance of the study and scope. Chapter two contains a review of related literature. Methodology of the study, sources of data, target population, sample and sampling technique, data gathering instruments, data collection procedures, reliability and validity, ethical consideration and methods of data analysis included under chapter three. Under chapter four, discussion results were analyzed. Finally in chapter five, conclusion and recommendations were listed.

CHAPTER TWO

2. LITERATURE REVIEW

This paper reviews determinant of cash crop productivity of small scale rural farmers.

2.1. Theoretical Review

Small scale farmers can be approached from the multiplicity of angles. Small-scale agriculture was not used interchangeably with smallholder, family, subsistence, resource-poor, low-input and low technology (Heidhues and Bruntrup, 2003). The definitions diversify to conceptual approaches. Family farms operating units in which labor and enterprise come from family puts much of working time into farm (Oksana, 2005). On the other side World Banks rural strategy defines as a low asset base operating less than two hectares of cropland (World Bank, 2003).

The otherstudy defines as smallholder farmers with limited resource endowments, relative to other farmers in sector (Dixon *et al.,* 2003). There is no clear out definition of smallfarms and smallholder farmers. The simplest meaning of smallholder is when land available for a farmer is very limited (Chamberlain, 2008; Hazel *et al.,* 2007). However, meaning goes beyond this conventional definition and consists of some general characteristics called small farms or smallholders exhibit. Chamberlain has recognized basis of which smallholders differentiated from others. These themes include land size, wealth, market orientation and vulnerability to risk productivity. For this reasons smallholder is include inadequate land availability, poor-resource endowments, subsistence-oriented and highly in risk. However smallholder may or may not exhibit dimensions of smallness simultaneously. It is common numeric valued way of defining small-farms.

Hazel *et al.,* (2007) define that smallholder farmer are those less than two hectares of cropland.Others define smallholders as endowed with limited resources of land, capital, and labor. Also describe small farms in terms low technology use, heavy dependence on household labor and subsistence. There is not stated single definition to what constitutes small farmers in Ethiopia is case in developing countries in Ethiopia and food grain production (Betre, 2006).

In Ethiopia smallholder farmers farm about 95 % of total cropped land and produce more than 90% of agricultural output. The average land holding size of 1.18 hectares per farm household (CSA, 2008) in Ethiopia meets the conventional meaning of small farms less than two hectares per

household. Even smallholder Ethiopia are known for their resource constraints such capital, inputs and technology, heavy dependent on household labor, their subsistence orientation and exposure to risks as reduced yields, and crop failure (Mahelet, 2007).

2.1.2. Agricultural cash crop productivity and its measurement

The term productivity has been used in different meanings and has aroused many conflicting interpretations. Pandit (1965) has expressed the connotation of productivity as productivity is defined in economics as the output per unit of input ratios and art of securing an increase in output from same input or of getting the same output from a smaller input". Agricultural cash crop productivity defined as a measure of the efficiency by means of an agricultural production structure employ land, labor, capital, and extra resources. Agricultural cash crop productivity is the key determinant of the income inequality separate LDC from other countries and developed countries. Low efficiency in agriculture is a reason for the occurrence of poverty in most LDC.

There are two measures of agricultural crop output, partial factor productivity and total factor productivity partial factor production is ratio of yield to inputs, regularly one input describe as single-factor efficiency. The measures of partial factor productivity defined as ratio of output to total harvested area and input productivity. Total factor productivity, theoretically measures of output to inputs, commonly measured index of ratio of total agricultural cash crop outputs to total crop inputs. As extension analysis measuring partial factor productivity included variables used in measuring (IFPRI, 2016).This improvesto agricultural productivity in order to reduce poverty reductions.

2.1.3 General concepts on cash crop productivity and its benefits

Cash crop production differs from general agricultural production in that it entail engage in the output market to make sales. This requires reliable access to markets and implications on the scale and quality of production (Key *et al.,* 2000). In amount of cash crops differ from food crops in social norm state that they traditionally imply more male involvement in decision-making, production and sale processes. This suggests female involvement in cash crop market is lower than male participation (World Bank 2009). As paradigmof women only represent 20 percent of cocoa

farmers in Ghana (Vigneri and Holmes, 2009) and female-headed households significantly less likely to farm than men in Ethiopia.

Crop productivity and non-farm income are used interchangeably in several studies. From this productivity defined measure of efficiency which an agricultural production system employs land, labor, capital is much broader than non-farm earnings and it made up of agricultural wage income advantage to non-farm income. Authors agree to non-farm incomes which exclude income from agricultural employment. According to Haggblade *et al., (*2007) off-farm income means off owners farm that includes wage income in agriculture earned on other peoples farms along nonfarm from the owners enterprises or from nonfarm wage earnings. Therefore off-farm income is the sum of rural non-farm income and wage earnings in agriculture.

As World Bank (2007) fresh and processed fruit vegetables, fish and fish products, meat, and agriculture accounts 47% agricultural exports from developing countries. The sustained growth of these exports requires value chains particularly domestic transport, managing and packaging high final costs. Moreover procurement systems for integrated supply chains and supermarkets with stringent food-safety standards raise concerns how to ensure small farmers participation in agricultural products markets. The concept of marketing is deal about cash crop farms. In case of crops highly perishable carry timing and coordination costs, higher transportation costs and higher search costs than crops easily stored. Observing studies of market involvement have importance of nearness to rural market in determining farmers share in it but same time's households near to market is most source of heterogeneity in transaction across individuals, and characteristics of household are important in how they decide to sell Ehui (2005).

2.1.4 Household impacts of cash crop production

Households are reacting differently to cash crop production opportunities and welfare benefits from participations. Results from participation are potential heterogeneity of impacts. Poulton and Dorward (2005) argue that in general traditional export cash crops can make a significant contribution to poverty reduction when there is broad based participation by farmers in an area labor intensive production processes and potential positive links to productivity in cash. At household level spillover effects can resulted when production of commercialized crop enables farm households to acquire new resources and capital accumulated that would not otherwise be

accessible. As recent evaluation pride Africans drummed sunflower promotion intervention Okello (2010) found households participating service bundling program earned higher incomes leads produces more food on their farms.

2.1.5 Determinants of small scale cash crop farm Participation

According to Lukanu *et al.,(*2004) expected farmer's decision to cultivate given cash crop influenced by including household individuality, economic factors including crop productivity and market accessibility, institutional factors to accessibility of extension, input, credit services and environmental factors that involve crops compatibility to existing climate, soil, and pest conditions. In same way, Boughton *et al., (*2007) argue that the main challenge and restriction factor for smallholder farmers to involve in cash crop production is low efficiency in food crop production and its market failure. According to this author, as farmers have entrée secure their food demand they are expected to participate in production of market-oriented cash crops.

Cadott *et al., (*2006) demonstrates private asset accumulation is a prerequisite for smallholders' from subsistence production. It suggest that one possibility for farmers to accumulate personal asset is into cash cropping, investment in public infrastructure such as roads and information communication services are determine participating in productions. Current study analyze to factor affect smallholder participation in production of sesame cropped in Ethiopia. So studies were undertaken in this regard in country problems assessed sesame value chain analysis in Metema woreda and verified lack of improved variety seed that properly fits woreda's natural ba lance, lack of agro-chemical supply, and prices constrains production in Metema. In addition accordingly,climateproblemreduceoutput, and marketed supply sesame. Aysheshm (2007) findings indicate sesame marketing constrained by shortage of modern inputs and capital used.

Using community survey data from Tigray, Kruse man *et al.*, (2006) conducted factors analysis of several market access variables distance and travel times to towns, weather roads and bus service, and found these variables highly correlated to single market factor. This factor founded to more production teff most important cash crop in region is less subsistence-oriented.

Using similar household data for Amhara, Benin (2006) found market and road associated with differences in input use and land management practices that impacts were different in high vs. low

rainfall areas of region, and crop yields were higher further from roads in high potential areas. Thus market and road access defined are often found to have positive impacts.

2.1.5.1. Household distinctiveness nexus agricultural productivity

The household characteristics affect agricultural production such education level, gender, age, family size, landholding. To agricultural productivity technology should have to use. Formal education enhances engagement in environmental programs and methods for sustainability of agriculture (Burton, 2013). Because information and knowledge are basic for farmers adopting technology, access input. Education leads productivity of farmers also eliminating custom to growth such as traditional methods (Asfaw, &Admassie, 2004).

Gender is significant determinants of agricultural production since male-headed and female-headed households not the same capability enhancing productivity where the former is stronger (Nyanga *et al.,* 2012). In Kenya(Ekbom *et al.,*2012) found female-headed are high inefficient and unproductive compared to men. Agricultural productions were influenced by households' characteristics, age, family size, and land holding size. Households age is proxy variable for farming experiences. Farmers are highly dependent to their experiences of cultivating different crop (Adomi *et al.,* 2003). Hence experienced farmers expected to high productivity. However limited older farmers lacked physical strength and technology adoption (Burton, 2013).

It means land size is an indispensable asset of agricultural production increment. According to Teryomenko (2008), relationships of farm land size and production is nonlinear in a manner it increases and then decreases when land size exceeds the optimal amount. However, Endrias *et al.,(*2013) claim that large farmland size can expand production by exploiting economies of scale; higher input usage and tend to reject the traditional broadcasting method by adopting a row-planting method which pertinent for increasing productivity and high yielding varieties.

2.1.6 Poverty reduction and income effect of cash crop productivity

There is direct relation of productive efficiency and poverty measures at macroeconomic level across countries. Since impact of land and labor on percentage of population living on less than US$1 per day using country-level data used to 2000 World development report. Thirtle *et al., (*2001) suggest agricultural productivity has crucial impact on poverty reduction.

The direct benefits from agricultural cash crop productivity growth in increasing rural incomes are core economic sustainable growth. Simphiwe (2001) argued non-agricultural employment in rural areas on lively growth local incomes. Hence rural consumption consists spending on consumer goods are main driving force of rural economy and poverty reduction in farm area.

Small-scale cash crop farming in developing countries could form basis agriculture-led process of economic development. As Simphiwe (2001), theories and empirics shows that small-scale agriculture has been driver of development in rural areas and small scale agricultural units have attained higher returns land, capital over time. From African perspective quoted in Machethes (2004) arguesmallholder's agriculture is too important employment, welfare, political stability of Sub-Saharan Africa, and market economy of nations.

The empirical literatures provide the gain from cash crop production. The studies explicitly test hypothesis that commercially oriented production increases net household incomes. A study of Benefice and Boughton (2006), on study of tobacco farmers in Zambezi valley of Mozambique using stratified random sample are by monophony concessions, farmers participate in scheme to grow tobacco. The researchers wereanalysis determinants of household income. According to their results, factor endowments were key determinant of participation and tobacco growers. Non-growers had more diversified incomes with statistically significantly from off-farm wage labor than tobacco growers.

Agricultural productivity determines price of competitiveness of tradable goods important to a meeting effects determine real income of increased outputsof households (World Bank, 2007). Increased agricultural productivity changes relative prices of agricultural outputs in relation to products also costs of inputs to production. If increased productivity drives downward product price or cost of production rises due to increased demand than increased agricultural output may not transformed into higher actual farm income (Irz *et al.,* 2001). Output growth may not increase farm household incomes if price effects counter acts of the production gain then food price of the supplied product of farmers in markets depends upon the level of the productivity of agricultural cash crops.

