Determinants of smallholder farmers' perception towards smart subsidies; a case of Nakuru Noth district, Kenya

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ABSTRACT

The behaviour of farmers towards an intervention largely depends upon their perception. Consequentially, their perception will further influence their participation in such interventions. This study used data collected from four hundred smallholder farmers using a structured questionnaire to examine their perception and the determinants of perception towards a smart subsidy program. The Ordered Probit model was used in analysing the determinants of perception. Results showed that the farmers had a positive perception towards the program and that their perception was influenced by factors such as the gender of the household head, farm size, participation in the program, being the household head, education level, training and source of information.

Keywords: Perception, Smallholder farmers, Smart subsidy, ordered Probit, Kenya

1. INTRODUCTION

After the 2008/2009 financial, food and energy crisis, there has been a renewed interest in agriculture especially on increasing productivity. With most of the developing countries, especially sub-Saharan Africa (SSA), production per unit area being below the global average, much of the interest in agriculture have been geared towards increasing these countries production in order to feed an increasing that population that is projected to surpass nine billion mark by 2050 (UN, 2013: 1).

One of the factors that have contributed to low productivity in sub-Saharan Africa is the low use of inputs such as fertilizer. As such, even though SSA production has increased, the increase has been as a result of expansion in land area under production rather than increase in land productivity (Henao and Baanante, 2006: 1). Therefore, increasing productivity through input access is seen as one of the way of increasing reversing this trend which has brought back debates on subsidies. Subsidies are not a new approach towards increasing productivity with universal subsidies common in the 1960s to 1980s. These subsidies were implemented through government owned institutions that controlled the importation and distribution of the subsidized fertilizer; an aspect that hindered the private sector development (Minot, 2009: 7). Unfortunately, due to challenges such as rationing of fertilizer, high cost of implementing the subsidy program, lack of involvement of the private sector, inefficiencies and leakages that benefit the well-off farmers, these subsidies were generally a failure (Morris *et al*., 2007: 31; Minot 2009: 7; Baltzer and Hansen, 2011: 2). This has brought about a shift in interest from the universal subsidies to smart subsidies. Smart subsidies are "mechanisms to provide subsidized goods and services designed both to promote market development and to enhance welfare of the poor" (Minot and Benson, 2009: 4). Smart subsidies are different from the traditional universal subsidies in design in that they are targeted to specific farmers, aimed at

market development by using the existing private sector network and have a specified time-bound or objective exit strategy (Minde et al, 2008: 5).

The *Kilimo Plus* subsidy program is a program under the National Accelerated Agricultural Inputs Access Program (NAAIAP). NAAIAP was started by the Kenyan government in 2007 as a safety net for poor farmers who did not have adequate resources to access agricultural inputs. The program was a response to the 2001 Fertilizer conference in Nigeria that recognized nutrient depletion in African soils due to nutrient mining either without replacement or inadequate replacement had led to low productivity and an incapacitation of the farmer to meet neither their own food requirement nor the growing population food need (AU, 2006: 2). The program has four components (MoA, 2010: 11) which are *Kilimo Plus, Kilimo Biashara,* orphan crop promotion and agro-dealer network development. The *Kilimo Plus* subsidy program targets resource poor farmers who own less than a hectare of land by giving them a *Kilimo Plus* Starter kit comprising of 10 kg of certified maize seed, 50kg of base fertilizer, 50kg of top dressing fertilizer and training. The kit is aimed at aiding the farmers to cultivate at least 0.4 hectares of land which is enough to provide enough food for an average household (five persons) (FAOSTAT, 2013). The grant is administered through a voucher which enables the farmer to purchase inputs from accredited stockists who in turn redeem the voucher from a government contracted financial provider.

However, research has shown that access or provision of agricultural inputs does not necessarily translate to uptake and use by smallholder farmers (Martey *et al.,* 2013: 31). One of the factors that affects the uptake and use of inputs is the farmers' perception (Martey *et al.,* 2013: 29). Perception is determined by how a person interprets data in the environment (Malim and Birch, 1998: 3). Research has shown that perception influences the uptake of a technology, method or practices. In these researches, the perception of farmers towards technologies, methods and practices depends on factors such as product's attributes and benefits (Lin and Milon, 1993: 727; Gandonou et al., 2003: 13; D' Antoni et al., 2012: 18), the profit that the farmer will accrue (Batte and Arnholt, 2003: 137), information access (Polson, R.A. and Spencer, D.S.C., 1991: 77; Strauss et al., 1991: 358), risk (Minot, 2009: 6) and its relationship to labour intensity (Chi, 2008: 112). Therefore, this study aimed at analyzing the farmers' perception towards the Kilimo Plus and its determinants and thus helps to understand resultant the farmers' behaviour.

