



DETERMINANTS OF WOMEN'S PARTICIPATION IN FARMING. A CASE STUDY IN BOMACHOGE CHACHE SUBCOUNTY, KISII, KENYA

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Abstract: Agriculture plays a pivotal role in Kenya's economy, serving as a major source of livelihood, employment, and food security for the rural population. Women constitute a substantial portion of the agricultural labour force; however, their participation in farming activities remains limited due to various socioeconomic, cultural, and institutional barriers. Understanding the factors influencing women's engagement in agriculture is therefore crucial in formulating policies and interventions that promote gender equity and enhance productivity in rural areas. This study analyzed the determinants of women's participation in farming activities in Bomachoge Chache Sub County, Kisii County, Kenya. The study specifically sought to identify key economic, social, and institutional factors influencing women's participation in farming. A multistage random sampling method was employed to select 215 respondents, comprising 140 women participants and 75 non-participants. Both quantitative and qualitative data were collected from primary sources using structured and semi-structured interview schedules, complemented by focus group discussions and key informant interviews. Binary probit analysis was used to determine the significant economic determinants influencing women's participation in farming. Out of the twelve explanatory variables included in the model, farming experience, access to credit, farm size, extension visits, land tenure rights, distance from the nearest market, and hired labour costs per man-day were found to have a significant relationship with women's level of participation in farming activities. The study concludes that improving access to credit facilities, strengthening agricultural extension services, enhancing women's land ownership rights, and reducing barriers to market access could substantially increase women's participation in farming. These findings provide critical insights for policymakers and development practitioners seeking to promote inclusive agricultural growth and gender equality in rural Kenya.

Keywords: Women's participation in farming activities, Single out major determinants, Bomachoge Chache Sub County, Kisii County, Kenya.

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1. INTRODUCTION

The agricultural sector in many developing countries is underperforming, in part because women, who represent a crucial resource in agriculture and the rural economy through their roles as farmers, labourers and entrepreneurs, almost everywhere face more severe constraints than men in access to productive resources. Yet, Women produce over 50 percent of the world's food (FAO, 2011) and comprise about 43 percent of the agricultural labor force, both globally and in developing countries (Doss, 2014). Efforts by national governments and the international community to achieve their goals for agricultural development, economic growth and food security will be strengthened and accelerated if they build on the contributions that women make and take steps to alleviate these constraints. In Kenya, Agriculture remains the backbone of the Kenyan economy and it is considered the most important sector in the economy, contributing approximately 25% of the GDP, and employing 75% of the total national labour force (Republic of Kenya, 2005). Women play a pivotal role in agricultural production and they make up between 42% and 65% of the agricultural labour force in Kenya (World Bank, 2014) in addition to their traditional domestic role. Furthermore, women produce between 60 and 80 per cent of food in most developing countries and are responsible for half of the food production in the world (Chinery, 2011). Despite women being a critical force in agriculture and rural development in sub-Saharan, their central role in agricultural production has been largely ignored, particularly in policy (FAO, 2011). For a developing country like Kenya, the agricultural sector has direct implications on at least two critical areas that the country has to address, namely food security and employment creation. Rural women in Kenya are heavily dependent on males due to the socially constructed traditional gender roles that define the division of labour, and are therefore subordinate socially, economically and politically (Feldman, 1983). Women's farm activities in Kenya cover the entire agriculture cycle-including hoeing, planting, weeding, scaring birds and animal pests, and harvesting. Furthermore, they play a prominent role in managing poultry (Guèye, 2000) and dairy animals (Tangka, et al., 2000) and in caring for other animals that are housed and fed within the homestead in Kenya. The importance of agriculture in rural Kenya is emphasized on farm cultivation and food production for home nourishment and trading or selling as the primary means for the income (Wane, 2003). Despite women's important role in the agricultural sector, however, empirical evidence shows that they face a number of constraints and lag behind men with regard to agricultural productivity in Sub Saharan Africa due to the gender inequalities that persist in respect of access to, control over and utilisation of productive resources such as land, livestock, labour, education, extension and financial services, and technology (Slavchevska, 2015). Biased land inheritance rights often favour male relatives, leaving both widows and daughters at a disadvantage (Agarwal, 2003). However, Owning land gives women access to capital and the freedom to leave abusive marriages (wasike, 2013). In addition, women's access to credit is serious obstacle to improving their farming or agricultural productivity, as without credit women farmers are unable to buy inputs such as seeds, fertilizers and improved technologies or they are unable to hire labour (Daman, 2003). Women's participation in farming is widely perceived to be a key factor in closing gender gaps in agricultural productivity in Kenya. When women are empowered and can claim their rights and access

to land, leadership opportunities and choices, economies grow, food security is enhanced and prospects are improved for current and future generations, Michelle B. 2017. Women's empowerment thus has direct impact on agricultural productivity and household food security (Srabon et al., 2014). Thus, Kenya has enacted policies documents aimed at improving the subordinate nature of rural women in agricultural production (Muriithi and Matz, 2015).