The empirical studies use household consumption as an indicator of welfare and test the impact of crop productivity of small scale level on the consumption of other production. Delarue *et al., (*2009)

deconstruct and rework the 2007 national household survey to the paradoxical finding of inverse relationship between cotton production and poverty in Mali and in Sikasso region in particular. Per capita food consumption increased with amount of cotton produced positively.

2.1. 7 Cash crop production and food crop productivity relations

Strasberg *et al., (*1999) argue that crop commercialization contribute to food crop productivity.Because income from commercial production overcome credit constraints to purchase other inputs to increase crop productivity, providing access to inputs through marketing that can be used on food crops. Randrianarison and Swinnen (2009) study found technical training of marketing increased food crop productivity of smallholder households. Farmers participating to increase productivity through technology resulting from increased access inputs on credit.

2.1. 8 Impacts of smallholder cash crop farms on regional economies

A study of Benfica (2006), it examines the effect of cash crop production on regional economic growth. The author simulates magnitude of secondary effects that would result from cash crop productivity shocks on regional economies of Zambezi valley in Mozambique using household survey data. Shocks incorporated into productivity contributes to an export price increase in tobacco, cotton, maize also to increase imported prices of inputs and government tax on cash crops. His studies result suggest these shocks would have a sizable effect on income growth rates and poverty reduction for grower and non-grower households but effects would be larger in tobacco than cotton areas.

2.1.9 Market access and institutional factors

The structure of the supply chain, smallholder-market relationship and institutional context for production affect the extent of smallholder participation to welfare gains. Poulton and Dorward (2005), argues that successful development and coordinating institutions require investment in more intensive production to provide acceptable returns.

Murekezi (2009) demonstrates type of marketing outlet available to coffee farming households in Rwanda is a significant determinant of the impact of coffee sales on household income and food consumption. Farmers located near a washing station can sell whole coffee cherries for a premium price while farmers located far from processing facilities are forced to sell parchment coffee for minimum government-mandated price.

2.2. Empirical Review Literature

A study George (2017) in Kenya, employing cob Douglas production function and ordinary list square estimation technique as method of analysis and used secondary data from period 1980 – 2013; found that increase one percent labor caused an increase in agricultural productivity by 19.84%. From this result, we can understand it is directly related to agricultural productivity.

A research conducted by Ighodaro *et al.,* (2013) analyses impact of soil erosion on agricultural productivity in eastern south Africa by using cross-sectional data. The findings revealed high negative correlation of soil erosion and agricultural productivity. It recommended soil control mechanism should be pushed to farmers by extension services to curb negative impact of it on productivity. To credit constraints farm households in developing countries often participate in off-farm activities. As thisresult off-farm income effects on agricultural production of rural population did not main issue of empirical research in development economics literature.

Cornelius (2005) covers extent rural off-farm activities, in particular, wage employment, assist households in developing countries to overcome constraints on-farm contribute to agricultural development. In study researcher apply model pooled OLS and fixed effect on panel data taken from Zimbabwe from the period 1993/94 – 1997/98.

Lhing *et al., (*2013) using Cobb-Douglas functional form and Logistic regression model found the most common influencing factor on household off-farm income in Myanmar. Among these factors, educational level, age, gender, farmland size, crops, and new enterprise have influence on household income. Another study by Andover (2013), an analysis of household non-farm income in Ghana, found that availability of infrastructure; banks, roads and Savannah zones are factors in non-farm income. Increased production and productivity in the agricultural sector is designed to be achieved by scaling-up unrestricted funds allocated for irrigation development, skill development in agricultural sector, seed and fertilizer supply, soil fertility management, livestock, and research development. In development agricultural output market, production and related risks are external factors that could affect commercialization process of agricultural crops (Pender *et al.,* 2006).Other resources endowments, land, natural capital, labor; physical capitals are determinants of agricultural productivity.

According to Govereh *et al., (*2003) commercialization measured continuously from zero that total subsistence-oriented production to unity of 100% production. It has a measurement index called household crop commercialization index (CCI) which computed ratio of gross value of crop over gross value of all crop production multiplied by hundred.

Empirical research generally used cob-Douglas production function to measure the relationship between inputs and output. Measuring agriculture productivity indicates that level of incomes of the rural household, those who are engaged in agricultural activity. Agricultural productivity estimated using parametric and non-parametric approach. In parametric approach, coefficients of the production function are estimated statistically using econometric approach whereas, non-parametric using mathematical programming approach. The parametric approach commonly used in estimation of production functions while non-parametric approach used in efficiency analysis (Tru, N.A., 2009; and Taru *et al.,* 2008). The studies judge on parametric approach to estimate agricultural productivity function if study contain continues and dummy explanatory variables. For this case econometric approach is advantaged of statistical, hypothesis testing and analysis of confidence interval to test the reliability of model estimated.

Since dependent variables include continuous, it represents agricultural products produced in quintal per hectare cultivated. The dependent variable in study expected binary outcomes; the ith household productivity status that measured interns of efficient or inefficient will be based on cob Douglas production functions' coefficients after regressions. Enhance where Y is level of output produced, lnA is natural logarithm function of other explanatory determinant variables of factor productivity inputs and εi is error term, and then negative values of αith in production function specification represent the existence of inverse relationship between input variables and productivity levels. The relationship would classified as inefficient productivity, while positive value of αith represent to existence of direct relationship between input variables and productivity levels, then classified under efficient productivity levels of factor productivity after regressions(Tru, N.A., 2009; and Taru *et al.,* 2008). As a result to analysis of agricultural productivity, researchers uses cob-Douglas production function since this production model has theoretically and empirically reasonable to estimate, to test significance of variables also its effect on outputs, and using standard statistics that would be more important.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. Description of the study area

Mana is one of the woreda from Jimma Zone of Oromia regional state of Ethiopia. It bordered to south by Seka Chekorsa, to west by Gomma, to north by Limmu Kosa and to east by Kersa, and administrative center is Yebu. The scenery of Mana includes mountain, high forests and plain, valleys. Mountains include Weshi and Bebella. Rivers include Aniso, Doha, Wanja, Yebu and Sogibo. The investigation of woreda's land shows that 89.1% is arable under annual crops, 2.7% pasture, 2.8% forest, and 5.4% is swampy including degraded unusable.

Figure 1: Location and administrative map of the Mana woreda

The topography of area is classified into dega (2.9%), woinadega (95%) and kola (2.1%) agro-climateareas. Annual average rainfall is ranged from 1,467 to 2517mms. These district areas have average elevation 1470-2610 meters above sea level. Thus includes kola, woinadega, and dega climates based on their elevations. Also area has annual temperature 13 to 24.8^{o}C. Mixed cropping systems maize, teff, sorghum, barley, wheat, coffee, chat, bean cultivated in district. Chat and coffeewas important cash crop for this woreda and on 4789 hectares planted this crop (Mana woreda administrative office, 2018).

3.1.1 Population

According to Mana woreda administrative office and survey of health sector report (2018), current total population of district is reached 200153, and total households 42093. From listed numbers

101876 were men and 98277 were women. Accordingly Mana woreda has 2 kebele in town and 24 kebeles in rural area and totally has 26 kebeles. From this 2252, and in percent (5.39%) of its population were included in urban kebeles and 189346 in percent of (94.6%) were included in rural areas. The majority of inhabitants were Muslim 90.23% of population, while 8.44% populations follows Ethiopian orthodox christian and 1.15% Protestant (Survey administrative and health office of Mana Woreda, 2018).

3.2. Research Design

The researcher uses cross-sectional survey data designed to study. This research designed helps researcher to examine determinants of rural small scale coffee productivity farmers. In addition it helps researcher to examine determinant effect offactorsto different area ofMana woredaincluding dega, woinadega, and kola and difference effect to different areas productivity.

3.3. Research Method

Quantitative and qualitative method of study was utilized to undertake the study. According to Creswell (2012), combining both forms of data provided a better understanding of the research problem than either quantitative or qualitative data. For this case, research questions raised for undertaking this study required both numerical and non-numerical data and to effect, both quantitative and qualitative methods were employed with the assumption that quantitative data collected through questionnaires was supplement by qualitative data gathered through FGD improve the reliability of the findings. Because of this, the researcher was uses both methods in this study. So method that data from primary sources were collected through field survey and survey instruments applied through questionnaire and interviews with the head of rural farm households in selected kebele's population sample. In data collection, simple random sampling technique used to select household and kebeles samples with stratified sampling. To collect primary data questionnaires were prepared by English language, and then translated to local languages of respondents to Afan Oromo.

3.4. Source of Data

This study used primary and secondary source of data to address basic questions to answer research question. Relation to this, Creswell (2012) noted that to answer research questions and hypothesis. Primary data collected from selected households' of specified kebeles for purposive area through

questioner, interview, focus group discussions, field survey and list of enumeration areas to get information basically on production level, farm size, farm input, technology used, educational level, family size, gender, age, market distance, credit access, and climate change. Secondary data agricultural statistical offices of districtwere responsible to respective of coffee productivity per hectare during specific production period of 2018, numbers of households in selected kebeles respectives to different climate area.

3.5. Target Population and Sampling Method

This study target population was small scale rural coffee farmers in Mana woreda of sampled different climate area representatively by kebele from different agro-climatic areas.

3.6. Sampling Techniques and Sample Size Determination

For sampling technique to get sample size has multistage sampling techniques. Population from sample drawn did not constitute a homogeneous group; for this stratified sampling technique was used to representative sample (Abdi.K, 2015). By using this stratification process study was take sample of representatives based on stratified sample. But after population stratified to homogeneous populations, researcher simply apply sample size determination formula of Yemanes (1967) explained as: N/ (1+N (e^2)), Where n is sample size, N is total population size, and e is level of precision was used to select random sampling methods to select specific kebeles from stratum.

Researcher selects three area from Mana woreda based on heterogeneity of climate areas from a total of 24 kebeles from Mana randomly. Therefore researchers' aims were to achieve general objectives of this study and to fill conducted research gaps. In doing so sampling was conducted separately in each stratum of different agro climate areas of Mana woreda.

Respective to sampled households selected from each stratum been on proportional allocation of samples keeping proportional to size of each stratum. Means were Pi represents proportion of population included in stratum i and n represent total sample size, number of elements selected from stratum i were n Pi (Yemanes, 1967). Depend on above mechanism of selecting a sample from strata:

n1, n2, n3 = nPi

Where, n is total sample size, n1 is a sample size from strata of dega area that sampled by Haro kebele, n2 is sample size from strata of woinedega area that sampled by Somodo kebele, n3 is sample size from strata of kola areas of that sampled by Kela Guda kebele from Mana woreda.

According to Mana district administration office and survey of health office of Mana woreda in 2018, total number of household were 42093. From this, total population 2113 in percent 5.019 were urban dwellers within two kebeles those administered by town administrative and 39980 percent 94.981of its populations were rural residents within 24 kebeles. Also from listed rural population 6526 households were within from selected rural areas for study purpose such Haro, Somodo and Kela Guda kebele purposively selected respectively. This figure indicates share of each location is 34.27%, 35.48 %, and 30.23% respectively and in numbers are 2237, 2316 and 1973 within listed three different areas respectively. In addition their distance from Mana woreda are7km to west direction of woreda, 17km to east direction of woreda and 4km to east direction of woreda respectively, where Mana from Addis Ababa and Jimma zone respectively distances as on public roads 347.18 and 17.7 km to south east of Ethiopia and to north east of Jimma zone respectively.

