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Determinant Factors and their Coping Strategies of Cassava Production of Farm Households: The Case of Amaroworeda in Southern Nations, Nationalities and Peoples Regional State of Ethiopia

Zemach Lemecha Legesse
Department of Agribusiness and Value Chain Management, Wolaita Sodo University
P.O.Box 138, Wolaita Sodo, Ethiopia, email id: lemecazemach@gmail.com

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Abstract **– This study assessed the extent of cassava production, evaluated its determinant factors and their coping strategies on the households in Amaro Woreda, Southern Ethiopia. Both primary and secondary data were used for the study. Primary data were collected from the sample of 100 respondents drawn from both 67 cassava producer and 33 non-producer households. Descriptive statistics and econometric model were employed for data analysis. The descriptive statistics result showed those socio-economic, institutional characteristics and the coping strategies of the sample households for facing challenges. These copping strategies were revealed as 20%, 16%, 15%, 14%, 14%, 14%, 11% and 9% were using post harvesting technologies, using selected varieties, adopting newly introduced technologies, improving farming systems, changing plating dates, using chemical fertilizers and other interrelated mechanisms were the selected coping strategies respectively. The study employed also econometric model (The Multiple Linear Regression model) for estimating the determinant factors of cassava production. The model result revealed that three explanatory variables were significantly influenced the cassava production such as age of the household heads, educational level, family size or members of the sample households at 5% probability level.**

Keywords **– Cassava, Determinant Factors, Copping Strategies, Multiple Linear Regressions.**

I. INTRODUCTION

Ethiopia is located in the horn of Africa with total geographical area of 1.11 million square kilometres with immense physical and climatic diversity its physical diversity ranging from about 200 metres below the sea level to over 4000 meters above the sea level and it has about 18 major agro-ecological zones. Ethiopia's physical and agro-ecological diversity also extends to its population, which comprises about 85 ethnic or linguistic groups with 286 different languages (Zewditu *et al*., 2001; Sisay and Tesfaye, 2003). The country is with the population of 82.9 million and the second most populated country in Africa next to Nigeria. According to 2011 estimate, the population is growing at an estimated annual rate of 2.1%. From the total inhabitants, around 83% of the population are living in the rural areas (CSA, 2011a).

Agriculture is the means of livelihood for almost all of the rural population as the main source of domestic food production and major supplier of raw materials for industries. It is a dominant sector in Ethiopia and contributes about 43% of the gross domestic product (GDP); this employs nearly 85% of the total labor forces and contributes about 90% of exports. Small scale farmers account for 95% of the total area under crop cultivation and more than 93% of total agricultural output (MoARD, 2012).

Root crops covered more than 1.62% of the area under all crops in the country. These crops are; Potatoes, sweet potatoes, taro and cassava these crops were contributed 23.4%, 38.4% and 17.7% of the total root crop production in the same order. However, cassava production is not significantly used in many areas of the country except Amaro *woreda*, Gamo Gofa zone and some*woreda's* in Wolaita zone. In Amaro *woreda* where this study conducted in Amaro in which cassava is an introduced crop than indigenous and has been accepted widely by the farmers of the *woreda* as in other African countries which are familiar with cassava production like Nigeria, Ghana, Senegal etc.(FAO, 2012).

1. Cassava and Cassava Production

Cassava (*Manihot esculenta*) is a shrubby, tropical, perennial plant that is not grown well known in the temperate zone with eventually some periods of dormancy (if temperature is low). In cultivation, however, it is treated as annual crop. During the growth there are five distinct phases. These are sprouting phase, leaf and root system development phase, canopy establishment phase, high carbohydrate translocation phase and dormancy phase (Lebot, 2003). The cassava plant grows tall sometimes its height reaches 15 feet or 4.57 meters, with leaves varying in shape and size. For most people; cassava is most commonly associated with tapioca or starches. However, the edible parts are the tuberous root and leaves. The tuber is somewhat dark brown in color and grows up to 2 feet long.

Cassava thrives better in poor soils than any other major food plants. As a result, fertilizer is rarely necessary. However, yields can be increased by planting cuts on well-drained soil with adequate organic matter. Cassava is a heat loving plant that requires a minimum temperature of 80°F to grow, in other hands it grows under a favorable temperature conditions which ranges from 25 to 29℃, but it can tolerate temperature as low as 12℃ and as high as 40℃. Its leaf has a capacity to reduce evaporation at a hot temperature conditions by closing the stomata. This increases the water use efficiency (Lebot, 2003:2009). Since many cultivars of cassava are drought resistant it can survive even during the dry season when the soil moisture is low but humidity is high. The critical period for cassava

root initiations after planting is 30 to 150 days. During this phase the water deficit causes decreases its production from 60 to 30%. Also if water deficit reaches high, it can cause a death of plant. Cassava can successfully cultivated in the areas of annual rainfall is between 1000 to 3000 mm but it can tolerate low rainfall if well distributed. The most favourable conditions seem to be in climates with 1500 to 2000 mm per year and maximum solar radiations and it can be planted all years round (Lebot, 2003; Kyamanywa *et al.,* 2011).