Factual information about women participation in farming in the study area remains scanty. It is for this reason this research was undertaken with an objective of analyzing the determinants of Women's Participation in Farming in Bomachoge Chache Subcounty, Kisii, Kenya. The specific objectives of the study were to:

1. Single out major determinants in relation to women participation in farming
2. Describe the sources of the agricultural information of the women participants and non- participants in farming in the study area.
3. Identify major constraints faced by women and proffer solutions that can lead to an increase in farm participation.

The findings of the study will be useful in providing information to policy makers, researchers and development practitioners on possible strategies for improving women's participation in farming.

The rest of the paper is organized as follows: In section two, we provide research methodology that underlies the study. The results are presented and discussed in section three. In section four, conclusions and policy implications deriving from the study are presented.

2. RESEARCH METHODOLOGY

2.1 Description of the study area

The study was conducted in Bomachoge Chache sub county of Kisii County located in a warm tropic region of the rain forest of the South Western Kenya. It was purposively chosen to check the existence of women's participation towards farming.

2.2 Research design and Sampling Techniques

This study employed empirical approach based on case study and descriptive designs. From several approaches to determine a sample size, this study utilized Morgan, Krejcie, Robert, and Daryle (1970) procedure for determining sample size. They established an efficient procedure of determining the sample size needed to be representative of a given population using the following formula.

$$s = \frac{\chi^2 NP(1-P)}{d^2(N-1) + \chi^2 P(1-P)}$$

Where :

s = required sample size.

χ^2 = the table value of chi-square for 1 degree of freedom at the desired confidence level (3.841).

N = the population size.

P = the population proportion (assumed to be 0.50 since this would provide the maximum sample size).

d = the degree of accuracy expressed as a proportion (0.05).

Multistage sampling was further employed for the selection of sample women. A combination of stratified sampling and simple random sampling was used to select the sample. The women were divided into groups (called strata) according to categories of and levels of participation. Simple random samples from each of the strata were collected and combined into a sample. A total of 215 respondents were selected.

2.3 Types of Data and Method of Data Collection

Primary data was collected using both structured interview and semi-structured interview schedules. Focus group discussion, observations and use of key informant interview was employed. The pre-testing of interview before actual administration was effected to 10 respondents. These were not considered in the sample size of the study.

Sets of questionnaires were administered to interview 215 respondents from participant and non- participant. Information collected through questionnaire included: Personal factors (e.g. Age, Marital status, Education level and Family size), Socioeconomic factors (like Land size, Land tenure rights, Income and Farming constraints) and Situational factors (e.g. Contact with ext. agent, access to credit). The pre-testing of interview before actual administration.

2.4 Method of Data Analysis.

After data collection, the data was edited, coded, and entered into the computer for analysis. Both qualitative and quantitative statistical techniques and procedures were utilized for the analysis of data. In other words, Data collected were subjected to both descriptive and inferential statistics. Qualitative analytical methods like interpretation and explanation of various opinions, views, concepts, and summarizing, categorizing, and presentation of these in convenient forms were used to supplement quantitative analysis.

2.4.1 Choice for modeling dichotomous

Binary regression models can be estimated with ordinary least squares method (OLS) also known as linear probability model (LPM), Logit, and Probit models. A LPM is a linear regression model where the dependent variable is a binary variable ($y = 1$ or 0).

$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \dots \beta_k x_k + u = x\beta + u$, where $x\beta$ is expressed in a matrix form.

Expected value of y is $(y) = x\beta$. Because the binary variable y has two outcomes 0 or 1, the expected value for y is the probability of y being 1, $(y = 1)$. Thus $(y) = 1 * P(y = 1) + 0 *$

$(y = 0) = P(y = 1)$. Thus LPM for the probability of the outcome $y = 1$ is $(y = 1) = x\beta$. However, linear probability model has four issues while estimating the model with binary outcome. First, the LPM assumes that the probability of regressand moves linearly with the value of the regressor, no matter how small or large that value is. Secondly, By logic, the probability value must lie between 0 and 1. But Predicted probabilities can be less than 0 or greater than 1. This is because OLS does not take into account the restriction that the estimated probabilities must lie within the bounds of 0 and 1. Thirdly, the usual assumption that the error term is normally distributed cannot hold when the regressand takes only values of 0 and 1. Fourthly, the error term

in the LPM is heteroscedastic, making the traditional significance tests suspect. Finally, Marginal effects are the coefficients, which are constant/do not vary with x .