To respective of classifying Mana woreda to different area of agro climates, benchmark that helps to this is Ethiopia located in tropical zone lying between equator and tropic of cancer. It has three different climates according to respective of area's elevations. As such Kola tropical zone is below 1830 meters in elevation. Woinedega (subtropical zone) include highland area 1830-2440 meters in elevations' and dega (cool zones) is above 2440 meters in elevations. In line this Brown, Molly E.*et al.,* (2017) "a climate trend analysis of Ethiopia" were advanced. Based on this evidence to respective of Mana woreda, this district has average elevations 1470-2610 meters above sea level, and each kebele has its own elevations accordingly. Thus it includes kola, woinadega, and dega climates based on respective of their elevations. As such, Haro kebele located toan elevation 2504.4 meters, Somodo kebeles' elevation 2050 meters and Kela Guda kebele with elevation 1826.8 meters above sea level respectively.

Accordingly depend on Yemanes (1967) sample size determination, = N/ (1+N (e^2)), Where n is sample size, N is the total population size of three sampled kebele's and e is precisions.

$$n = \frac{6526}{1 + 6526 * 0.06^2} = 279 \; n1 = n * \frac{N_1}{N} = 279 * \frac{2237}{6526} = 96 \quad n2 = n * \frac{N2}{N} = 279 * \frac{2316}{6526}$$

$$= 99, \quad n3 = n * \frac{N3}{N} = 279 * \frac{1973}{6526} = 84$$

To this case, N is 6526, ±5% precision levels where confidence level is 95% and P=5, Hence total sample size is 279 and from this number of sampled from rural areas of Mana district was determined.

3.7. Instruments of Data Gathering

Instrument utilizes for data collection have been determined by general objectives of this study. Hence to address objectives quantitative and qualitative data have been used. To doing so using multiple instruments like structured questionnaires, interviews, field survey and focus group discussion were employed to gather relevant data for this study.

3.7.1. Questionnaires

Scholars view on importance of questionnaires to collect information from large respondents. According to Creswell (2012), questionnaire is used in survey design that participants in study response and returned to researcher. It means eliciting beliefs and practices of individuals on the issue under study. Through questionnaires the researcher was collect data from the small scale ruralhouseholds. Closed and open-ended questionnaires used to gather quantitative data and questionnaires based on objective of research.

3.7.2. Focus Group Discussion

The researcher used focus group discussions to participants with including required respondents and used based on literature review, objectives of study and research question to achieve general objective of study.

3.8. Ensuring Validity and Reliability

Ensuring quality of data was main activities of the researchers. Hence to determine validity of instruments, researcher used face to face, and format questionnaires. Irrelevant items modified as comments were given for instruments from advisors. Then English versions of questionnaires

language translation into Oromic local languages to minimize confusion and communication barriers in data collections.

3.9. Ethical Consideration

Researcher was considered on ethics of respondents. Therefore, the researcher was follow great respect for value of participants. Accordingly, the researcher was for the consent of participants intervening and kinds of information without any influence and pressure. Inform respondent about purpose of this study and used information researcher committed to privacy informants. To respectful and increase respondents self-confidence, researcher used interview in a private and safe place.

3.10. Methods of Data Analysis

Method of data analysis used was descriptive statistics for demographic social characteristics, and econometric model analysis used to identify determinant factors of coffee productivity on rural households, and cob Douglas production model used to measure productivity levels of household coffee productions. It was subjected to analyses using software Stata version 13. Descriptive and econometric interpretations employed to demographic social characteristics, and econometric model analysis respectively used descriptive and probit model.

3.10.1 Descriptive analysis

The data analyzed econometric and descriptive used mean, frequency, percentage to analysis determinants of rural household coffee productivity respective of each selected study area, and difference in different areas focused.It subjected to analyses by using stata soft ware's version 13. Descriptive and econometric techniqueof interpretationsemployed. The specific tool used include table in both statics analysis results.

3.11. Econometric model selection and specifications

The econometric models applied to this study were used based on the scientific requirements of dependent and explanatory variables have been considered. Aim of this study was to analysis determinants of rural small scale coffee productivity. Econometric methods used to targeted objectives were including different agro climate conditions within specific area. Theresearcher used model to analysis determinants of rural small scale coffee farm productivity including, farmland size, farm technology, educational level, family size, gender, age, market distance, credit access and climate was collected from primary sources of data as determinant factors,but Birhanu (2014) uses OLS regression models to determine factors which reduce farmers productivity in Tigray region by using cross-sectional survey. He found gender, age, education; family size, draft animals, area and

credits are significantly affectfarmers' participation in farm. In addition the evidence is from last researcher's work on topics determinants of small scale rural cash crop production by Yishak (2017) used cross-sectional survey to analyze rural crop production yield in Wolayta zone. His finding include sex, farm size, livestock ownership, oxen ownership, education, leadership, income, and market distance were founded key determinants of households participation to agricultural cash crop productions.

Since researcher used probit model of econometric specification, it was having been the exact specifications for this study. A probit model is a type of model where dependent variable takes binary outcomes on coffee farm household responses and analysed by regression of econometric model. Therefore this estimate that individual's characteristics were falling into specific one of categorical value. The probit model used probit link functions standard maximum likelihood procedure called probit regression.

3.11.1. Theoretical framework

A production function describes the technical relationship that transforms inputs into outputs. To this study to determinanant of agricultural cash crop productivity to continuous and dummy variable used log- linear (semi-log) cob Douglas production functions. Because this production function used was important to analysis different agricultural factor productivity since using log-linear functions comprise simultaneously factor production input and other determinanant of factor production input (Tru, N.A., 2009; and Taru *et al.*, 2008). Therefore to this analysis these production functions were used as a general production function as:

$Y = \beta 0 + \beta 1X + \varepsilon_i$..... (1)

Equation 1 was transformed into a log-linear function form as follows:

$\ln(Y) = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + \beta 5X5 + \text{----} \beta nXn + \varepsilon i$..... (2)

Where: Y = production output, β1… βn are coefficients of explanatory variables, X1 . . . Xn is explanatory variables.

Therefore, since implicit form of production function analysis to coffee production in this study include factor input and other determinanant of factor input, and include dummy variables it stated as follows;

$Y = f(X1, X2, X3 \ldots Xn,) + \varepsilon i$..... (3)

Where: Y = coffee productionper hectare

X1 = gender (dummy), X2= education level (years), X3 = family size (No), X4=farm size (hectare), X5= farm technology (dummy), X6 =credit access (dummy), X7 = market distance (walk- in minutes), X8 = climate change (dummy), X9 =household age (years) and εi = error term. Then the model was stated explicitly the log-linear as:

$\ln Y = Y = \beta 0 + \beta 1X + \varepsilon_i$..... (4).

However, since identified explanatory variables include both dummy and continuous variables the production function was stated as follows:

$Y=AX1^{\alpha 1}X2^{\alpha 2}$..... $Xn^{\alpha n}$ e β1D1+β2D2 + β3D3 +-.....+βnDn + εi..... (5)

Equation 5 was transformed into log-linear function form as follows:

$\ln(Y) = A + \alpha 1\ X1 + \alpha 2\ X2 + \ldots \alpha n\ Xn + \beta 1D1 + \beta 2D2 + ,\ldots\ldots..\beta nDn + \varepsilon i$..... (6)

Where: Y= coffee productionper hectare

A: The intercept that tells impact of productions

$X_1\ X_2 \ldots\ X_n$: are continuous explanatory variables.

$D_1, D_{2\ldots}$ Dn: are dummy explanatory variables

$\alpha_1, \alpha_2 \ldots \alpha n$: coefficient of explanatory variables

$\beta_1, \beta_2 \ldots \beta n$: is coefficient of dummy explanatory variables

εi: is an error term

Analysis of parameters: $\alpha_1, \alpha_2 \ldots \alpha n$, and $\beta_1, \beta_2 \ldots \beta n$ was expected by linear regression analysis via statistical software (STATA).

In addition to stated Cob Douglas production function, the econometric model specifications of the variables was discussed as follows:

Cofpdcvty = β0 + β1 gen + β2 age + β3 leveduc + β4 famsz + β5 farmsz+ β6 markdist + B7 farmtechn + β8 cred + β9 clima+ εi

Where: Coffee productivity - Continuous dependent variable researchers was replaced by Y.

Xi - a vector of explanatory variables

βi - a vector of estimated coefficient of the explanatory variables

εi - error term (Gujarati, 2006).

gen = indicates the gender of coffee farm households

age = stands for the age of coffee farmers in years

leveduc = indicates the educational level of household's heads

famsz = stand for the farmers family size

farmsz = indicates farmland allotted for coffee production

markdist = market distance from coffee production area

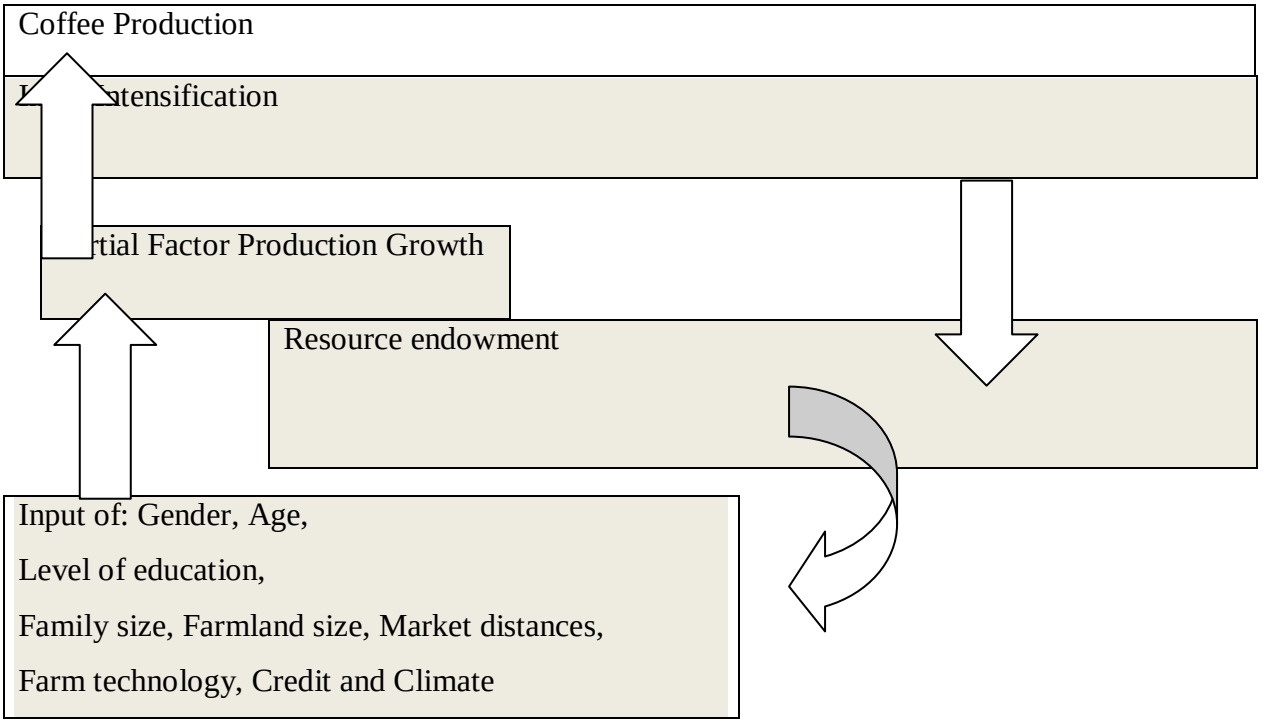
farmtechn = indicates farm technology used of coffee producers

cred= stands for credit access of household levels to coffee productions

clima= it refers to insufficient rainfall for coffee productions

3.11.2. Conceptual Framework

The height of the bars indicates the productivity rate of real output. The productivity of output raise input intensification capital, labor, farmland and partial factor productivity. Improvements in partial productivity are by improvement of gender, age, education level of household, family size, farmland size, market distance, farm technology, credit, and climate change and scale of economic returns. The decomposition of productivity growth into components is both naturally attractive and direct policy relevance; input intensification is strongly influenced by changes in resource endowments, whereas total factor productivity growth is strongly influenced by long-term investments in agricultural research and improved resource quality (USDA, 2007).