Cassava is a native from South America around Brazil of Goias state, that is extensively cultivated as an annual crop in the tropical and sub-tropical regions for its edible starchy tuber as root but in Ethiopia it is a perennial crop for edible the root. Cassava has the ability to grow on marginal lands and its one of the most important staple food crops in Tropical Africa with its efficient production of food energy from its roots, year round availability and tolerant of extreme environmental stresses which makes it eminently suitable for farming and food system in many cassava producing countries. Cassava production is highly applied in some African countries like Nigeria, Cameroon, Ghana, Madagascar, Uganda, Zambia, Zimbabwe, Senegal etc. (Okupukpara, 2006). Around the world, cassava is also produced highly in Brazil, Thailand and some others South America and Asian countries and it is comparable to potatoes, except that it has twice the fibber content and a higher level of potassium, rich in carbohydrate content as to compare with other root crops and it is the third carbohydrate rich crop next to Rice and Maize in tropical zones (Ayoade, 2012).

According FAO (2002) there are two types of cassava varieties such as sweet and bitter varieties. Sweet cassava variety is normally used directly by human for consumption which has less than 100 mm of the total Cyanogenic Glycosides (CGs) per kg of the peeled fresh roots. And bitter cassava variety is not suitable for human nutrition as it is fresh but it needs further processing, which have higher starch content (more than 100 mm of CGs), which is used for animal feed or processed into industrial inputs (Vessia, 2007 and Lebot, 2009). However, Out of 242 million tonnes of total cassava produced in 2009, only a fifth was globally traded (FAO, 2009). The bulky and low value nature of the crop makes efficient transportation necessary for cross border trade to be viable (Tijaja, 2010).

As the scale of human activities expands the capacity of the eco-systems to regenerate the natural resource base becomes an increasingly binding constraint to further growth and development with respect to agriculture, the combined effect of population growth on the developing countries faces the same challenges to the less developing countries (Kostas, 2001), Erratic rainfall, limited access to gainful off farm employment. Special heavily reliance on rain fed agriculture, during conditions of very variable rainfall and recurrent drought affects agriculture and its related activities and hence, has adverse effects on the economy of Ethiopia (World Bank, 2006). The socio-economic progress of Ethiopia rests on the performance of the agricultural sector, which is dominated by smallholder farmers. As it is well known, in peasant agriculture the goal of development is undoubtedly changing the scope and efficiency of food crops production (Nord and Andrews, 2002).

There are many different factors that affected cassava production; like drought, pests and diseases, unbalanced rainfall, unequal distributions of land holding, unstable political situations, limited infrastructure, lack of finances, lack of asset holding awareness and skill, lack of storage for produced products, climate changes, new technology adoptions, marketing situations, lack of incentives from stockholders, soil fertility status problems, limited water for irrigations, lack of extension visits, educational background, inequality of income generation, working conditions and etc. In order to tackle these and other factors associated with cassava production, there were different copping strategies that were developed by many scholars has gotten an international attention Mahungu (2010). The Clinton Foundation, Pan African Cassava Initiative and Kellogg Foundation through pan African cassava initiatives were assisting farmers in planting high yielding cassava varieties that grow in relatively dry conditions in Sub-Saharan Africa (Alwang and Siegel, 2003; Moyo *et al*., 2007).

This study explicitly point out a causal effect of agricultural production in case of cassava production on farm households' wellbeing or in other word; it establish an adequate counterfactual situation and identify the true causality of change. Indeed, in order to assess the extents of cassava production in the study area; the researcher should be able to assess what the situation would be like if the cassava production had not been adopted, *i.e*., the determinant factors that affecting the cassava production that can lead to misleading policy implications, as at the household level many other factors may have changed along with technology.

This study was attempted to address the objective like;

2. General Objective of the Study:

The general objective of the study was to assess the challenges and their coping strategies, determinant factors of cassava production of farm households in Amaro *woreda.*

3. The specific objectives were:

1. *To identify the factors and coping* strategies of farmers participating in cassava production.
2. To examine the extent of determinants of cassava production in the study area

Determinants of Cassava and Production

Tsedeke *et al*., 2002; the determinants of cassava productions are included Land and water related factors (such as farm/water course location, quality of land or fertility status of land, sources and proximity of water, quality and quantity of water and timing of water application, fragmentations of land etc.), Climatic factors (i.e. rainfall, temperature, sunshine or light, frost, drought etc.), Agronomic factors such as: quality, quantity and timing of input application (i.e. seeds, fertilizers, chemicals, herbicides, labour, etc.), Socio-economic factors (such as farmers' health, education, experience in farming, family size, tenancy terms, gender issues, availability of credit and marital status), Farm management factors (i.e. adoption of

modern production technologies, farm planning and management practices, etc.).

Some of these factors are interrelated and the effects of some of them may be much greater than those of others and there may be locational variations in the degree of their effects on productivity. Some of these factors might be under the direct control of all the farmers. Others might be controlled by groups of other farmers, managers at the system level and policy makers at higher levels. Yet some of these are beyond human control (Adegeye, 1996; Naiken, 2002).