For all these reasons, LPM is not the appropriate choice for modeling dichotomous variables. Instead of using OLS (LPM), Logit/Probit models are estimated using Maximum Likelihood Estimation (MLE) procedure to estimate the parameters of the model. The probit and logit models would estimate the probability of $y = 1$ as a non-linear function G of the regressors. This is expressed as: $(y = 1) = G(\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \dots \beta_k x_k) = G(x\beta)$. G is a non-linear function that transforms $x\beta$ to be between 0 and 1 and we need that because $(y = 1)$ is a probability as it needs to be bounded between 0 and 1. Both Logit and Probit models produce very similar results and in practice there is hardly any difference in empirical results between the two. The choice between them depends on the availability of the statistical software and the ease of interpretation. It is important to note that the regression coefficients for (LPM), Logit, and Probit models are different. OLS (LPM) coefficients are obtained by minimizing the sum of squared residuals while the coefficients of logit and probit are obtained by maximizing the log likelihood function. Moreover, the coefficients between the probit and logit models differ because of the functional forms of this probit and logit model. The probit model uses the cumulative distribution function (cdf) of the normal distribution whereas the logit model uses the logistic function,

2.4.2 Probit model

This study chose and employed probit model to assess the determinants of women's participation in farming in the study area. Women participation in farming (regressand) was treated as dichotomous variable. That is a random variable y (regressand) takes the value of "1" if the woman participates in farming and "0", otherwise. Typically, the outcome of interest is denoted as 1. Binary outcome models estimate the probability that $y = 1$ as a function of the regressors.

The probit model uses the cumulative density function (cdf) of the normal distribution Φ . This is expressed as:

$$P(y = 1) = \Phi(x\beta) = \int_{-\infty}^{x\beta} \Phi(z) dz$$

$(y = 1)$ will be the number between 0 and 1 because the cdf of the normal distribution is a number between 0 and 1. Probit model is estimated using the **maximum likelihood method**.

2.4.3 Likelihood function

The likelihood is the probability that the outcome for observation i is y_i

Given the likelihood of $y_i = 1$ is $P(y_i = 1)$ and the likelihood of $y_i = 0$ is $P(y_i = 0)$, the likelihood function is defined as: $P(y_i = 1)^{y_i} P(y_i = 0)^{1-y_i}$, thus the likelihood of $y_i = 1$ is given as $P(y_i = 1)^1 P(y_i = 0)^{1-1} = P(y_i = 1)$ and the likelihood of $y_i = 0$ is $P(y_i = 1)^0 P(y_i = 0)^{1-0} = P(y_i = 0)$.

The advantage about this likelihood function is that it combines both of the outcomes of $y_i = 0$ and $y_i = 1$ such that it's basically giving you the likelihood that y would be whatever we observe it to be. Hence if $y_i = 1$ that function will give you the $(y_i = 1)$ and

if $y_i = 0$ that will you the likelihood or the probability that would be equal to Zero ($P(y_i = 0)$).

2.4.4 Maximum likelihood estimation

Given likelihood function is: $(y_i = 1)^{y_i} P(y_i = 1) (y_i = 0)^{1-y_i} P(y_i = 0)$ and taking logs and summing up over all observations i .

The log likelihood function is:

$$\sum_{i=1}^n (y_i * \log P(y_i = 1) + (1 - y_i) * \log P(y_i = 0))$$

Substituting $(y_i = 1) = G(x\beta)$ into the log likelihood function

$$\sum_{i=1}^n (y_i * \log(G(x\beta)) + (1 - y_i) * \log(1 - G(x\beta)))$$

The β coefficients of the probit model are obtained by maximizing the log likelihood function.

$$\max \sum_{i=1}^n (y_i * \log P(y_i = 1) + (1 - y_i) * \log P(y_i = 0))$$

If the outcome $y_i = 1$, the predicted probability ($y_i = 1$) is maximized (e.g. 0.8, 0.9 or higher but certainly above 0.5).

If the outcome $y_i = 0$, ($y_i = 0$) is maximized or equivalently the predicted probability $y_i = 1$ is minimized (e.g. 0.2, 0.1 or lower but certainly below 0.5).

The maximum likelihood estimators are consistent, asymptotically normal, and asymptotically efficient if the assumptions hold.

2.4.5 Predicted probabilities

After estimating the models and obtaining the coefficients β , predicted probabilities can be calculated as:

$$P(y_i = 1) = G(\beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \beta_3 x_{i3} + \dots + \beta_k x_{ik}) = G(x_i \beta)$$

If the actual value $y_i = 1$ and the predicted probability ($y_i = 1$) is above 0.5, it is a correct prediction.

If the actual value $y_i = 0$ and the predicted probability ($y_i = 1$) is below 0.5, it is a correct prediction.

- Otherwise, it will be incorrect prediction.

The average of the predicted probabilities will be the unconditional probability, which is the sample average $\bar{y}$.

Since the magnitude⁴ of coefficients of probit model cannot be interpreted directly, marginal effects are reported. The marginal effects reflect the change in the probability of $y = 1$ given a 1 unit change in an independent variable x .

2.4.6 Marginal effects in the probit model

For the probit model,

$$P(y_i = 1) = G(\beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \beta_3 x_{i3} + \dots + \beta_k x_{ik}) = G(x_i \beta)$$

$(y = 1) = G(\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \dots + \beta_k x_k) = G(x\beta)$ where the coefficient on x_j is β_j . The marginal effect of x_i on the probability

of $y = 1$ is calculated as:

$$\frac{\Delta P(y = 1)}{\Delta x_j} = G'(x\beta) * \beta_j$$

Thus in this model, the marginal effects are the coefficients multiplied by a scale factor $G'(x\beta)$, which is the derivative of the G function.