Source: Economic Research Service, USDA 2007

Figure 2: Conceptual framework

The researcher used conceptual framework of responsesto variable Y as binary two outcomes which were denoted as 1 for efficiency and 0 for inefficiency response of study hypothesis. Since Y represent efficient ^{or} inefficient of independent variables effect, success or failure of expected

productivity, yes or no responses from survey. It was explanatory variables xi sign by which explained variables influences effects.

3.12. Definition of model variables

3.12.1 The dependent variable

The dependent variable is continuous variable representing coffee productivity produced in quintal per hectare cultivated. It is level of ith rural farm household productivity participation status. The benchmark of this classification is based on cob Douglas production functions. Enhance where Y is output produced, lnA is the natural logarithm of input and εi is error term. Negative values of αith in specification represent negative effects of input variables on productivity. So relationship classified into inefficient household's coffee productivity,but positive values of αith represent positive effect of variableson productivity, and classifiedto efficient productivity after analysis (Tru, N.A., 2009; and Taru *et al.*, 2008).

3.12.2. Description of Independent variables

Among number of explanatory variables that are used as explanatory variables in this model to productivity in this study are gender, age, family size, education, credits, farmland size, market distance, farm technology, and climate are hypothesized to explain the dependent variable.

i. **Gender:** This variable is categorical household head in this study. Increased likelihood that male-headed households are more productive than female. A dummy variable was used to represented as Male = 1; Female = 0. Measurement scale, tools of analysis and type of analysis that was used was a nominal, percentage, and econometric model.
ii. **Age of household head:** It is continuous variable measured in years of that indicates farm experience and time to farm activities until age limit, then activity and productivity would decrease (Adebiyi and Okunlola, 2013). The negative effect have been expected from the final regression result.
iii. **Education Level:**Continuous variable measured in years of schooling that could increase farm income than illiterate (Uwagboe *et al.,* 2012). The positive coefficient was expected from regression result. According to Alaba and Kayode (2011), literate households are more probable to participate in off-farm activities, unlike illiterate ones. Hence literate were expected to participate more.
iv. **Family size:** It is family members of household, and employed members more productive than members who unemployed. Therefore family sizes have positive or negative effect to productions,

continuous variable measured in numbers and when households' larger number of child aged between 1-16 and more than age productions of 60 years participate in off-farm activities (Merima, 2012),larger family size diversify farm than smaller (Zahonogo, 2011).

v.Credit access: It is dummy variable; 1 for household's access credit and 2 others. Credit reduces problems which facehousehold production (Mpawenimana, 2005). Access to credit is measured at least one member of household receive or not during last production period (Angelopoulos *et al.*, 2011).

vi. Farmland size: It is continuous variablemeasured in hectare and expectation was negative sign. Larger farmlands owner participate less frequently due to productive potential large farm size restrain off-farm preferthan farm (Arimi, Kayode, 2011). The larger land dependency ratio inducesdeclining productivity, decreased fallows, increases landlessness, and decline livestock tenancy. Therefore it expected negative effects on productivity.

vii. Market distance: It is continuous variable represented by the time that it takes to reach the market from product area. As result farmers nearest to market centers motivated to produce market-oriented crops through easy access to market information related product value. The variable measured in a minute per kilometer and longer distant of market improbable wills their participation to production (Babatunde and Qaim, 2009). Hence, negative sign expected to productivity.

viii. Farm technology: This is categorical dummy variable representing 1 if farmer uses farm technology and 2 otherwise. The wide used agricultural technologies by farm operators in Ethiopia are irrigation, fertilizer and improved seeds as variable for measuring effect of technology on productivity. As of Samuel (2006), hence positive coefficient was expected from regression result. It hypothesized agricultural productivity is positively affected by application of each of these technologies.

ix. Climate: This is variable refers low rainfall causes damage on crops, prevents them from giving expected productivity. It takes dummy variable "1" if households faced negatively by climate change.This expected with negative relationship between drought and agricultural productivity. It represents where respective location considered as climate deficient or sufficient (Abebe 2008).

3.13. Estimation of the Procedure

The researcher used probit model regressions as econometric techniques in this study, test were used to run this study including by following tests.

3.13.1. Multicollinearity Test

Multicollinearity test measures existence of linear relationship among explanatory variables of regression model (Gujarati, 2003). According to econometric literature, do not have one unique method of detecting multicollinearity but rules of thumb. This study used rule of thumb that if pairwise correlation coefficients between two explanatory variables are affected low or high levels say excess of 10, then multicollinearity is high serious problem and if less 10 not series problem. Depend on this all explanatory variables in model were checked for multicollinearity before econometric analysis. The results of test reveals, variables didn't collinearity to each other. Diagnostic test used white test to check heteroscedastic problem. Model is tested for omitted variable by probit link function test. Correlation matrix and variance inflation factor used to test multicollinearity. Correlation matrix of explanatory variables has absolute value equal or above 10 indicates severe problem of multicollinearity.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1. Descriptive Analysis

It is believed that demographic characteristics of sampled households were relevant in to insights about general features of Manaworeda under investigations. Hence attempt has been made to describe important characteristics of sampled respondentsfrom different areas of woreda.

4.1.1. General Characteristics of Sample Respondents from Mana woreda

This study have been covered total 279 sampled households from three different areasof Mana woreda including dega, woinedega, and kola indicated by Haro, Somodo, and Kela Guda areas respectively. From sampled areas 96 household numbers from Haro, 99 from Somodo, and 84 households from Kela Guda were selected, andMana woreda's characteristic were presented.

4.1.1.1. Description of Demographic and Socio-Economic Variables in Mana woreda

Table 1: Marital status of Mana woreda's household respondents

level of HHs participations				
	Married	Separeted	Widowed	Total
	180	10	89	279
	64.52%	3.58%	31.90%	100.00%

Source: Owen survey result, 2019

To respective of Mana woreda's from sampled households married , separated and widowed farm heads include frequently 180(64.52%), 10(3.58%) and 89(31.90%) were participated on coffee productions. In coffee farm of Mana woreda, number of households headed of marital status were married is larger than other headed of separated and widowed status, where separeted is smaller than other married and widowed.The implication of this indicates in Mana married have more responsibility for coffee productivity than other status, since separeted were less responsible for productivity.

Table 2: Religion of Mana woreda's household respondents

Religion of HHs participations						
	wakefata	orthodox	catholic	protestant	muslim	Total
	101	18	8	13	139	279
	36.20%	6.45%	2.87%	4.66%	49.82%	100.00%

Source: Owen survey result, March 2019

To respective of Mana woreda from sampled households religion respondents were frequently wakefata 101 (36.20%), orthodox 18(6.45%), catholic 8(2.87%), protestant 13(4.66%), Muslim 139(49.82%) were participate on coffee productions.. As generally in Mana woredahousehold headers Muslim were larger than others, but catholic followers were small. The implication of this result to productivity was concluded Muslim accounted to coffee productivity than other religion followers.

Table 3: Ethnic groups of Mana woreda's household sampled respondents

Ethics of HHs participants					
	Oromo	Amhara	SSNP	Others	Total
	169	12	85	13	279
	60.57%	4.30%	30.47%	4.66%	100.00%

Source: Owen survey result, 2019

In Mana areas ethnic groups respondents frequently Oromo169 (60.57%), Amhara 12(4.30%), and SNNP 85 (30.47%) and others 13(4.66%). Impliesin Mana coffee farm area the number of household headed of Oromo ethnic were the largest than other ethnics, were Amhara ethnics was diminutive. Therefore to coffee farm heads Oromo have responsibility to coffee productivity than other ethnics, since Amhara was small and then were not more responsible for coffee productivity in dega area.

Table 4:Income Source of Mana woreda's household sampled respondents

Income source of HHs participants					
	Other crop	trade	coffee	Livestock	Total
	48	0	199	32	279
	17.20%	0.00%	71.32%	11.47%	100.00%

Source: Owen survey result, 2019

Respective Mana areas of study areahousehold's source of income were comprises frequently trade 0(0.00%), livestock 32(11.47%), coffee production 199(71.32%) serve as production inputs of households. Generally to rural coffee farm in Mana areas, income source of households were comparatively from coffee production was largest than other,while trade was undersized.These imply purchase coffee production inputs of households mainly generate from coffee productions than other source.Therefore income generated from coffee production wasmore responsible for coffee productivity of households in specified locations.

4.2. Determinants of Rural coffee productivity in Mana Woreda

There are different factors could be affect rural small scale coffee productivity in Mana woredaidentified includes gender, education level, family size, farmland size, farm technology, credit, market distance, climateand age respective of Mana woreda's climate covered. However they could determine or not was based on significance level of their estimated coefficients after regressions.

4.2.1. Multicolinarity Test of variables to Respective of Mana Woreda

Depend on economic theory and literature before passing into analysis of regressions, testing existence of problem encounters econometric data is important to respective of Mana woreda. Therefore study undertake different test to check whether basic assumption of model are met or not and results were attached to appendix parts to respective of coverage area.Multicollinearity enhances independent variables determined by linear combinations of independent variables (Gujarati, 2003). Perfect multicollinearity occurs when one independent variable is perfect linear combination of others, then it is impossible to estimate regression coefficients to all the independent variables in model. When severe Multicollinearity occurs, this study used rule of thumb pair wise order correlation coefficients between two explanatory variables is high in excess or equal to 10,

then multicollinearity is serious problem. Based on this for case of this study all variables where checked for multicolinarity.

4.2.1.1. Test for Heteroscedasticity problem

For the studyto check the presence of heteroscedasticity problem white test was used. The result of white test show was there is no heteroscedasticity problem in model to respective study area.

4.2.1.2. Testing Variance Inflation Factor

In order toregressionthe hypothesis of explanatory variables were checked to multicollinearity problem for continuous and dummy variables. According to Wooldridge (2012) VIF defined as: VIF (Xi) = 1/ 1-Ri2, where Ri2 is squared correlation coefficient between explanatory variables. The larger value VIF is more troublesome. As a rule of thumb if VIF of variables exceeds 10, variable is said highly collinear. Based on this evidences, VIF values to respective Mana woreda were tested, and have value less than 10. Therefore, multicollinearity variables has not problem.