Various other studies have documented some of these factors. Other factors that abound in economic literature include technology, labour employment, education and training of farm operators, agro-ecological factors, environmental conditions, security of land ownership rights and funding which determines the maximal physical quantity of output that can be reached as well as the number and quantity of the inputs required (Ayoade, 2012). There are different factors that affect the cassava production and productivity and challenges in cassava production areas. From these determinant factors the following are stated by different researchers (Nweke, 1994).

Pests and Diseases: The two current viral pests and diseases, which are spread by a whitefly vector (*Bemisia tabaci*) and the movement of planting materials, now pose a severe threat to cassava culture in many areas in the cassava producing regions. According to researchers at the National Agricultural Research Organisation of Uganda, there has been a significant increase in the density of whitefly populations in recent years, to the extent that whitefly has in itself become a crop pest causing damage to cassava leaves as well as being a disease vector. These have the same effect on different cassava producing countries (FAO, 2010).

Technology availability: under this there are different technology related activities for farmers such as; Improved varieties, seeds, chemical fertilizers, and so on drawing on the overlapping resources of the participating centres to accelerate the development, delivery and adoption of the technologies with stable yields, stress resistance, and high nutritional or quality value. Value-added benefits from the collaboration include the ability to share breeding protocols across centres and crop and to exploit the higher yield potential and predictability of the products. Producing Sustainable seed systems: building on advances in technologies for high volume production of quality planting material and semi-formal approaches such as; those producing quality declared seed to meet the needs created by lack of formal seed systems and postharvest technologies. These all technology changes might change the minds of farmers and this is called Farmers' skills and behaviours changes (Adesina and Forson, 1995).

Climate changes: The effects of climate change on cassava production determine the quality, quantity and productivity of cassava (Ayoade, 2012). Therefore, requires addressing the role of climate change that has a relationship with four basic concepts directly or indirectly: such as households income, the nature of their exposure to food prices, integration and local food markets. Which are highly global markets, and their broader longer run prospects for livelihood improvement (Lobelland Burke, 2010). The components which highly related with climate changes are; agro-ecological factors, rain fall, temperature, humidity and wind. The components indirectly related with climate changes are; land size, soil fertility, varieties, irrigation, education and etc. which affect cassava production.

Credit availability: credit is the amount of money that a financial institution is prepared to lend some body purposively. The influence of credit in adoption of modern agricultural innovations or technologies in cassava production, remain poorly understood (Ersado *et al*., 2004; Omonona, 2009). Access to credit affects household welfare outcomes through at least two channels. First, it alleviates the capital constraints on agricultural households (Okpukpara, 2010). Access to credit also reduces the opportunity costs of capital intensive assets relative to family labor, thus encouraging labor saving technologies and raising labor productivity, this is a crucial factor for agricultural development, especially in many African countries (Delgado 1995; Zeller *et al*., 1997). The second channel through which access to credit affects household welfare is by increasing its risk bearing ability and altering its risk coping strategy. The household might therefore be willing to adopt new, more risky technologies (Baidu and Forson, 1999; Aliou *et al*., 2000; Fakayode *et al.,* 2008).

Other interrelated constraints: These are other related factors affecting cassava productions such as: untapped market opportunities, inadequate infrastructures, lack of postharvest handling technologies, shortening fallow period and declining soil fertility, insufficient and poor quality planting materials, the cyanide scare, absence of reliable information, incentives and so on are the most frequently determining factors in cassava production (Wambugu and Mungai, 2000). Not only the above mentioned factors affects cassava production, but also there are additional factors that affects the cassava productions such as: planting and maturity time, tillage practices, weeds or herbs, insects, fertilizers, lack or availability of tractors, species or varieties etc. (Okpukpara, 2010).

II. Research Methodology

2.1. Descriptions of the Study Area

This study was conducted in Amaro *Woreda* of Segen Area Peoples Zone, SNNPRS. Segen area people zone is one of the 14 zones of the SNNPRS. It is located in the southern part of the country. It is divided into 5 *woredas* and Gomayde is the head quarter of the zone and is located at the distance of 713 **kms** from Addis Ababa and 412 **kms** from regional city Hawassa. The headquarter of the Amaro *woreda* is Kelle, which is located at a distance of 510 **kms** from Addis Ababa and 207 **kms** south from regional city of Hawassa. It is bounded by Oromiya region from the east, Konso *Woreda* from the west, Burji *Woreda* from the north and NechSar National Park from the south. Amaro *Woreda* comprises three agro-ecological zones namely, Highland (*Dega*) its altitude ranges from 2301-3601 m.a.s.l, middle altitude area (*Weyena dega*) its altitude ranges from 1501-2300 m.a.s.l and Lowland (*Kola*) which ranges from 1000-

1500 **m.a.s.l** with 32%, 38%, and 30% of the area coverage, respectively The altitude of the *woreda* ranges from 1000–3600 **meters** above sea level (**m.a.s.l.)** at Dulbe to Dello Mountain (AWADO, 2008). The study site is known by its bimodal rainfall distribution. The first small rainfall season is Autum (*Belg*), occurs from the beginning of March to the end of April and the second main rainfall season is summer (*kiremt)*, occurs from the beginning of July to the end of November in normal years. The average annual rainfall ranges from 735–1200 **mms**. The rainfall intensity and distribution in the cropping season was reported to be decreasing over time, resulting in common crop failures and drought. The *woreda* is known by its chained mountains from north to south direction and with small stream flow on the sides of the mountains chain. Also, the *woreda* is known with use of long-time local irrigation from those streams.