The marginal effect explains the effect of the regressor on the probability that $y = 1$ (by how much the probability of $y = 1$ increases when x_j increases by 1 unit).

In this model, $(y = 1) = \Phi(x\beta)$, the marginal effect is given as :

$$\frac{\Delta P(y = 1)}{\Delta x_j} = \phi(x\beta) * \beta_j$$

Φ is the cdf and ϕ is the pdf of the normal distribution.

2.4.6.1 Marginal effect at the mean and average marginal effect

The marginal effect depends on x .

$$\frac{\Delta P(y=1)}{\Delta x_j} = G'(x\beta) * \beta_j \quad \text{or } \partial p / \partial x_j = \phi(x'\beta) \beta_j$$

The marginal effect at the mean⁵ is calculated at the mean value of x , which is $\bar{x}$.

$$\frac{\Delta P(y=1)}{\Delta x_j} = \phi(x\beta) * \beta_j \quad \text{or } \partial p / \partial x_j = \phi(\bar{x}'\beta) \beta_j \quad \text{or}$$

The average marginal effect is calculated for each observation, and then averaged across all observations.

$$\frac{\Delta P(y=1)}{\Delta x_j} = G(x\beta) * \beta_j = \frac{1}{n} \sum_{i=1}^n G(x_i \beta) * \beta_j \quad \text{or } \partial p / \partial x_j = \frac{1}{n} \sum_{i=1}^n \phi(x_i' \beta) \beta_j$$

Where:

The index j^{th} refers to the j^{th} independent variable (when we use the index i , it refers to the i^{th} observation).

While in the second approach, *average marginal effects* estimated as the average of the individual marginal effects. That is:

$$\partial p / \partial x_j = \frac{\sum \phi(x_i \beta) \beta_j}{n}$$

This is a better approach of estimating marginal effects despite the fact the two procedures produce almost identical results most of the time.

2.4.6.2 Marginal effect for an indicator variable

If the model is: $(y = 1) = G(\beta_0 + \beta_1 * d_1 + \beta_2 x_2)$ with a regressor d_1 which an indicator variable taking values of 0 or 1, the marginal

⁴ The magnitude cannot be interpreted using the coefficient because different models have different scales of coefficients.

⁵ The marginal effect at the mean uses the means of the variables, but there may not be such "average" individual (e.g. mean for variable female is 0.3). The average marginal effect makes more sense. In practice, the marginal effects will be similar.

effect is calculated as:

$$(\beta_0 + \beta_1 * 1 + \beta_2 x_2) - G(\beta_0 + \beta_1 * 0 + \beta_2 x_2)$$

Thus the marginal effect of d_1 being 1 instead of 0 is the difference in $(y = 1)$ if $d_1 = 1$ and the probability of $P(y = 0)$ if $d_1 = 0$.

2.4.7 Goodness of fit measures

After results, Goodness of fit statistic was established through percent correctly predicted values and Pseudo R-squared (McFadden R-squared) to determine whether model used was good.

2.4.7.1 Pseudo R-squared

Pseudo R-squared (McFadden R-squared) compares the log-likelihood of a model with that of a model with only a constant.

$$Pseudo R^2 = 1 - \frac{LL_{ur}}{LL_0}$$

LL_{ur} is the log likelihood for the unrestricted model with all regressors.

LL_0 is the log likelihood for the restricted model with only a constant.

If the regressors do not explain the regressand then the log likelihoods for the restricted and unrestricted models (LL_0 and LL_u) will be the similar and the pseudo R-squared will be 0.

If the regressors explain the dependent variable very well, then because the log likelihood for the unrestricted model LL_{ur} will be maximized (which is negative number that will approach 0), the pseudo R-squared will approach 1.

The pseudo R-squared indicates how well the model predicts the outcome and how well the model improves on a null model with only an intercept, but the magnitude is not interpreted.

A higher pseudo R-squared with the same regressand but different regressors would indicate that the model predicts the outcome better.

2.4.7.2 Percent correctly predicted

Percent correctly predicted is a goodness of fit measure, which shows the percent of correct predictions to total predictions for the binary outcome. The actual outcome y is 0 or 1. The predicted probability $y = 1$ is a number between 0 and 1. If the predicted probability is greater than 0.5, then $\hat{y} = 1$, otherwise $\hat{y} = 0$.

Table 1 There are four cases of making correct or incorrect predictions.

	Actual $y = 1$	Actual $y = 0$
Predicted $\hat{y} = 1$	Correct prediction	incorrect prediction
Predicted $\hat{y} = 0$	incorrect prediction	Correct prediction

Percent correctly predicted is the proportion of correct predictions to total predictions. Ideally percent correctly predicted should have high values (perhaps above 70%).

2.4.7.3 Omnibus Test

The likelihood ratio chi-square test was employed to farther test whether the model that contains a set of selected predictors represents a significant improvement and fit over unconditional model with no predictors.