4.2.1.3. Measures of Goodness Fit test of the Model

Another commonly used test of model fit is the Hosmer and Lemeshow's goodness-of-fit test. Goodness of fit is correctly predicted McFadden (1974) quoted in Wooddridge (2000) suggests measure of goodness fit is predicted frequency and observed frequency should match closely and more closely they match, better the fit. The Hosmer-Lemeshow's goodness-of-fit statistic is computed Pearson chi-square from contingency table of observed frequencies and expected frequencies. Similar to test association two-way table, good fit as measured by Hosmer and Lemeshow's test was yield large p-value. When there are continuous predictors in model, there will be many cells defined by predictors making very large contingency table, which would yield significant result. So combining patterns formed by the predictor variables into 10 groups and form a contingency table of 2 by 10 with p = 5%, say Hosmer and Lemeshow's goodness-of-fit test indicates model fits the data well. Based on this, for this study since p- value were greater than 5%, this model fit data well for this selected study areas.

4.2.1.4. Test for Omitted Variable

The model checked omitted variable by applying probit link test function to check specification error. The idea behind link test is if the model is properly specified, it should not able to find additional predictors that are statistically significant except by chance. After probit regression

command, link test use linear predicted value (_hat) and linear predicted value squared (_hatsq) as predictors to rebuild model. The variable _hat should be statistically significant predictor, since it valued from model. These will the case unless model is unspecified. In other hand, if model is properly specified variable _hatsq shouldn't have much predictive power except by chance. Therefore, if _hatsq has significant then link test is significant. This usually means has omitted relevant variables or our link function is not correctly specified (Alvarez, Ret *et al.,* 1999).This is

the base to this study, probit model link test was checked and value of variable _hat was statistically significant predictor at 5% (p = 0.000) to respective of study areas, while variable_hatsq was insignificant at 5%. Therefore, model was properly specified to selected study areas.

4.2.1.5. Skweness Kurtosis Test for Normality

Skewness measures asymmetry probability distribution of random variables about its mean. It represents direction of skewed. Normality test helps to determine how random variable set normally distributed. Skewness Kurtosis gives the null and alternative hypotheses results for normality tests. Enhance if null hypothesis data follows normal distribution and if alternative hypothesis data does not follow a normal distributions. Therefore 'sktest' shows number of observations which represent survey and probability of skewness implying that skewness is normally distributed if p-value of skewness > 0.05. Similarly, Pr (Kurtosis) indicates that kurtosis is also distributed if p-value of kurtosis > 0.05, and chi2 is must be greater than its significance at 5% level. Consequently null hypothesis cannot reject (George and Mallery, 2010). Therefore, according to Skewness test for normality residuals shows for this study purpose normally distributions. For this case this study used to Skewness Kurtosis tests and result shows normality distributions to Mana woreda for study purposes.

4.2.3. Estimating determinant of coffee productivity in Mana woreda using probit model

All relevant tests for regression model have been seen from listed Appendix A. Stata version 13 used to estimate empirical models using probit model as bellow.

Table 5: Estimating determinants of coffee productivity using probitmodel

coffeepdcvty	Coef.	Std.Err.	z	P>|z|	[95% Conf.Interval]
Dummy gender(female)	.5898677	.2063475	2.86	0.004***	.1854341 .9943013
leveduc	-.1531996	.079062	-1.94	0.053**	-.3081582 .001759

famsz	-.2445477	.0824169	-2.97	0.003***	-.4060818 -.0830135
farmsz	.2840214	.1014654	2.80	0.005***	.085153 .4828899
Dummy farmtechn"yes"	.498369	.1813816	2.75	0.006***	.1428675 .8538705
Dummy credit"yes"	-.4720217	.1961077	-2.41	0.016**	-.8563857 -.0876577
marketdist	-.1561532	.0971124	-1.61	0.108	-.3464901 .0341837
Dummy climate"yes"	.5461358	.1662529	3.28	0.001	.2202861 .8719855
age	-.5357709	.1359573	-3.94	0.000*	-.8022423 -.2692995
-cons	1.598701	.4252913	3.76	0.000	.7651454 2.432257
Number of obs = 279 Prob > chi2 = 0.0000					
Log likelihood = -153.63415 Pseudo R2 = 0.1993 LR chi2(9) = 76.49					

Source: Survey data result, 2019; Stata version13

Gender is significant at 1% level and positively influences households' participationson coffee productivity. Gender is significant determinants of production since male-headed and female-headed households not have same capability to agricultural production and productivity but male are stronger (Nyanga *et al.*, 2012). In Kenya Ekbom *et al.*, (2012) found female-headed households are unproductive compared to male. This finding agrees to findings of Nyanga *et al.*, (2012).

Level of households' education (leveduc) was negative and insignificant at 5% significance level to participation on coffee productivity. This finding agreed to Joliffe, Dean (2004) relatively education level has less incentive to participate in agricultural activity. Then household's education insignificantlyto households participations.

Household's family sizes (famsz) is statistically significant at 1% level and negatively affect households participation. This implies larger familytends to participate less than smaller ones due to larger households' have the smallest farmland size to proportion of their family member. This argument is supported by the fact production is generally labour-intensive and it has been found that household size influences participation in production (Kassie *et al.*, 2014).

Households' coffee farmland size (farmsz) was positive and significant at 1% in level of coffee productivity of households. This due to large farmland owns since to resource requirements for farms; tends to expand their coffee productivity. Because larger households tend to participate more than smaller family size due to facts large family cheaper labor force to coffee production inputs. This finding advanced by argument of Welch (2003) that relatively smaller farmland size were less incentive to increase productivity to proportions of large family labor force than having small family size to agricultural productivity.

Farm technology used to coffee productions (farmtechn "yes") refers to program of agricultural provide to farmers in order to produce effective productions. Indeed availability of technology statistically significant at 1% level and positivelyaffects on coffee productivity. This implies that as provision of agricultural sectors advances for coffee production of household farmers become increase leads households coffee production participation increase. This finding is consistent with view formal education; training in agriculture improves farmers' abilities to acquire accurate information, production processes, and agricultural inputs practices efficiently (Mbowa, 2012).

Access credits (credit) were significant at 5% level and negatively influencehousehold'scoffee productivity. This implies credit access increased implies, participation of households on productivity become decrease since they use it for purchase of other cereal productions for food rather coffee productions. This finding of this contradictto argument of (Angelopoulos *et al.*, 2011), that lack of access credit is a constraint for amount of coffee production that might be offered for outcome to sustain productivity, and enables to purchase inputs in order to increase and meet the quality requirements in coffee productivity.

The market distances (markdist) nearest market where influence level of participation in coffee productivity negativebutinsignificant at 5 % level. Beside it disagreed to accessibility of market

become increase leads to increase household's to participation productivity since expects next production revenue outcomes (Benin, S., 2006).

Climate change (climate) was significant at 1% level and positively affects households' coffee productivity. This implies that negative climate change increased during coffee production, it leads

to decline household's coffee productivity than others not faced by climate. Beside were climate negatively change have been decline it decreases constraint of coffee productivity participations of households. This reliable with claim of Guam *et al.,* (2010) that states lack of weather affects agricultural productivity.

Effect of age (age) on coffee productivity was negative and statistically significant at 1% level. Enhances coffee productivity require physical strength individual households whereby younger farmers better than too older. The magnitude of negative sign infers age increases by year farm participation in agriculture would decrease productivity. For this older farmers receive support. This finding trustworthyto findings of Babatunde and Qaim (2009) in Kwara State Nigeria and Abebe *et al., (*2008) in rural parts of Uganda probability of participation decreases as age increases.

4.3. Marginal Effect of the Probit Regression Model

The analysis of marginal effects of explanatory variables using probit model shows a unit change in independent variable affectsdependent variable. The key factors in influencing productivity of coffee shownas from Table6, and findings of this study shows one percentage increased of identified factors effect on dependent variables stated as table 7 below.

Table 6**:** Marginal effects of coffee productivity determinants using probit model estimates

Delta-method					
	dy/dx	Std. Err.	z	P>|z|	[95% Conf. Interval]
Dummy gender" female"	.1844661	.0618706	2.98	0.003	.063202 .3057301
leveduc	-.0479093	.0242714	-1.97	0.048	-.0954804 -.0003381
famsz	-.076476	.0247257	-3.09	0.002	-.1249374 -.0280146
farmsz	.0888204	.0303495	2.93	0.003	.0293365 .1483044
Dummy farmtechn "yes"	.1558522	.0546533	2.85	0.004	.0487336 .2629707
Dummy credit"yes"	-.1476127	.0594851	-2.48	0.013	-.2642013 -.0310242
marketdist	-.0488329	.0299799	-1.63	0.103	-.1075924 .0099265
Dummy climate "yes"	.17079	.0489526	3.49	0.000	.0748446 .2667354
age	-.1675487	.0392515	-4.27	0.000	-.2444802 -.0906171

Source: Survey data result, 2019; Stata version13

The inference on gender coffee productivity participation is positive and statistically significant at 1percent level. This implies being female headed householdsincreased other constant, have 18.44% higher probability of participation on coffee productivity than male. In such instances probability of participation becomes higher on productivity. The finding of this study oppose with findings of Babatunde and Qaim (2009) in Kwara state of Nigeria, and Abebe (2008) in Ethiopia whereby female households less probable to participate on agricultural activity influenced by cultures.

The estimation result reveals that effect of educational level of farm respondent's illiterate and literate were negative and statistically significant at 5% level. Despite this the implication here is that, more farmers become literate, higher will their probability of searching off farm economic activitiesthan agricultural productions. The magnitude of negative sign infers literate households keeping other things constant, by4.79 % less probability of participate than illiterate. This finding of study disagreesto findings of cited in Babatunde and Qaim (2009) in such way more literate household more probable to search new productive techniques than illiterates.

Family size is negatively related to coffee productivity and statistically significant at1% level. This implies larger households really do farm activities side by side up to saturation points with having their own farmland. But in dega own land underutilized with family size, then infers to negatives. This implies a one unit increase in family size would decrease participation on coffee productivity by 7.64 %. This finding is contradicted to findings of Merima (2012), in Ethiopia large family would participate better than small family size; however this finding consistent to Zahonogo (2011) in South-Guinean zones Burkina Faso views small family size found better participants of productivity than large family size with having equal farm land size.

Farm size of households was positively relatedto productivity and statistically significant at1% level. This implies larger households owned farmland can participate on coffee farm activities up to

needed. A unit increase in farm land size would raise participation of households' land owners in area by 8.88 % than fewer holders of farm lands. This finding agreed argument of Welch (2003), smaller farmland size has less incentive to increase productivity to proportions of large family than having small family size to agricultural productivity.

Farm technology of household's to productivity of coffee was positive related and statistically significant at 1% level. This implies providing of advances from agricultural sectors to households coffee producers, leads productions of households' increased by 15.58% higher than other without advancements of technology. This finding agrees to formal education, training on agricultural improvement, and farmers' abilities to information, new agricultural inputs and practices efficiently (Mbowa, 2012).

Credit access has negative effect on coffee productivity participation and significant at 5% level. As credit increase by a birr one, participation of households on coffee productivity decreased by 14.76% than other not credits. This implies that households' access credit enforced themselves to purchase food crop but not for coffee productions. Hence, access credit influencescoffee productions indicating more farmers have access to credits, more participate to purchase food crops rather coffee production inputs and to increase coffee productivity. This finding disagreed to findings of Abebe (2008) views in Ethiopia as taking credit is important for solving liquidity problem and increases probability of participation on agricultural productions.

Market distance have negative effect on production participations and statistically insignificant at 5% level. This disagree to market distances of production area influence participation of households and supply product to market, more participate to coffee productivity and able to hire different market value of their products information to earning at the moment than other far from market information access (Benin, S., 2006).