The *woreda* has total human population of 167,379 of which 84,411 (50.4%) are males and 82,968 (49.6%) females. And also there were 18,375 households from sample *kebeles*. Most of the population or about 70% was engaged in mixed farming systems. The *woreda* has total area of 1,422.16 sq. km. With regard to land use pattern of the *woreda*, grazing land comprises the largest area of 369.76 **sq. km** (26%) followed by cultivable area which counts 242.99 sq. km (17.1 %) (CSA, 2011b).

2.2. Data Sources and Sampling Technique

Amaro *woreda* was purposively selected because the area was representative for cassava productions than other *woredas* in the same zone based on agro-ecological feature, soil type, farming system etc. Primary data were collected from sample households using semi-structured, well prepared and pretested interview schedule that would be administered to the respondents by the trained enumerators and questionnaires. Simple random sampling technique was used in selecting proportional respondents from each *kebele* for making a total of 100 households as the sample size from 6 *kebeles* which were Danobulto, Gumure, Zokessa, Kobo, Gamule and Darbamenena with their Households and sample households of 509 (11), 912 (20), 433 (9), 704 (15), 623 (13) and 1512 (32) were identified respectively.

The Sampling technique for this study was applied three stage sampling technique. In the first stage, in the second stage, 6 cassava producing *kebeles* were selected by stratified sampling technique from 21 cassava growing *kebeles* in the *woreda* based on the extent of cassava production and in the third stage 100 respondents were selected randomly by using simple random sampling technique. There are many different approaches to determine the sample size; out of these different methods (Yemane, 1967), was used to calculate the sample size from the total household heads of the sample *kebeles* as well as *woredas* (CSA, 2010). Therefore, the simplified formula to calculate the sample size used for this particular study was determined at 90% of confidence interval. The formula is stated below in equation 1.

$$n = \frac{N}{1+N(e^2)} = \frac{4,693}{1+4,693(0.01)} = 100 \qquad (1)$$

Where; n is the number of sample size from the population N is the total number of household heads in study area *e* is degree of precision at 90% confidence interval in this study i.e. e = 10%. The distributions of the total sample in sample *kebeles* were based on the probability of proportional to the number of population of cassava producers in each *kebele*.

2.3. Methods of Data Analysis

Descriptive and inferential statistics along with econometric models were used to analyze the collected data. Descriptive statistics such as mean, standard deviation and percentage were employed to analyze the data on socio-economic and institutional characteristics of the sample households while inferential statistics such as t-test and chi-square or $\chi 2$ tests were used to undertake statistical tests on different continuous and categorical or discrete variables respectively. For the econometric analysis the data were checked for regression model assumptions including outliers, multicollinearity, and heteroscedasticity and model specification test.

2.3.1. Analysis of Cassava Production

To analyze the extent of total cassava production; a multiple linear regression model was employed by regressing production against with different explanatory variables. Multiple liner regression was used to analyze factors that affected the cassava production in the study areas (Gujarati, 2003).

$$Y = f(X_1, X_2, X_3, X_4, X_5, D_1, D_2, D_3, D_4) \qquad (2)$$

$Y_i = B_0 + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4 + B_5X_5 + D_1 + D_2 + D_3 + D_4 + D5 + \boldsymbol{\varepsilon i}$; Where:

Y is total amount of cassava production in quintals per year

B_O is intercept constant of Yi

B_i is slope coefficient of X_i's

X_1 is age of sample household heads

X_2 is family size of sample households

X_3 is the land holding of sample households in hectare

X_4 is the farming experiences of sample household heads in years

X_5 is the extension contacts of both farmers and agricultural development agents

D_1, D_2, D_3, D_4 and D_5 are dummy or discrete variables representing; educational level of sample households, fertility status of the soil, access to modern irrigations, access to agricultural inputs and pests and diseases respectively. These dummy variables take the values 1, if the participants in cassava production have; irrigation access, agricultural inputs, and 0, otherwise and others with their categorical prospective.