2. MATERIALS AND METHODS

2.1. Measures of Perception

Since its inception, the Likert-type scale has been widely used in economics to gather information about attitudes, feeling and perception (Likert, 1932: 46). The Likert-type scale ranks the responses and thus making it possible to order them. The Likert-type scale used to measure the perception of farmer's towards the *Kilimo Plus* program had five ranks (poor, fair, average, good and excellent) and comprised of thirteen questions that related to how they perceived the *Kilimo Plus* subsidy program. This study used a summation approach to analysing perception as suggested and used by Likert (1932) and suggested by Boone and Boone (2012). The responses to the thirteen questions were further subjected to a reliability test using the Cronbach's alpha (Cronbach, 1951: 331) to check their consistency in measuring perception. The Cronbach's alpha (Cronbach, 1951: 302) is defined as:

$$\alpha = \frac{K\bar{c}}{(\bar{v} + (K-1)\bar{c})} \qquad (1)$$

Where K are the items to be summated, $\bar{c}$ is the average of all covariance's between the items across the sample, $\bar{v}$ is the average variance of each item and 1 is a constant. The Cronbach's alpha reliability coefficient ranges between 0 and 1 whereby the closer the Cronbach's alpha coefficient is to 1, the greater the internal consistency. George and Mallery (2003: 54) defined the coefficient to have excellent internal consistency if the Cronbach's alpha is above 0.9, if it is 0.89 to 0.8 is has a good internal consistency, between 0.79 and 0.7 it has acceptable internal consistency, if it is between 069 and 0.6 it has questionable internal consistency, between 0.59 and 0.5 it had poor internal consistency and below 0.5 it has an unacceptable internal consistency.

2.2. Tests for Multicollinearity and Heteroscedasticity

Tests for multicollinearity and heteroscedasticity are usually to ensure that the statistical tests of significance in the Ordered Probit model were valid. The variance-covariance estimator was used to test for multicollinearity in dummy variables. The closer the value are to +1 or -1, the more correlated they are (Taylor, 1990: 38). The Variance Inflation Factor (VIF) was used to test for multicollinearity in the continuous variables. Gujarati (2004: 351) defined the Variable Inflation Factor as:

$$\mathrm{VIF}(x_i) = \frac{1}{1 - R_i^2} \qquad (2)$$

Where VIF (x_i) is the variance inflation factor for explanatory variable x_i and R_i^2 is the square of the multiple correlation coefficients obtained from regressing x_i on the remaining explanatory variables. If the Variable Inflation Factor is above 10, then there is multicollinearity.

As for heteroscedasticity tests, due to the nature of the models used in this study, the tests were deemed not to be necessary and thus were not run. A study done by Williams (2009: 555) found out that heteroscedasticity does not affect the Ordered Probit model since the level of confidence and coverage rates for a homoscedactic ordered probit and a heteroscedastic ordered probit are close to the ideal and hence give negligible differences.

2.3. Ordered Probit Model

The ordered probit model was chosen over the ordered logit model since it gives more consistent results in situations where populations have an order and there exist individual effects (Hahn and Soyer, 2005: 11). Hence, since perception depends on individual experience and insight, the model was deemed more appropriate than an ordered logit. To determine the perception of farmers towards the *Kilimo Plus* program, the farmers were asked to rate the program based on a number of questions relating to the program on Likert Scale with five ranks, 0 to 4 where: 0 is poor, 1 fair, 2 average, 3 good and 4 excellent. An ordered probit model was then used to determine the relationship between perceptions and the factors hypothesized to influence it. Thus:

$$y^* = \beta' X + e \qquad (3)$$

Where y^* is the farmers perception ranging from 0 (poor) to 4 (excellent), β is the parameter to be estimated and e is the error term that is normally distributed with a mean of zero and variance of one. The choices will thus be:

$$y^* \begin{cases} 0, if\, y = 0 \\ 1, if\ 0 < y \le \mu_1 \\ 2, if \mu_1 < y \le \mu_2 \\ 3, if \mu_2 < y \le \mu_3 \\ 4, if \mu_3 < y \le \mu_4 \end{cases} \quad (4)$$

Whereμ's are unknown parameters to be estimated. The probability of a farmer's choice falling between each category is:

$$\begin{aligned} &\Pr ob(y = 0|\,\mathrm{X}) = F(-\beta'\mathrm{X}), \\ &\Pr ob(y = 1|\mathrm{X}) = F(\mu_1 - \beta'\mathrm{X}) - F(-\beta'\mathrm{X}), \\ &\Pr ob(y = 2|\mathrm{X}) = F(\mu_2 - \beta'\mathrm{X}) - F(\mu_1 - \beta'\mathrm{X}), \\ &\Pr ob(y = 3|\mathrm{X}) = F(\mu_3 - \beta'\mathrm{X}) - F(\mu_2 - \beta'\mathrm{X}), \\ &\Pr ob(y = 4|\mathrm{X}) = 1 - F(\mu_3 - \beta'\mathrm{X}). \end{aligned} \quad (5)$$

Where F (.) is the cumulative probability distribution written as:

$$P_i = F(\beta'\mathrm{X}) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\beta'\mathrm{X}} e^{\frac{-z^2}{2}}\, dz, (z \sim N(0,1)) \quad (6)$$