2.4.7.4 Odds ratio (OR)

Odds ratio were employed to report the overall effect of participation. OR tells us the odds that a given action leads to a particular outcome. They are used when there are only two possible outcomes for the event being measured such as participating and nonparticipating in farming.

Selected determinants were used to analyze the impact of women in participation.

3 RESULTS AND DICUSSIONS

3.1 Socioeconomic characteristics of respondents

Table 1 show that majority 55.8% of respondents (with 36.3% participants and 19.5% non- participants) were between the age group of 26 to 50 years. Mean age of participants was 40 years while non-participants was 41years. Majority of respondents (75.8%) were married of which 50.7% were participants and 25.1% non-participants. 96.3% of the respondents (64.6% participants and 31.7%) had undergone formal education. 52.1% of the respondents had a household or between four and six with an overall mean of six members per household.

Approximately 27% of the respondents (18.6% participants and 8.4% non-participants) had a total land size of 6-10 acres with an overall mean total land size of 8.8screes

Table 2: Distribution of respondents according their Socio-economic characteristics

Variables	Participants		Non Participants		All respondents	
	Frequency	%	Frequency	%	Frequency	%
Age (Years)						
0-24	28	13.0	10	4.7	38	17.7
26-50	78	36.3	42	19.5	120	55.8
51-75	39	18.1	18	8.4	57	26.5
Average Age	40		41			
Marital Status						
Single	13	6.0	8	3.7	21	9.8
Married	109	50.7	54	25.1	163	75.8
Widowed	23	10.7	8	3.7	31	14.4
Level of education						
No formal education	6	2.8	2	0.9	8	3.7
Adult literacy	25	11.6	4	1.9	29	13.5
primary education	45	20.9	29	13.5	74	34.4
Secondary education	51	23.7	27	12.6	78	36.3
technical/ttc	15	7.0	6	2.8	21	9.8
University	3	1.4	2	0.9	5	2.3
Household size						
1-3	21	9.8	4	1.9	25	11.6
4-6	69	32.1	43	20.0	112	52.1
7-9	41	19.1	13	6.0	54	25.1
10-12	14	6.5	10	4.7	24	11.2
Mean	6		6			
Total land size(acres)						
0-2	24	11.2	5	2.3	29	13.5
3-5	37	17.2	12	5.6	49	22.8
6-10	40	18.6	18	8.4	58	27.0
11-15	26	12.1	20	9.3	46	21.4
16-20	14	6.5	14	6.5	28	13.0
20-24	4	1.9	1	0.5	5	2.3
Income						
Kshs 0-50000	63	29.3	35	16.3	98	45.6
kshs 51000-100000	34	15.8	19	8.8	53	24.7
kshs. 101000-200000	40	18.6	14	6.5	54	25.1
kshs. 201000-500000	7	3.3	1	0.5	8	3.7
kshs. 501000-1000000	1	0.5	1	0.5	2	0.9

3.2 Sources of Agricultural information in farming

Table 3 shows that Agricultural extension staff was the most important source of agricultural information for both participants (54.9%) and non participants (27%). This was followed by radio

with 7% participants and 4.7% non-participants. Obtained information from neighbours was ranked third with 5.6% participants and 0.9 % non-participants.

Table 3: Distribution of respondents according to major sources of agricultural information

Sources of information	Participants		Non participants		Respondents	
	frequency	%	frequency	%	frequency	%
Agricultural extension staff	118	54.9	58	27.0	176	81.8
Radio	15	7.0	10	4.7	25	11.6
Neighbours	12	5.6	2	0.9	14	6.5

3.3 Distribution of respondents by their Level of farming enterprise

Table 4 indicate that all respondents farmed cash crops, food crops and livestock ranging from tea, coffee , bananas, maize, vegetables, sugarcane, dairy and poultry. 29.8% (20.5% participants and 9.3% non-participants) of the respondents were engaged in tea and coffee. Banana growing was ranked second with 18.1% (12.1%

participants and 6.5% non-participants). This was closely followed by maize with 17.2 % (11.6% participants and 5.1% non-participants). Vegetables and dairy farming were ranked fourth and fifth with 14.4% (10.2% participants and 4.2% non- participants) and 7.9 (4.7% participants and 3.3 % non-participants) respectively. Sugarcane, poultry and other livestock (like goats and sheep) were all ranked sixth in farming enterprise.

Table 4: Distribution of respondents by their Level of farming enterprise

Name of selected enterprise	Participants		Non participants		Respondents	
	frequency	%	frequency	%	frequency	%
Tea and coffee	44	20.5	20	9.3	64	29.8
Banana	26	12.1	14	6.5	39	18.1
Maize	25	11.6	11	5.1	37	17.2
Vegetables	22	10.2	9	4.2	31	14.4
Dairy farming	10	4.7	7	3.3	17	7.9
Sugarcane	6	2.8	4	1.9	10	4.7
Poultry	6	2.8	4	1.9	10	4.7
Other Livestock (Goats and sheep)	6	2.8	1	0.5	7	3.3