Change of climate during production in dega have positive effect on coffee productivity and significant at 1% level. This implies thatexisted climate change duringproduction period leads to increase coffee productivity. As a result of this expected coffee productivity would increase by 17.07% than others faced when climate faces of production become increased. Due to thisfinding agreesto findings of Abebe (2008) that lack weather affects agricultural productivity.

Age of household effect on productivity is negative and statistically significant at 1% level. Agricultural productivity does require physical strength and fitness whereby younger farmers are better than too older. The magnitude of negative sign infers that as age increases by year farm, effectively of production would decrease by 16.75%. As farmer grows too older, he/she will concentrate on supports. So finding agrees to findings of Babatunde and Qaim (2009) in Kwara of

Nigeria and Abebe (2008) in rural parts of Uganda household's participation decrease as age increases. This finding contradicts to finding of Zahonogo (2011) in Sudanese; where older households headed more tend to participate on agricultural productivity.

5. Marginal effect of factors differences on coffee productions of Mana woreda

From table 6estimated marginal effect of determinants of coffee productionin Mana woreda have beeninfluenced by gender, education level, family size, farm size, farm technology, credit, market distances, climate and age in different climate areas. Basically implication of those variables was by different levels to respective production effect.

The implications being female gender farm headedand farm cultivated size on coffee production participation have been positive and statistically significant at 1% level. But female-headed householdbeing farm head,other remain constant positively participated by 18.44%. However, differences in participation indicate in area female headers on production participation have positive effects than male. Thus this finding disagrees to Babatunde and Qaim (2009) in Kwara State of Nigeria, and Abebe (2008) in Ethiopia whereby female-headed households are less probable to participate on agricultural activity. As well as farm cultivated size has effects on household's participation in productions positively 8.88%.

The probit result reveals effect of educational level of farm respondent is negative and statistically significant at 1% level. So the majority of farm household's participate in a different living activity that did relative to formal education. Despite this implication here are those farmers become literate higher will probability of searching other off-farm income and less to agricultural activity to yield high productivity from coffee productions. The magnitude of negative sign in area infers that as a one level education of households increased affects by 4.79% participations on coffee productions declined than illiterate. This implies that in area as level of education increased it was leads to searching off farm activities rather coffee productions. Accordingly this finding for area agreed with findings of Zhu and Luo (2006) cited in Babatunde and Qaim (2009) in way more literate household is, more probable to search and participate in new productive techniques than illiterates to more productive.

Family size and age of householdwere negative related to coffee productions of households coffee producers and statistically significant at 1%level. This sign infers other variables remain constant, a unit family members increased and a year age of household producers increased affects negatively

coffee production participation of household's by 7.64% and 16.75% respectively. This implies largefamily size actuality does different off farm living activities to self sustains where they have no equilibrium own farmland than others own lands. This study finding disagreed with findings of Merima (2012) in Ethiopia households' large family size would participate better than small family size. The others also to respective age of households implies as other variables remain constant, as age of households increased by a year affect negatively participation of households on production by 16.75% than others young households. This finding is consistent with findings of Abebe (2008); in rural parts of Uganda in probability of participation decreases as age increases.

Farm technology using and dummy climate change "yes" to production of coffee participation was positively related and statistically significant at 1% level.The implication were as 1% increase using level of farm technology and climate insufficiency, but other remain constantthen participation of households on production of coffee affected positively by 15.58% and 17.07% respectively. As overall, this finding is consistent to view of formal education and training of agriculture improves farmers' abilities, production processes to practices efficiently (Mbowa, 2012) for farm technology and to climate respectives agrees to the findings of Guam *at el.*, (2010) that lack of weather affects agricultural production.

Credit access were negatively affects coffee production participation of households and statistically significant at 5% level. This implies as 1% of households access credit increased affect probability participation of households on production negatively by14.76% than other households not take credit but other remain constant. This implies as household's access credit they enforced themselves to purchase cereal food production and start other business activity not use for coffee production purpose. So finding disagreed with Abebe (2008) in Ethiopia; as taking credit is important for solving liquidity problem and thereby increases the probability of participation of household's on agricultural productions.Market distance effects werenegativeson households production participation and statistically insignificant at 5% level.

Generally this papers finding found in linewith identified factors the increment of being females coffee farm heads by 1% positively affect participation on coffee production of the area than other factors and also the least positively affect households participation was a 1 unit increment of farm land size. However that has high negative effect on household's participation as a year increase of

households' age in year was age of households where as the least affect negatively household's participation was level of households' education.

6. Agricultural productivity model specification

The reasonable base intended for choosing Cobb-Douglas production function is based on fact that it is simple and convenient to specify and interpret. Moreover, Cobb- Douglas production function has been applicable in similar studies to this one. To respective of this study is based on empirical literature of(Tru, N.A., 2009; and Taru *et al.,* 2008) evidenced. The researcher used Cobb Douglas production functions. Because Cobb Douglas production function used as important on different agricultural outputs and other determinant factors of factor productivity analysis.

It is necessary to understand the major factors that affect the productivity of coffee in the study area. Cobb-Douglas production used scholars on different agricultural determinants outputs and productivity analysis so far (Tru, 2009; and Taru *et al.,* 2008). So that, for this study the researcher was use the log-linear production model which specified as below.

$$Y=AX1^{\alpha 1}X2^{\alpha 2}X3^{\alpha 3}X4^{\alpha 4}X5^{\alpha 5}X6^{\alpha 6}X7^{\alpha 7}X8^{\alpha 8}X9^{\alpha 9} +\beta 1D1+\beta 2D2+\beta 3D3 +\beta 4D4 +\beta 5D5+\beta 6D6 +\beta\ 7D6+\beta 8D8+\beta 9D9 + \varepsilon i \quad \ldots\ldots 1$$

Therefore to achieve the objective of this study researcher usedagricultural production model stated in log-linear functions since implicit production function to coffee productivity to this study include factor input and another determinant of total factor input, and dummy variable the model was stated as functions as stated bellow:

$$\ln Y = \beta 0+ \beta 1\ \text{gender} + \beta 2\text{leveduc} +\beta 3\text{famsz} + \beta 4\text{farmsz}+ \beta 5\text{farmtechn} + \beta 6\text{credit} + \beta 7\text{markdist} + \beta 8\text{clima} + \beta 9\text{age} + \varepsilon i \quad \ldots\ldots 2$$

Howeveridentified variables include dummy and continuous variables the production function was transformed into logarithmic function form as follows equation 3.

$$\ln Y = \ln A +\alpha 1\ln X1 + \alpha 2\ln X2 + \alpha 3\ln X3 +\alpha 4\ln X4 + \beta 1D1 + \beta 2D2+\beta 3D3 + \beta 4D4 + \varepsilon i \quad \ldots\ldots 3$$

Where: Y= coffee productivity per hectare, A: intercept impact of variables on productivity, X1 X2... Xn: are continuous explanatory variables, D1... Dn: are dummy variables, α1..... αn: are

coefficients of explanatory variables, β1…βn: are coefficients of dummy variables, and εi: is an error term. Enhances;

$$\ln Y = \ln A + \alpha 1 \ln leduc + \alpha 2 \ln famisz + \alpha 3 \ln farmisz + \alpha 4 \ln madist + \alpha 5 \ln ag + \beta 1 gender + \beta 2 farmtechn + \beta 3 credit + \beta 4 climate + \varepsilon i \quad \ldots\ldots 4$$

The analysis parameters: α1, α2…αn, and β1, β2 ….βn were conductedby linear regression. The dependent variable was coffee productivity that ith rural farm household productivity measured in terms of output and input relationships. A benchmark to say negative or positive relationship classification is based on where Y is coffee output produced, A is intercept and εi is error term, and then negative values of αith specification represent the inverse relationship between input variables and productivity levels (Tru, N.A., 2009; and Taru *et al.,* 2008). This, relationships were classified to negative values of αith represent inverse relationship of input variables and productivity. Positive values of αith represent there were direct relationship between input variables and productivity. In order to analysis this study female, farm technology, credit, and climate were classified to dummy variables, while level of education, family size, age and farmland size were continuous explanatory variables, and effect of them on productivity were regressed as bellow.

6.1. Estimated Cobb-Douglas Production Function of Factors Affecting Coffee Productivity

Table 7: Cobb-Douglas production model result for productivity

lnY	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]
Dummy gender(female)	-.1489452	.1127817	-1.32	0.188	-.3709922 .0731018
lnleduc	.0116311	.0495433	0.23	0.815	-.0859108 .109173
lnfamisz	.0754212	.066117	1.14	0.255	-.0547514 .2055939
lnfarmisz	.1007218	.0497858	2.02	0.044**	.0027025 .1987412
farmtechn “yes”	-.3196609	.1245787	-2.57	0.011**	-.5649341 -.0743876
Dummy credit “yes”	.2593681	.1251274	2.07	0.039**	.0130145 .5057217

lnmadist	-.1449632	.0570452	-2.54	0.012**	-.2572752 -.0326513
Dummy climate"yes"	-.2904053	.1134632	-2.56	0.011**	-.5137942 -.0670165
lnag	.2935592	.0632327	4.64	0.000***	.1690653 .4180531
_cons	1.765267	.258338	6.83	0.000	1.256645 2.273888
Number of obs = 279 F(9, 269) = 5.68Prob > F = 0.0000 R-squared = 0.1597 Adj R-squared = 0.1316Root MSE = .92024					

Source: Survey data result, 2019; Stata version13

The results of R squared is equaled to 0.1597 which implies that 15.97% changes of coffee productivity are explained by the explanatory variables included in the model. The coefficient of being dummy gender "female" farm heads, education level of households and family size for coffee productivity was positive and statistically insignificant at 5%.

The coefficient of farm size to coffee production was positive andsignificant at 5%. The positive coefficient farm size suggests a unit increase in variable for coffee production when other explanatory variables are held constant is consistent relation positively elastic to output by 10.07%. It is consistent with the prior expectation. Farmland size is importance of this factor in peasant agriculture where mode of production is extensiveopposed to intensive pattern. When land to household is too small to produce subsistence requirements from less profitable and risk become increasingly, farmers tend shift to other high profitable cash crops. But if sufficient land isavailable to support subsistence requirements, farmers restore more to cropping cash crops. Allocation of large area of land for coffee farm can also indicate higher degree attention in managing farm. Therefore, an increase in land size allocated for coffee by 1% led to increase in coffee production by 10.07% keeping other variables constant. The farmland highlighted as important input to agricultural production affecting farm output. This finding disagreed by

argument of Welch (2003) smaller farmland sizes less effect to increase agricultural productivity than higher farmland size.

The coefficients ofusing farm technology “yes” were negative and statistically significant at 5% level.The negative coefficient of using farm technology to coffee production suggests a unit increase in variable for coffee production when other explanatory variables are held constant negatively elastic related to output by 31.96%. It is inconsistent with the prior expectation. The significance of using farm technology is importance of this factor in peasant agriculture where mode of production is intensive pattern. When supplying of technology available to coffee producers is exist to produce output, the use of technology resulted to productivity of producers production shift to negative outputs. Therefore, an increase in supplying farm technology for coffee producers from sectors by 1% led to decrease coffee production by 31.96% keeping other variables constant.Farm technology highlighted as important input to agricultural production affecting farm output. Using farm technology of households was important which shifts upward production leading high productivity. This result is inconsistent with Okoye and Onyen wearku (2007).