Ei is error term

2.5. Definition of Variables and Working Hypothesis

1. **Dependent variables:**
   a. **Total annual cassava production:** This is the amount of cassava produced by a household measured in **quintiles** and entered in multiple linear regression models as a dependent variable to assess the extent of cassava production per a year.
   b. **Participation in Cassava production:** The participation in cassava production is measured as dummy variable taking a value of 1 if the household is cassava producer and 0 otherwise.
2. **Explanatory variables:** The explanatory variables that were used in the econometric model was specified as; in multiple linear regression model: were Factors

which affected the extent of production of cassava these were age of the sample household head, family size of the household, educational level of the household head, land holding of the household, farming experiences of the household head, extension contact both for farmers and agricultural development agents, soil fertility status, use of modern irrigation practices, applying agricultural inputs, and perceived effect of pests and diseases on cassava production. The hypothesized relationships between these explanatory variables and the dependent variable are discussed below.

Age of the sample household heads (AGE): Age of the household heads was assumed to reflect the farming experience of the farmers. However, as the farmer gets older, managerial ability is expected to decrease. If this is the case we could conclude that middle age farmers could be able to obtain farm production than others (Omonona, 2009).

Farming experience of the sample household heads (EXPRICE): This is also almost similar with age of sample households. It was again assumed to reflect the year of farming practice of the farmer. However, as the farmer gets older, managerial ability is expected to decrease. As a result older farmers could be reluctant to adopt newly introduced technologies. Therefore, a negative relationship is expected between farming experience and the cassava production.

Educational level of the sample household heads (EDU): Farmers are expected to acquire the ability of better management through education. In this study education was hypothesized to determine cassava production positively because of its role in enhancing the adoption of newly introducing technologies. It was as a categorical variable taking values 1 who can write and read, 2, if the farmer attained up to grade 4, 3 if she/he attained second cycle of the primary educational level, 4 if she/he has reached 9-12 grade and 5 for above grade 12 (Feder *et al.,* 1985; Baidu-Forson, 1999).

Family Size of the sample household (FAMILYSIZE): This was taken as a continuous variable. Family members were an important source of labour supply in the area. Family size could have positive effect in farm production of the farmer in the production of cassava. Since labour was the main input in crop production as the farmer has large family size can manage crop plots, sowing or planting, weeding, watering and harvesting on time. Therefore, family size had a direct influence on income level of the family. Thus family size was hypothesized to determine cassava production positively (Wambugu and Mungai, 2000).

Pests and Diseases (PESTS): According to Mishra and Osta (2002), this was measured as categorical variable. Pests and diseases had a significant effect on the productivity of the crops or cassava; it attacked cassava and other crop. Thus it was hypothesized that pests and diseases attack determine farm productions negatively. It was measured as categorical by identifying its effect on farm land of cassava (1 for it has no effect on cassava production, 2 for it has low effect on cassava production, 3 for it has medium effect on cassava production and 4 for it has high effect on cassava production).

Access to modern irrigation services (IRRIGATION): Access to modern irrigation services (like drip and sprinkler) as one of the technology options available, enables the farmers to diversify their production, practice multiple cropping and supplement moisture deficiency in production. In doing so, it helped the farmer to increase production and it was assumed to have a direct relationship with household output. It was dummy variable taking the value of 1 if the household has access to modern irrigation service and 0 otherwise.

Extension visits and its time (EXTVISTTIME): Farmers who have had longer extension contact with agricultural development agents were expected to be more productive in agricultural productions than others. Thus extension visit measured in years of the service (which was continuous variable). It was hypothesized to influence agricultural production by having many visits time to have a positive relation.

III. Results and Discussion

3.1. Descriptive Results

3.1.1. Socio-economic and institutional characteristics of the sample households

In this sub-heading the characteristics of sample household's both continues and discrete variables were stated such as: age of the sample household heads, family size of the sample households, sex of the sample household heads, educational status of the sample household heads, marital status of the sample household heads and so on.

Table 1 Socio-economic and institutional characteristics of the sample households for continuous variables

Variables	Total Samples (N = 100)		Producers (N = 67)		Non-producers (N = 33)					
	Mean	SD	Mean	SD	Mean	SD	Min	Max	Mean difference	t- value
AGE	44.51	10.9	45.5	11.32	42.48	9.79	23	85	1.754	-1.66*
FAMIYSIZ	6.77	2.31	7.04	2.36	6.23	2.13	1	10	0.376	-2.1**
HA	3.44	3.5	3.55	3.41	3.22	3.84	0.25	28	0.629	-0.551
L4CP	1.14	0.92	1.23	0.837	0.954	1.04	0	4	0.167	-1.79*
TCP	3063	16400	3451	19377	2288	7633	0	192000	2175	-0.416

EXPERIE	13.7	11.1	14	10.4	12.96	12.3	0	42	0.879	-0.52
EXVT	9.24	6.49	9.29	6.86	9.13	5.76	0	42	1.045	-0.139

Source: Own survey result (2017),* and ** show a mean significance at 10% and 5% probability level respectively

As it is indicated in Table 1, there was significant mean difference between cassava producers and non-producers in terms of age, family size and land used for cassava production.