3.4 Analysis constraints /Challenges facing women in farming

Farming constraints in farming (production, marketing and infrastructure) facing women as perceived by the respondents are presented in table 5. All the constraints were weighed in the percentage to establish the importance of each one of them. The frequencies and percentages measure the pervasiveness of the given constraints facing women in farming in Bomachoge Chache Subcounty. In the order of prevalence the constraints are Disease and pests, poor roads, inadequacy of extension, financial constraints, lack of market demand, lack of certified seed. The most prevalent and perhaps most devastating, is Disease and pests. This emerges from the fact that 40% of the total respondents (26% participants and 14% non-participants) consider diseases and pests

to be the major stumbling block facing women in farming. The low yields of various enterprises are thought to result from of diseases and pests. The second most important constrain is Poor roads. Frontage roads and access roads are crucial to a farmers' timely transportation of farm produce and logistics. Otherwise poor roads incapacitate most of the farming and marketing activities. It was noted that some farmers sale their produce in as far as Nyamira county. Some of them cannot reach the market due to distant markets and poor transport network system between their farms and markets. The third most prevalent on farm problem is inadequacy of extension system. About 16.3% of the total respondents (12.1% participants and 4.2% non-participants) consider extension orientation to women towards farming to be

inadequate. This seems the case because there is limited financial package to support intensive extension programme on various farming enterprises. The fourth most important on farm production constraint is financial constraints. Out of the total respondents surveyed 13% (10.2% participants and 2.8% non- participants) allude the dismal performance of farming to financial constraints. There is outright lack of capital for women to invest on various farming enterprises, and Inaccessibility to credit facilities. Lack of market demand was considered the fifth prevalent problem at

marketing level. About 7% (3.3% participants and 3.7% non-participants) of women farmers in Bomachoge Subcounty consider lack of market demand to be the major stumbling block to farming. Lack of certified seed was the sixth devastating constraint. About 6% of the total respondents (4.2% participants and 1.9% non-participants) consider absence of certified seeds to a major stumbling block to farming. Low yields of various enterprises are thought to result from use of uncertified seeds whose quality is not assured.

Table 5: Perceived farming production constraints /Challenges facing women in farming in Bomachoge Chache Subcounty, Kisii

Nature of constraint/challenge		No of respondents		women participants		non-participants	
		Frequency (f)	%	f	%	f	%
1	Disease and pests	86	40.0	56	26.0	30	14.0
2	Poor roads	38	17.7	25	11.6	13	6.0
3	Inadequacy of extension	35	16.3	26	12.1	9	4.2
4	Financial constraints	28	13.0	22	10.2	6	2.8
5	Lack of market demand	15	7.0	7	3.3	8	3.7
6	Lack of certified seed	13	6.0	9	4.2	4	1.9
	Total	215.	100	145.0	67.4	70.0	32.6

3.5 The probit model

The probit model results were used to Single out major determinants in relation to women participation in farming are shown in Table 6. Out of the twelve variables used in the model, eight variables were significant with respect to women's participation in farming. These variables are land tenure rights, hired labour, visits by extension officers, availability of credit, distance to/from the market, farm size (cultivable area), years of experience and Cost of hiring in mandays. Age, household size, number of labours and income were found to have no significant influence on women participation.

Wald Chi-Square was used to test the significance of the regression coefficients. The null hypothesis is the population slopes would be equal to zero (0).

The effect of the significant explanatory variables on the women's participation in farming in the study area is discussed below:

3.5.1. Land tenure rights:

Land tenure rights were significant at 1% level. Thus women with land tenure rights (in comparison with those without land rights) are **more likely** to participate in farming. This means that the probability of participating in farming increases with land rights. The odds ratio of 2.339 for land tenure rights suggests that, all other things held constant, the odds ratio in favor of women's participation in farming increases by a factor of 2.339 as land tenure rights increases another one person.

3.5.2. Hired labour:

It was found that hired labour had positively and significantly influenced the probability of women's participation in farming at

1% significance level. This implies that women with hired labour are **more likely** to participate in farming than women with no hired labour.

The odds ratio of 1.891 for hired labour shows that, ceteris paribus, the odds ratio in favor of women participation in farming increases by a factor of 1.891 as the hired labour increases by one person subject to availability of finances.

3.5.3. Visits by extension officers:

Visits by extension officers are positively and significantly influenced the probability of participation at 1% significance level. This result suggests that, those women who are visited by extension officers have better chance (**more likely**) to participate in farming than those who are not visited by extension officers. This is partly because extension services are vital in farming activities. Other things held constant, the odds ratio of 2.137 for the number of visits by extension officers indicates that, the odds ratio in favor of women's participation in farming increases by a factor of 2.137 as the number of visits by extension officers increases by one unit.

3.5.4. Availability of credit:

Availability of credit had influenced women's participation positively and significantly at 5 % probability level. This means that the probability of participating in farming increases with the increase availability of credit. Thus women who access to credit (in comparison with those lack of access to credit) are **more likely** to participate in farming. The odds ratio of 1.561 for availability of credit suggests that, all other things being equal, the odds ratio in favor of women's participation increases by a factor of 1.561 as availability of credit increases in a unit.