The coefficient of dummy credit access “yes” of coffee producers for coffee productions was positive and significant at 5%. The positive coefficient accessed credit suggests a unit increase of supplied credit to producers when other explanatory variables are held constant is consistent relation positively elastic to output by 25.93%. It is consistent with the prior expectation. The significance of accessed credit is importance of this factor in peasant agriculture where mode of production is extensive opposed to intensive pattern. When credit available to producer is existed to produce high required from less and risk low production become managed, farmers tend shift to high profitable cash crops. Therefore, an increase in supplied credit to coffee producers allocated for coffee by 1% led to increase elasticity of productionpositively by 25.93% keeping other variables constant. The accessed credit highlighted as important input to agricultural production affecting farm output. This finding agreed to Abebe (2008) in Ethiopia; as taking credit important for households on agricultural productivity from finding of this study area.

The coefficient of market distance to coffee production was negative and significant at 5%. The negative coefficient of market distance on coffee producers suggests a unit increase in distance

of producers from market area when other explanatory variables are held constant is consistent relation negatively on elasticity of output by 14.49% . It is consistent with the prior expectation. Market distance of producer from production area is importance of factor in production agriculture

where production is extensive pattern. Whendistance of production area is too large to produce subsistence requirements resulted to risk of low production become increasingly, farmerstend elastic production negatively to produce crops. But if less distance of production area to produce product resulted to positively elastic productions. Therefore, an increase in market distance by 1 % from time allocated led to decrease elasticity of production by 14.49% keeping other variables constant. The market distance highlighted as important input to agricultural production affecting farm output. This findingagreed by argument of Welch (2003) that smalldistance has importance on agricultural production thanhigh distance.

The coefficient of dummy climate change "yes" to coffee production was negative and significant at 5%. The negative coefficient suggests a unit increase in variable during coffee production when other explanatory variables are held constant isconsistent relationnegatively on elasticityof output by 29.04%. It is consistent with the prior expectation. Sufficiency of climate during production is most importantfactor for agriculture where mode of production is extensive opposed to intensive pattern. When climate sufficiency during production is insufficient to producewhat requirements amount leads to low productivity become increasing. But if sufficient climate isavailable to support subsistence requirements, farmers restore more to cropping cash crops. Allocation of areas climate for coffee farmindicate higherdegree attention in managing farm product. Therefore, an increase in climate change during coffee production by 1% led to elasticity of outputdecrease by 29.04% keeping other variables constant. The climate of area highlighted as important factors to agricultural production affecting farm output. This finding agrees with the findings of Guam *at el.,* (2010) that lack of weather affects agricultural productivity.

The coefficient of age to coffee production was positive and statistically significant at 1%. The positive coefficient suggests a year increased of variable when other explanatory variables are held constant is consistent relation positively elastic to output by 29.35%. It inconsistent with the prior expectation. Age of household is important in peasant agriculture where mode of production is far-reaching pattern. When householdsage is too old to produce output requirements become more and more farmers shift positively upwardto output. But if young age of farm experience isavailable

supported subsistence requirements, farmers restore low to cropping cash crops. Allocation of age of farm experience for coffee productions indicates higherdegree attention in managing farm output. Therefore, an increase in age allocated for coffee by a year led to increase elasticity coffee

productions by 29.35% keeping other variables constant. Age of production experience highlighted as important input to agricultural production affecting farm output. This finding agreed to findings of Gul Unal (2008); Okoye *et al. (*2008) and Master son (2005) for age. Old age might pose a disadvantage to agricultural productions but older farmers most times more experienced.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

In order to achieve general objectives researcher was use sample of 279 households from study areas of Mana woreda. Doing so probit model was applied to identify determinants of rural small scale coffee producers, and agricultural productivity model log linear functions used to measure identified factors' effect on productions. Due to this analysis results the finding of this study using probit model reveals that in line with identified factors coffee productions were influenced by different factors in different area. As results in different areas same identified determinant factors include gender, education level, family size, farmland size, farm technology, credit, market distances, climate changes and age of households.

Based on effects of factors marginal effect analysed to respective area identified determinant factors female gender, farmland size, farm technology and climate carried positive implications indicating positive effect on household's participation on coffee productions, while level of education, family size, credit and age of producers carried negativeindicating affect households' participation on productions negatively but market distance were insignificant.

The estimated agricultural productivity model reveals for family size, level of education, dummy credit "yes" and age of producers has positively contribute to the productivity of coffee producers. However dummy female gender, farm land size, dummy farm technology used "yes" and climate change of the area affect productivity of coffee producers negatively while market distance were insignificant factors to productivity of coffee producers.

As generally in area accessing of credit for household coffee producer contributes large than other factors to productivity positively, but dummy farm technology used were the most factor that contributes negatively to productivity of households on coffee productions in Mana woreda.

5.2 Recommendation

To a large extent the problem of low productivity of cash crop in rural area in Ethiopia would be addressed by agricultural rural development strategies of government plan but the problem were not

solved accordingly due lack of its implementations. Most important alleviating low productivity and increasing economic welfare benefits of small scale households from natural resource of area is in fact needs governments agricultural strategies to implementation of it by all concerned bodies to respective in all areas of country. As result, a lot has been done largely on identifying determinant factors of coffee productivity in Mana woreda's different rural areas to respective of different climates that will suffice the following policy recommendations based on the estimated of the Cobb-Douglas production functions.

- Being female headed participation on coffee productionsresulted unproductive; so needed call forintervention of government to providefor all areas farm training concernedwomen'sto make productive. This implication to female constraints to has value to high productivity.

- Inarea educationallevel affects inefficiently productivity of households. In order to curb human capital for rural productivity improvement calls for intervention of rural people-centered coffee training preferable to have farmer teaching centers aimed to promote farmers education level in areas considered productivity aimed to households.
- The results of this study showed that holding of cultivated land size ineffectivelydetermine to coffee productions of households. Therefore, call for introducing to increase productions per having land area what could produceby policy interventionsin production intensification.
- This study reveals inefficiently contribution of climate change to coffee production participation of producers. To overcome this, risk mitigation strategies should be adopted supplying improved seeds, environmentalconservation.
- Access credit of household is important negative impacts to coffee productions in Mana woreda. Therefore financial literacy should be raise households' awareness on its benefitfrom improved productivity by overcoming cost related problem in production to areas.
- The result of this study show family size was negativelyaffectcoffee productions of household. Therefore approaching households' family plan program were not implemented to improve family productions. As a result, this call for introducing concern of increasing production with having planed family size in areas.

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APPENDICES

Appendix A: Econometric test of variables

i. Correlation Matrix of Explanatory Variables

```
. corr gender leveduc famsz farmsz farmtechn credit markdist climate age
(obs=279)
```

	gender	leveduc	famsz	farmsz	farmte~n	credit	markdist	climate	age
gender	1.0000								
leveduc	-0.0490	1.0000							
famsz	-0.2035	-0.0297	1.0000						
farmsz	0.0402	0.2229	-0.0592	1.0000					
farmtechn	0.0442	0.1425	-0.1244	0.1517	1.0000				
credit	-0.0475	0.0978	-0.1414	0.0434	0.1193	1.0000			
markdist	-0.1703	0.1109	0.0252	0.1363	0.1299	-0.0057	1.0000		
climate	0.2018	0.0242	0.0306	-0.0623	0.0398	-0.0049	-0.0906	1.0000	
age	0.0140	0.0316	0.0354	-0.0060	0.0775	-0.0232	-0.0026	0.0576	1.0000

ii. Variation Inflation Factor(VIF) Test

```
. vif
```

Variable	VIF	1/VIF
gender	1.14	0.879758
farmsz	1.09	0.915091
famsz	1.09	0.917900
farmtechn	1.09	0.921658
leveduc	1.08	0.922000
markdist	1.08	0.928446
climate	1.06	0.939256
credit	1.05	0.955119
age	1.01	0.987446
Mean VIF	1.08	

iii. Skweness Kurtosis Test for Normality

```
. sktest resid
```

Skewness/Kurtosis tests for Normality

Variable	Obs	Pr(Skewness)	Pr(Kurtosis)	joint adj chi2(2)	joint Prob>chi2
resid	96	0.9070	0.9490	0.02	0.9912

iv. Goodness of Fit of the model

```
. estat gof, all group(10)

Probit model for coffeepdcvty, goodness-of-fit test

  (Table collapsed on quantiles of estimated probabilities)

      number of observations =       279
            number of groups =        10
    Hosmer-Lemeshow chi2(8) =      6.35
                Prob > chi2 =      0.6084
```

v. Omitted variable test by applying link test probit function

```
. linktest

Iteration 0:   log likelihood = -191.87817
Iteration 1:   log likelihood = -163.38669
Iteration 2:   log likelihood = -163.24224
Iteration 3:   log likelihood = -163.24173
Iteration 4:   log likelihood = -163.24173

Probit regression                                 Number of obs   =        279
                                                  LR chi2(2)      =      57.27
                                                  Prob > chi2     =     0.0000
Log likelihood = -163.24173                       Pseudo R2       =     0.1492
```

coffeepdcvty	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_hat	1.013375	.1493097	6.79	0.000	.7207334	1.306017
_hatsq	.0719846	.1792143	0.40	0.688	-.2792689	.4232381
_cons	-.0219259	.0989437	-0.22	0.825	-.215852	.1720001

vi. Test for heteroskedasticityproblem

```
. estat hettest  gender leveduc famsz farmsz farmtechn credit markdist climate age

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: gender leveduc famsz farmsz farmtechn credit markdist climate age

         chi2(9)      =     3.33
         Prob > chi2  =   0.9500
```

vii. Results for Probit Regression Coefficients to Mana area

```
. probit coffeepdcvty i0.gender leveduc famsz farmsz i1.farmtechn i1.credit markdist i1.climate ag
> e

Iteration 0:   log likelihood = -191.87817
Iteration 1:   log likelihood = -154.05986
Iteration 2:   log likelihood = -153.63504
Iteration 3:   log likelihood = -153.63415
Iteration 4:   log likelihood = -153.63415

Probit regression                                 Number of obs   =        279
                                                  LR chi2(9)      =      76.49
                                                  Prob > chi2     =     0.0000
Log likelihood = -153.63415                       Pseudo R2       =     0.1993
```

coffeepdcvty	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
gender						
female	.5898677	.2063475	2.86	0.004	.1854341	.9943013
leveduc	-.1531996	.079062	-1.94	0.053	-.3081582	.001759
famsz	-.2445477	.0824169	-2.97	0.003	-.4060818	-.0830135
farmsz	.2840214	.1014654	2.80	0.005	.085153	.4828899
farmtechn						
yes	.498369	.1813816	2.75	0.006	.1428675	.8538705
credit						
yes	-.4720217	.1961077	-2.41	0.016	-.8563857	-.0876577
markdist	-.1561532	.0971124	-1.61	0.108	-.3464901	.0341837
climate						
yes	.5461358	.1662529	3.28	0.001	.2202861	.8719855
age	-.5357709	.1359573	-3.94	0.000	-.8022423	-.2692995
_cons	1.100332	.428043	2.57	0.010	.2613832	1.939281

viii. Results for marginal effects of determinant of coffee production in Mana Woreda

```
. margins,dydx(*)
(note: continuous option implied because a factor with only one level was specified in the dydx()
       option)

Average marginal effects                        Number of obs   =        279
Model VCE    : OIM

Expression   : Pr(coffeepdcvty), predict()
dy/dx w.r.t. : 0.gender leveduc famsz farmsz 1.farmtechn 1.credit markdist 1.climate age
```