Age of sample household heads (AGE): The average age of the sample household heads was 44.51 years whereas the minimum age was 23 and the maximum of it was 85. The average age of cassava producers was 45.53 and the corresponding figure for non-producers was 42.48; the mean differences between the groups showed that relatively younger generations were not interested to participate in cassava production. Because this issue has been seen traditional taboos and less marketability of cassava production. The t-value of 1.66 showed that the mean age difference between producers and non-producers was statistically significant at 10% probability level.

Family size of sample households (FAMIYSIZ): The average family size of the sample households in adult equivalent was 5.8 persons and in arithmetic mean of it were 6.8, with 1 and 10 being the minimum and the maximum family sizes, respectively. When we compare the average family size between cassava producers and non-producers, households that were participating in cassava production had higher household size than households that did not participate in cassava production. Average family size for cassava producers was 7.04 persons while it was 6.23 persons for non-producers. The mean comparison test of household size between the two groups showed that there was a statistically significant difference in the mean household size at 5% probability level between cassava producers and non-producers.

Land used for cassava production (L4CP): The result disclosed that, as the cultivated land size for cassava production increases, the households were able to decrease and diversify the quantity of any type of crop produced on the cultivated land this may in turn imply increased income and consumption. The average land holding for cassava production of the sample households were found to be 1.14 ha and mean of this variable for cassava producer and non-producer also was 1.23 and 0.95 ha respectively. Its mean difference between cassava producers and non-producers was statically significant at less than 10% probability level.

Total cassava production of sample households (TCP): The major crops grown in the study area are cassava, maize, *teffe*, wheat, coffee, khat, beans and horticultural crops such as onion, tomato, potato, bananas and papaya, *enset*, fruits and vegetables. The mean annual cassava production of the sample households was 3063 **quintals**, though the range varied between 0 quintal and 192,000 **quintals** whose mean difference is not statically significant between cassava producers and non-producers.

Access to extension service or visits time of sample households (EXTVISTTIME): The study result showed that 53.2% of the sample households got extension services. When we compare cassava producers and non-producer households, majority of the cassava producer households got support from agricultural development agents than non-producers. According to the survey result 43 cassava producers and 19 non-producers got extension service. Extension service here refers to advice about farming systems, animal managements (artificial insemination), and training, providing marketing information, demonstration and distribution of input (seed, chemicals and fertilizer distributions). About 47 cassava producers and 21 non-producers consulted extension agents whenever they needed technical advice related with farming activity in a minimum and maximum contact time between farmers and agricultural development agents of 0 and 42 respectively. The t-test has not showed mean difference between the cassava producers and non-producers were statically significant.

Table 2. Socio-economic characteristics of the sample households for discrete variables.

Variables	Categories	Producers household (N=67)		Non producers household (N=33)		Total sample size		Chi-square (χ^2)
		No	%	No	%	No	%	
EDU	Read and write	7	7	0	0	7	7	
	Grade 1-4	33	33	12	12	45	45	
	Grade 5-8	22	22	14	14	36	36	
	Grade 9-12	5	5	3	3	8	8	
	Grade above 12	0	0	4	4	4	4	**5.3*** **
	Total	**67**	**67**	**33**	**33**	**100**	**100**	
FERTILITY	Infertile	12	12	10	10	22	22	
	Fertile	55	55	23	23	78	78	**1.39**
	Total	**67**	**67**	**33**	**33**	**100**	**100**	
IRRIGATION	No	28	28	18	18	46	46	
	Yes	39	39	15	15	54	54	**0.124**
	Total	**67**	**66**	**33**	**34**	**100**	**100**	
PESTS AND DISEASE	Has no effect	3	3	2	2	5	5	
	Low	7	7	1	1	8	8	

	Medium	42	42	26	26	68	68	
	High	15	15	4	4	19	19	**4.5*** **
	Total	**67**	**67**	**33**	**33**	**100**	**100**	
AAI	No	59		16	17	76		
	Yes	8		17	17	24		**1.045**
	Total	**67**	**67**	**33**	**33**	**100**	**100**	

Source: Own survey Result (2017), *** mean differences significant at 1% probability level, respectively

As it is indicated in Table 2, there was significant mean difference between cassava producers and non-producers in terms of level of education and pests and diseases.

Level of education of the sample household heads (EDU): In the study area, according to the descriptive statistics result 45%, 36%, 8%, 7% and 4% of the sample households were found to be grade 1-4, grade 5-8, grade 9-12, under grade but they can read and write and above 12, respectively. The comparison by cassava production reveals that 7% were producers and 0% non-producers were found to be under grade. Whereas 60% producer households had attained grade greater than and equals to 1. The corresponding number for non-producer households was 33%. Therefore, from the total figure only 7% were can write and read or under grade and attained above grade 1, respectively. The chi-square test showed that there was difference in education between cassava producers and non-producer household heads which is statically significant at 1% probability level.

Sample household's perception of soil fertility status (FERTILITY): In the study area soil fertility is not a major problem because cassava production does not highly need fertilizers or fertile soil since cassava plant is drought resistant crop. Majority of the respondents said that they did not have soil fertility problem, 78% of them stated that they considered their land as fertile and 22% of them stated that they consider their land as infertile. The comparison between cassava producers and non-producer households showed that 55 cassava producers and 23 non-producers had fertile land (according to their opinion). Whereas 12 cassava producers and 10 non-producers had infertile soil, was considered not statistically significant between the groups.