3.5.5. Distance to/from the market:

Distance from market to homestead is negatively and significantly correlated with the probability of participation in farming at 1 % significance level. The negative correlation suggests that the Likelihood of women participating in farming declines (**less likely**) as the distance from market increases. This is because the proximity allows women to participate easily as it requires less time and cost to travel. This means that, those women who are in the areas close to market center may have better chances to regularly participate in purchasing farming inputs. The odds ratio of 0.451 for distance to Market reveals that, other variables held constant, the odds ratio in favor of women's participation decreases by a factor of 0.451 as the distance to market increases by one kilometer.

3.5.6. Farm size (cultivable area):

It was found that farm size had positively and significantly influenced the probability of women's participation in farming at 1% significance level. This implies that women with larger farm size are **more likely** to participate in farming than women with smaller farm sizes.

The odds ratio of 2.485 for farm size shows that, *ceteris paribus*, the odds ratio in favor of participation in farming increases by a factor of 2.485 as the farm size increases by one acre.

3.5.7. Years of farm experience:

This variable was hypothesized to be correlated positively with the

regressand. It was found that years of farm experience had positively and significantly influenced the probability of women's participation in farming at 1% significance level. This implies that women with more years of farm experience are **more likely** to participate in farming compared to women with less years of farm experience. The odds ratio of 1.860 for years of farm experience indicates that, other things held constant, the odds ratio in favor of women participation in farming increases by a factor of 1.860 as number of years of farm experience increases by one unit.

3.5.8. Cost of hiring in man-days

Cost of hiring per man-day is negatively and significantly correlated with the probability of participation in farming at 1% significance level. The negative correlation suggests that the women participation in farming is **less likely** as the cost of hiring per man-day increases.

This means that, those women who at hire at higher cost per man-day are less likely to participate in farming. The odds ratio of 0.449 for Cost of hiring per man-day reveals that, other variables held the constant, the odds ratio in favor of women's participation in farming decreases by a factor of 0.449 as cost of hiring per man-day increases by one unit.

Since the probit, logit or even regression coefficients differ by a scale factor, the magnitude of these coefficients cannot be interpreted. Instead, the coefficients of marginal effect of relevant models are used.

Table 6: Binary Probit regression estimates of Determinants of women Participation in farming

	Parameter Estimates of Variables in the Model					
Parameter	B	Std. Error	Wald Chi-Square	Df	Sig.	Exp(B)
(Intercept)	-0.093	0.6328	0.022	1	0.883	0.911
Age	-0.221	0.1725	1.645	1	0.200	0.802
Household size	-0.157	0.1332	1.384	1	0.239	0.855
Land tenure rights	0.850***	0.3121	7.410	1	0.006	2.339
Hired labour	0.637***	0.2681	5.652	1	0.017	1.891
Number of labourers	-0.154	0.1037	2.213	1	0.137	0.857
Visits by extension officers	0.759***	0.2327	10.649	1	0.001	2.137
Credit availability	0.445**	0.2383	3.489	1	0.062	1.561
Distance from Market	-0.795***	0.2335	11.602	1	0.001	0.451
Farm size	0.910***	0.2394	14.458	1	0.000	2.485
Years of farm experience	0.621***	0.2454	6.401	1	0.011	1.860
Subsidized inputs	0.078	0.2276	0.119	1	0.730	1.082
Cost of hiring in Mandays	-0.800***	0.2378	11.330	1	0.001	0.449

***and ** indicate significance at 1% and 5% level respectively.

Probit regression

Number of obs = 215 LR chi2(12) = 97.46

Prob > chi² = 0.0000

Log likelihood = -86.938364

Pseudo R² = 0.3592

3.6 Marginal Effect of the Probit regression model

Table 7 gives the average marginal effects of the probit model which show the change in the probability for an infinitesimal change in each regressor. The results show that women with land tenure rights are 19.3% more likely to participate in farming (in comparison with those without land rights). Similarly, women accessible to credit are 10.1% more likely to participate in farming (in comparison with who lack of access to credit). Women with large farm sizes are 20.7% more likely to participate in farming (in comparison with those of less farm sizes), while women visited by

extension officers are 17.3% more likely to participate in farming than those who are not visited. For each additional year in farming experience, women are 14.1% more likely to participate in farming. Also, women who are further away by a kilometer from the market are 18.1% less likely to participate of women in farming and women who would hire labour at high costs are 18.2% less likely to participate in farming. A comparison of the average marginal effects and marginal effects at the mean is shown in table 10.