	Delta-method dy/dx	Std. Err.	z	P>|z|	[95% Conf.	Interval]
gender						
female	.1844661	.0618706	2.98	0.003	.063202	.3057301
leveduc	-.0479093	.0242714	-1.97	0.048	-.0954804	-.0003381
famsz	-.076476	.0247257	-3.09	0.002	-.1249374	-.0280146
farmsz	.0888204	.0303495	2.93	0.003	.0293365	.1483044
farmtechn						
yes	.1558522	.0546533	2.85	0.004	.0487336	.2629707
credit						
yes	-.1476127	.0594851	-2.48	0.013	-.2642013	-.0310242
markdist	-.0488329	.0299799	-1.63	0.103	-.1075924	.0099265
climate						
yes	.17079	.0489526	3.49	0.000	.0748446	.2667354
age	-.1675487	.0392515	-4.27	0.000	-.2444802	-.0906171

ix. Results of estimating agricultural productivity model to Mana woreda

```
. reg lnY i0.gender lnleduc lnfamisz lnfarmisz i1.farmtechn i1.credit lnmadist i1.climate lnag
```

Source	SS	df	MS		
Model	43.2827923	9	4.80919915	Number of obs	= 279
Residual	227.799645	269	.846838829	F(9, 269)	= 5.68
				Prob > F	= 0.0000
Total	271.082437	278	.975116681	R-squared	= 0.1597
				Adj R-squared	= 0.1316
				Root MSE	= .92024

lnY	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
gender						
female	-.1489452	.1127817	-1.32	0.188	-.3709922	.0731018
lnleduc	.0116311	.0495433	0.23	0.815	-.0859108	.109173
lnfamisz	.0754212	.066117	1.14	0.255	-.0547514	.2055939
lnfarmisz	.1007218	.0497858	2.02	0.044	.0027025	.1987412
farmtechn						
yes	-.3196609	.1245787	-2.57	0.011	-.5649341	-.0743876
credit						
yes	.2593681	.1251274	2.07	0.039	.0130145	.5057217
lnmadist	-.1449632	.0570452	-2.54	0.012	-.2572752	-.0326513
climate						
yes	-.2904053	.1134632	-2.56	0.011	-.5137942	-.0670165
lnag	.2935592	.0632327	4.64	0.000	.1690653	.4180531
_cons	1.765267	.258338	6.83	0.000	1.256645	2.273888

APPENDIX B: SURVEY QUESTIONARE

JIMMA UNIVERSITY

COLLEGE OF BUSINESS AND ECONOMICS

DEPARTMENT OF ECONOMICS (MSC PROGRAM)

Survey Questionnaires Format

Objective: This questionnaires' designed to collect information about determinants of cash crop coffee productivity in Ethiopia: a case of small scale rural coffee farmers in Mana district in Jimma zone for the partial fulfillment of the Master of Science Degree in Developmental Economics Regularly, College of Business and Economics, Department of Economics, from Jimma University.

General Directions:

A. You are kindly requested to give genuine responses.

B. You don't need to write your identification.

C. Feel free to respond.

D. Circle the corresponding number of your choices from the given alternatives.

E. The study is completely academic and all responses are confidential.

F. Fill the numbers by encircling to it that you agree with to those questions confidentially.

Thank You!

Identification Information

1. Rural _____ 2. Kebele_____ 3. Enumerator's name _____

Part I: Demographic Characteristics of household head and members

1. Age of Household Head _____

2. Your Sex?1. Male 2. Female.

3. Marital Status

1. Single 2. Wedded

.3. Separated 4. Widowed.

4. Religion

1. Wakefata 2. Orthodox Christian 3. Catholic Christian.

4. Protestant. 5. Muslim 6.Others_____ (specify)

5. Educational level of household head

1. Illiterate 3. Primary (1-8) 5. Diploma holder 7. Above first degree holder.

2. Read and Write 4. Secondary (9-12) 6. First degree holder?

6. Ethnic Group

1. Oromo 2. Amhara

3. Southern Nation and Nationality people 4. Other _____ (specify)

7. Where is your previous residence?

1. Endogenous 2. Come from other rural areas 3. Mana area

8. Household's family size _____

Age Interval	Male	Female	Age	Male	Female
≤1-5			35-40		
5-10			40-45		
10-15			45-50		
15-20			50-60		
20-25			60-65		
25-30			≥65		
30-35					
Total family size of household:_____					

Part II: Economic characteristics of households

9. Where do you generate household income?

1. Trade 2. Employee of government 3. Employee other sector,

4. Other agricultural production 5. Coffee production.

6. Others, specify it_____

10. Does your household annual coffee production income cover your cost of production expenditure?

1. Yes _____ 2. No_____

11. If "No" to the 10th question how do you fill your household annual production expenditure gap?

1. Sale of assets _____ 2. Produce other agricultural crops
3. Support from relatives_____ 4. Credit loan from others.

5. Others _____(specify)

12. Based on question 10, if your answers "No" how you are plan for the next production periods?

1. Sale of assets 2. Produce cash crops 3. Support from relatives 4. Credit from others.

5. Others _____(specify)

13. How much does your family yields productivity of coffee per a single specified production year, (2017/18)?

1. Efficient 2. Inefficient

14. If your answer is been 2 choice for question 13 why the cases?

1. Matter of gender separation 2. A matter of age production 3. Problem of education level

4. Matter of family size 5. Problem of credit access 6. Lack of farmland 7. Market distances

8. Lack of farm technology 9. A matter of climate change.

15. How much level does your family yield coffee production per year?

1. Low 2. Medium 3. High

16. If your answer for 15 questions is 1 why?

1. Lack of farm technology 2. Lack of credit access 3. Climate change

4. In equilibrium of farmland and family size 5. Under utilization of age.

6. Limitation of market distances 7. Separation of sex on agricultural activities.

8. Others_____

17. If your answer for 15 questions is 3 why?

1. Farm technology 2. Credit access 3. Absence of drought causes

4. Equilibrium of farmland and family size 5. Utilization of age,

6. Nearly market access 7. In Separation of sex on agricultural activities,

9. Others

18. Which do you prefer to produce agricultural productions?

1. Coffee crops 2. None coffee crops

20. How many economically active family members live in your house? _____

21. Have you your own land to produce agricultural cash crops? A. Yes B. No

22. Based on your response question 21 if yes specify its size in hectare_____

23. Do you use farm technology? 1. Yes 2. No, if yes in what extent?_____

24. Have you age of dependents in your household to produce coffee? 1. Yes 2. No.

25. What is your household's economic coffee productivity determinant?

1. Farm technology 2. Credit access 3. Climate change causes

4. Equilibrium of farmland 5. Utilization of age 6. Education.

7. Family size 8. Gender separation 9. Market distances.

10. If others, specify_____

26. Do you produce enough cash crops for your household consumption?

1. Yes 2. No

27. If no, how do you cope up it?

1. Produce agricultural cash crops 2. Purchase food 3. Sale of livestock.

4. Borrow from neighbors/relatives 5. Others specify:_____

28. By what factors, Yours family coffee productivity determined?

1. Farm technology 2. Credit access 3. Absence of drought causes

4. Equilibrium of farmland 5. Utilization of age 6. Education,

7. Family size 8. Gender separation 9. Market distances.

10. Others:_____

29. As your locals, household member's participation on production of coffee influenced more by?

1. Gender 4. Family size 7. Farm technology inputs

2. Age 5. Share of Land sizes 8. Capabilities of credit access.

3. Education levels 6. Market distances 9. Face of climate change

30. Where do you obtain market for sells of your coffee productions?

1. Near of our product area 2. Far from our product area 3. Village level market

31. How you measure your coffee productivity that you get in production year of 2017/18?

1. Very low 2. Very good

32. If your answer for question 31 be 1 why?

1. Lack of farm technology 2. Lack of credit access 3. Climate causes

4. In equilibrium of farmland and family size 5. Under utilization of age.

6. Education level 7. Distance from market 8. Gender

9. Others._____

33. If your answer for question 31 be 2 why?

1. Access of farm technology 2. Credit access 3. Absence of drought causes

4. Equilibrium of farmland with family size 5.Utilization of age 6. Education level.

7. Gender separation 8. Market distances. 9. Others:_____

34. Do you get credit access from financial institutions for your coffee productivity?

1. Yes 2 No

35. If 1 is your choice to "34" questions responses for what purpose do you use? _____

36. If 2 is your choice to the "34" questions responses why the causes? _____

37. How much do charged interest rate for loans? _____

1. More than capability of farmers to repaid it after

2. Less than capability of farmers to repaid it after

3. Equilibrium with capabilities of farmers to repaid it after

38. Is there any satisfaction of utility to your productivity of coffee yield within specified period (2017/18)?

1. Yes 2. No

39. Based on question" 38" if your answer is be 1, why?

1. Gender equality participation 2. Family size equilibrium with farm land size

3. Farm technology inputs are appropriated

4. Included age is utilization 5. Good share of land sizes.

6. Capabilities of good credit access 7. Education levels 8. Market distances.

9. Free from face of climate change during production period

40. Based on question" 38" if your answer is be 2, why?

1. Gender inequality participation 2. Family size in equilibrium with farm land size

3. Farm technology inputs are in appropriated 4. Utilization of used age.

5. Inappropriate holding of farmland size 6. Incapability's of good credit access.

7. Limitation of education level 8. Face of market distances. 9. Face of drought

41. Are you faced on your coffee production by lack of farm technology advances from agricultural sectors?

1. Yes 2. No

42. Is there any negative constraints' in your coffee production activities participation with respectives of gender inequality?

1. Yes 2. No

43. Is there negative constraints' to your coffee production participation with respectives of age of your household's members?

1. Yes 2. No

44. Is there negative constraints' on your participation of coffee production with respectives of your household's education levels?

1. Yes 2. No

45. Is there negative constraints' on your participation of coffee production activities with respectives of your family size inequality with farmland size?

1. Yes 2. No

46. Is negative constraints' on your participation of coffee production with respectives of your market distances from production area?

1. Yes 2. No

47. Based on question 46, if your answer is yes specify its distance in walk minutes_____

48. Is there negative constraints' on your participation of coffee production with respectives of credit access from financial institutions?

1. Yes 2. No

49. Is there any negative constraints' on your participation of coffee production activities with respectives of climate change?

1. Yes 2. No

50. What solution do you have taken to fulfill coffee crop production gaps?

1. Gender equality participation 2. Family size equilibrium with farm land size

3. By getting farm technology inputs

4. Using utilized age 5. Good share of land sizes.

6. Capabilities of good credit access 7. Improving family's education level.

8. Creating market shade around production area

9. Conserving climate change during production period

51. Is that your family use farm technology to produce coffee efficiently?

1. Yes 2. No

52. If your response for question 51 is 2 why?

1. High price selling 2. No supply at all 3. Other:_____

54. How about your problem with respect to access of credit to coffee productions?

1. On credit access 2. On Credit took 3. On credit source 4. Others,_____

55. From where did you get credit?

1. Relatives and neighbors 2. Cooperatives 3. Debit Micro Finance

4. Credit traders with high interest rate 5. Didn't we get credit service.

56. Why you credit?

1. for agricultural coffee input production

2. for agricultural cereal crop production inputs

3. to start new business 4. To Purchase food crops.

Thank You, For Your Best Responses Voluntarily!