Modern Irrigation practice of sample households (IRRIGATION): Access to modern irrigation practice was positively related to cassava production in my hypothesis; the result showed that the study area is well known not only modern irrigation practice but also in traditionally irrigation practices. As a result, irrigation practice enables households to grow more other crops than cassava to ensure increased and stable agricultural productions, income and consumption thereby improving their livelihoods of the households. About 54% and 46% cassava producers and non- producers were participated in accessing modern irrigation water for their agricultural production.

Pests and diseases effects on cassava production (PESTS): In the study area an incidence of pests and diseases are a major problem and highly affecting cassava production. Majority of the respondents said that they had pests and diseases problems on their cassava production. According to this study results; about 68%, 19%, 8% and 5% of the respondents considered the effects of pests and disease on cassava production had; a medium effect, a high effect, a low effect and no effect respectively. The chi-square test revealed that there was a statistically significant at 1% probability level, the mean difference between cassava producers and non-producers in terms of pests and diseases.

3.2. Coping Strategies of the Households during Bad Time

Households in the study area have various coping mechanisms during crop failures. The survey result showed that cassava producer households had a better coping strategy than the non-producers. None of the cassava producers went into hungry or search for off-farm employment as a coping strategy. On the other hand, non-producers join off-farm employment during bad times as a coping mechanism. Using post harvesting technologies was the major coping strategy in the study area, with 12% of the cassava producers and 8% of the non-producers participated in it to pass bad times. About 16% of the respondents said using new cassava varieties is better way to improve cassava production from which 13% were producers and 3% were non-producers. Taking new technology adoption was also the third coping mechanism with 4% of non-producers and 11% of cassava producers having adopted this coping strategy. 14% is also about improving farming system as coping strategy in the study area, 14% of the sample household's response is about changing plating date and using chemical fertilizers is 14% and 7% of cassava producers apply this strategy and 9% of the sample households were replied as other issues are coping strategies to face the challenges of cassava productions and food security like consulting agricultural development agents to made awareness about technology adoptions, getting support from NGO's (Agri-services of Ethiopia), participating in entrepreneurship and small business, rearing animals, crop diversifications as a coping strategies from which 3% and 6% were non-producers and cassava produces respectively and a coping strategies had a statistically significant at 1% probability level between cassava producers and non-producers in Table 3 below.

Table 3. Coping strategies of the households during bad time

Coping strategies	Participation in cassava production						Chi-square (χ^2)
	Producers		Non-producers		Total		
	No	%	No	%	No	%	
Improving farming system	11	11	3	3	14	14	5.9***
Changing planting dates	10	10	4	4	14	14	
Using post harvesting technologies	12	12	8	8	20	20	
Adopting new technologies	11	11	4	4	15	15	
Using chemical fertilizers	7	7	7	7	14	14	
Using selective varieties	13	13	3	3	16	16	
Others	6	6	3	3	9	9	
Total	**67**	**67**	**33**	**33**	**100**	**100**	

Source: own survey result (2017), *** indicates a significance level at 1% probability level

3.2. Econometric Model

3.2.1. Determinants of cassava production

The participation of sample households in cassava production was determined by different factors that were indicated in descriptive statistics socio-economic and institutional characteristics. Such as agro-ecological factors, technological factors, incidence of pests and diseases, farm input supply factors, farm land holding, cassava plating systems, materials and dates, weeding, infrastructure, training, extension contact services, agricultural credit service, levels of education, family numbers, cassava varieties, age, marital status, sex adoptions of technologies and so on. The determinants of participation in cassava production were estimated by using the logistic regression model under MLR presented and the result of the function is calculated as follows from the table 10 below.

$$Yi = 19{,}420 - 399\mathbf{X}_1 + 1556\mathbf{X}_2 - 113\mathbf{X}_3 - 93\mathbf{X}_4 - 2879\mathbf{D}_1 + 1433\mathbf{D}_2 + 2564\mathbf{D}_3 + 2041\mathbf{D}_4 - 1313\mathbf{D}_5$$

Where: Yi is total cassava production in quintals, 19,420 is constant production without any assists of factors.

Table 4. Result of multiple linear regression about determinants of cassava production.

Variables	Unstandardized coefficients B	Standardized coefficients B_i (Beta)	t	Sig.
CONSTANT	19419.565		1.974	.050
AGE (X_1)	-399.128	-.265	-2.7**	.017
FAMILYSIZE (X_2)	1556.102	.219	2.3**	.021
EXPRICE (X_3)	-113.426	-.076	-.898	.371
EXTVISTTIME (X_4)	-93.354	-.037	-.463	.644
EDU (D_1)	-2879.363	-.186	-2.1**	.034
FERTILITY (D_2)	1433.307	.038	.454	.650
IRRIGATION (D_3)	2563.968	.076	.910	.364
AAI (D_4)	2041.260	.062	.757	.450
PESTS (D_5)	-1312.579	-.055	-.683	.496
R-square 0.86	Adj. R-square 0.59		F-statistics 26.52	

Source: Model output (2017),** shows the significance at 5% probability level

As indicated in the Table, 4 there are different variables which are considered as affecting factors of cassava production. From these different factors the only three explanatory variables are statistically significant between cassava production and its determinant factors.