Table 7: Marginal effects of the Probit model

Average marginal effects

	Delta-method					
	dy/dx	Std. Err.	z	P>z	95% Conf. Interval	
Age	-0.05038	0.038762	-1.3	0.194	-0.1263507	0.025594
Household size	-0.03566	0.029926	-1.19	0.233	-0.0943164	0.0229908
Land tenure	0.193435***	0.067306	2.87	0.004	0.0615177	0.3253514
Hired labour	0.145101***	0.059126	2.45	0.014	0.0292166	0.2609848
Number of labourers	-0.03514	0.023263	-1.51	0.131	-0.0807368	0.0104531
Visits by extension Officers	0.172913***	0.049231	3.51	0	0.0764226	0.2694041
Credit availability	0.101346**	0.05297	1.91	0.056	-0.0024732	0.2051653
Dist. From the market	-0.18111***	0.048877	-3.71	0	-0.2769053	-0.0853118
Farm size	0.207247***	0.048635	4.26	0	0.1119232	0.3025703
Years of experience	0.141342***	0.05335	2.65	0.008	0.0367787	0.2459049
Subsidized inputs	0.017861	0.05182	0.34	0.73	-0.0837033	0.1194256
Cost of hiring	-0.18223***	0.050545	-3.61	0	-0.2812964	-0.0831631

3.7 Test for goodness of fit

In terms of the goodness of fit, the hypothesis that all coefficients on the regressors included in the Probit model are jointly equal to zero is rejected given that the probability of having a chi-square value of 222.88 if the null hypothesis is true is zero. In addition, the hypothesis that all coefficients on the regressors included in the truncated regression model are jointly equal to zero is rejected

given that the probability of having a Wald chi-square value of 97.46 if the null hypothesis is true is zero.

The overall goodness of fit as reflected by Prob > **Chi**(0.0000) with Pseudo R²= 0.3592 was good. In terms of consistency with a priori expectations on the relationship between the regressand and the regressors, the model seems to have behaved well.

Table 8: Omnibus Test⁶

Likelihood Ratio Chi-Square	Df	Sig.
97.456	12	.000
Model: (Intercept), age, Household size, land tenure rights, hire labour, number of labourers, cost of hiring in man days, visits by extension officers, credit availability, distance from market, farm size, years of farm experience, subsidized inputs		

Based on the above results, the likelihood ratio chi-square is significant at 1% level. This indicates that the model containing the selected predictors represents a significant improvement and fit over unconditional model with no predictors.

The Percent correctly predicted values is 82.79 as shown in table 8

Table 9: Probit model for wpwnp

	True		
Classified	D	D	Total
+	Correct prediction =130	incorrect prediction =22	152
-	incorrect prediction =15	Correct prediction =48	63
Total	145	70	215

Classified + if predicted $\Pr(D) \geq 0.5$ True D defined as wpwnp ! = 0

Specificity	$\Pr(- \sim D)$	68.57%
Positive predictive value	$\Pr(D +)$	85.53%
Negative predictive value	$\Pr(\sim D -)$	76.19%
False + rate for true $\sim D$	$\Pr(+ \sim D)$	31.43%
False - rate for true D	$\Pr(- D)$	10.34%
False + rate for classified +	$\Pr(\sim D +)$	14.47%
False - rate for classified -	$\Pr(D -)$	23.81%
Correctly classified		82.79%

⁶ Compares the fitted model against the intercept-only model. Dependent Variable: WPWNP

4. CONCLUSION AND POLICY IMPLICATIONS

The results of the Binary probit regression model estimate indicate that out of the 12 regressors included in the model, the coefficients of the eight regressors were found to be significant indicating that any change in this variable will substantially influence on the probability of women being a participant in farming.

This study indicates that an increase in variables viz., land tenure rights, hired labour, Visits by extension officers, Credit availability, Farm size and years of farm experience were significant are more likely influence women participation in

farming. Significant variables like increased cost of hired labour and distance from Market to homestead are less likely to influence women to participate in farming.

Overall the results indicate that asset of predictors do a better job in of predicting the likelihood of women participating in farming than unconditional or no model and land tenure rights, hired labour, Visits by extension officers, Credit availability, Farm size and years of farm experience were contributing most to the likelihood of women participating in farming whereas cost of hired labour and distance from Market to homestead are contributing most to the unlikelihood of women participating in farming. Age, household size and subsidized inputs denied really contribute to the model.

APPENDIX

Table 10: A comparison of the average marginal effects and marginal effects at the mean

Women participation in Farming	Parameter Estimates of Variables in the Model			
	Probit: average marginal effects		Probit :marginal effects at the mean	
	dy/dx	Std. Err.	dy/dx	Std. Err.
Age	-0.05038	0.038762	-0.07041	0.055017
Household size	-0.03566	0.029926	-0.04984	0.041973
Land tenure rights	0.193435***	0.067306	0.27034***	0.100351
Hired labour	0.145101***	0.059126	0.20279***	0.085777
Number of labourers	-0.03514	0.023263	-0.04911	0.032962
Visits by extension Officers	0.172913***	0.049231	0.24166***	0.072004
Credit availability	0.101346**	0.05297	0.141639**	0.075198
Distance from Market	-0.18111***	0.048877	-0.25311***	0.075357
Farm size	0.207247***	0.048635	0.289644***	0.076845
Years of farm Experience	0.141342***	0.05335	0.197537***	0.076398
Subsidized inputs	0.017861	0.05182	0.024962	0.072435
Cost of hired labour	-0.18223***	0.050545	-0.25468***	0.07426

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