Age of the sample household heads (AGE): The age of the sample household heads was statistically significant at 5% probability level and had negative relationship with the cassava production. A year increases in the household head's age decreases the cassava production by 399 quintals. Thus, long period existence or experience of cassava production discourages the cassava producing farmer's performances in the study areas.

Family size of the sample households (FAMIYSIZE): The family sizes which attend the cassava production were statistically significant at 5% probability level and had positive relationship with the cassava production. As a one person increase in the family size it increases the cassava production by 1556 quintals. This has a direct relationship with cassava production.

Educational level of the sample household heads (EDU): The educational level of the sample household heads was statistically significant at 5% probability level had moderate negative relationship with the cassava production. A year of formal school increase in the education level of cassava producers decreases the cassava production by 2879 quintals. People without education and experiences were most likely had to be productive in cassava production. Because of these the cassava production level remains unchanged in our country.

IV. Summary, Conclusions and Recommendations

This section goes over the main points the major findings or results of the study and proposes recommendations for policy purposes. Section 4.1 is about Summary of the main findings and Section 4.2 is about Conclusion and Policy Implications or recommendations.

4.1. Summary and conclusions

In the analyzing the extent of cassava production, the first step that followed was to include variables that are likely to affect both the participation on cassava productions and the outcome variables so that, conditional on these measured variables. Here MLR with a logistic regression models were used to estimate the determinations of the factors.

This study was conducted in Amaro *woreda* and has been assessed using data collected by questionnaire prepared for this purpose. The primary data for this study were collected from 100 sample households from both cassava producers and non-producers household heads in mentioned study area using a well prepared questionnaire. The study applied MLR model, which was widely applied for identifying determinant factors. According to this study the households have different coping strategies to overcome the challenges which are facing farmers when they participated in cassava production these are using post harvesting technologies, using new cassava varieties, new technologies adoptions, improving their farming systems, change planting dates of cassava, using chemical fertilizers and other related issues were considered as a coping mechanisms of the sample households.

Multiple linear regression (MLR) models were used to analyse the determinant of cassava production of sample households in study area with the three important variables which were affects cassava production. These explanatory variables were found to influence outcome variables of sample households significantly. Such explanatory variables were: level of education of sample household heads, age of sample household heads, family size of sample household. This was also evidence to show relationship between cassava production and determinants in study area and also Participation in the cassava production was determined by combination factors of the above mentioned factors.

Finding a reliable estimate of the cassava production determinants were necessitates controlling for all confounding factors adequately. Furthermore, to analyse the determinants of cassava production MLR was applied. The results indicated that the determinants of cassava production by MLR is significantly influenced by three explanatory variables and shows existence of positive and negative significance relation between cassava production and them or determinant factors such variables were; age of sample household heads, level of education of sample household heads and family size of sample households.

4.2. Recommendations

Cassava production is an important for development of efforts in ensuring food security in the study area if it implemented properly. Based on the empirical results of the study, the following recommendations emerged for policy making.

On a positive note, this study has found evidence that the cassava production in the study area has shown that participants have more total annual income than non-participants in cassava production of sample households. This has an encouraging message for program designers, implementers and funding agents or donors to take proper action to achieve the intended goals of households' livelihoods.

The finding indicated that cassava production is affected by different factors like pests and diseases, agricultural inputs, irrigation practices and by other above stated factors. Therefore, concerned bodies such as United Nations, Food and Agriculture Organization, Ministry of Agriculture, NGOs and Research Foundations should give attention for promoting and controlling cassava production problems to improve household's livelihoods and environmental pollutions. Adult education is important for technology transformation. The research findings show that education and age had negative relation with cassava production by in participating in cassava production than their counterparts. Therefore, a way of access to adult education should be designed to make awareness for those had a negative attitude on cassava production.

Participate in to cassava production through agricultural development agents for rural households will have major impacts. These are not only for increasing household production or productivity, income and reduction of dependency on food aid, but also have a significant positive impact on the overall rural economy and increased agricultural production, and then national goals of MDG can be achieved both at households and national levels. Therefore, the farmers have needed to get the necessary support from government, non-governmental organizations (NGOs) and farmers' supporting groups in the area of cassava production expansion and support.

Therefore, government and other stakeholders should provide support through the establishment of project that can assist farmers to produce cassava and tackled their related challenges or factors. The farmers should adopt themselves with the above developed copping strategies to produce high amount of cassava for home consumption, marketing industrial raw materials. Policy makers need to promote cassava production development and promotion advertisements to the farmers can encourages more to produce cassava and adopt the copping strategies to overcome the problems.

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