Since the maximum likelihood estimation is used to estimate β and μ, then the probability equation can be reduced to:

$$\mathrm{Prob}(y = n) = \Phi(\mu_n - \beta'\mathrm{X}) - \Phi(\mu_{n-1} - \beta'\mathrm{X}), \quad \mathrm{n} = 0 \ldots 4 \quad (7)$$

Where Φ is the cumulative distribution function, $\mu_0 = 0$ and $\mu_4 = +\infty$ and $\mu_0, \mu_1, \mu_2, \mu_3$ and $\mu_4$are the five thresholds between which the categorical responses are estimated with a maximum likelihood function (Mckelvey and Zavoina, 2007: 148):

$$L = \prod_{i=1}^{n} \prod_{j=1}^{m} \left[\Phi\left(\mu_j - \beta'\mathrm{X_i}\right) - \Phi(\mu_{j-1} - \beta'\mathrm{X_i})\right]^{Z_{ij}} \quad (8)$$

But the estimated coefficients do not represent the effect of an individual variable on the farmer's perception; hence the marginal effects will be calculated to establish the effect (Greene, 2002: 722). The marginal effect is calculated as:

$$\frac{\partial \mathrm{Prob}\,(y=n)}{\partial \mathrm{X}} = -[\Phi(\mu_n - \beta'\mathrm{X}) - \Phi(\mu_{n-1} - \beta'\mathrm{X})]\beta, \quad n = 0 \ldots 4 \quad (9)$$

The goodness of fit is calculated as:

$$\mathrm{p}^2 = 1 - \left[\frac{\ln L_b}{ln L_0}\right] \quad (10)$$

Where L_b is the log likelihood at convergence and L_0 is the log likelihood computed at zero and $0 \le p^2 < 1$. If all the coefficients are zero, the goodness of fit is zero. The goodness of fit cannot be equal to one but a value close to one indicates a very good fit (Duncan *et al.*, 1998: 67).

The model is specified as:

$$\begin{aligned} Perception = {} & \beta_0 + \beta_1 GNDR + \beta_2 EDUC + \beta_3 HSHLDS + \beta_4 AGE + \beta_5 FAMINC + \\ & \beta_6 NFAMINC + \beta_7 RISK + \beta_8 WEALTH + \beta_9 EXTEN + \beta_{10} GRP + \beta_{11} MEDIA + \\ & \beta_{12} DSTMKT + \beta_{13} CREDIT + e \end{aligned} \quad (11)$$

Where perception is the dependent variables, $\beta_1, \beta_2 \ldots \beta_n$ are the parameter to be determined and *e* is the error term. The expected sign of the variables in the model and explanations are explained in Table 1.

3. RESULTS AND DISCUSSION

3.1. Study Area and Population

The study was carried out in Nakuru North District which is one of the four districts in Nakuru County. The district has three divisions, six locations and fourteen sub locations and covers an area of 593.3 km^2 of which 51, 891 ha is arable land and a population of 211, 691 people comprising of 51, 224 households.

The target population of the study were both participants in *Kilimo Plus* program and non-participants. The participants were the treatment group while the non-participants acted as the control group.

3.2. Sampling and Data

3.2.1. Data Collection

Data for the study were collected through interviewing the farmer's with the aid of a semi-structured questionnaire. The information collected was on their perception, institutional factors relating to them and their socio-economic characteristics.

3.2.2. Sampling Procedure and Sample Size

The total sample size comprising of both the participants and non-participants population was determined using the formula by Yamane (1967) which is specified as:

$$n = \frac{N}{1+N(e^2)} \quad (12)$$

Where *n* is the sample size, *N* is the population size, 1 is a constant and *e* is the level of significance (confidence interval of 95%). This gave a sample size of 397 households.

A multi stage sampling was used where in the first and second stage purposive sampling was used to select Nakuru North district and farmers in the district who were maize farmers respectively. In the third stage, systematic random sampling was done to get the farmers who had participated in the *Kilimo Plus* program where the first farmer was chosen at random while subsequent farmers were chosen in accordance to the formula by Black (2004: 229):

$$k = \frac{N}{n} \quad (13)$$

Where *k* is the sampling interval, *n* is the sample size and *N* is the population size. An element was chosen from the list at random and every k^{th} element in the sampling frame selected. The final stage was to select 369 non-participants who were sampled using simple random sampling as long as they are not in area where the subsidy was given. However, in order to ensure that the degrees of freedom and good matches between the participants and non-participants are obtained, 372 non-participants were selected thus bringing the whole sample size to 400.

4. RESULTS AND DISCUSSION

4.1. Descriptive Analysis

The mean household size for the sample was 6.39 persons, the mean age of the household head was 45.68 years and the mean land holding was 1.37 acres per household. About 92% of the sample households had a farm income that was below Kshs. 10, 000 while 90.73% of the respondents had a non-farm income that was below KShs. 10, 000. About 83.21% of the respondents had a total income that was below KShs. 10, 000.

About 80.8% of sample households were male-headed while 19.2% were female headed. About 13% of the respondents had no formal education, 16.25% had an incomplete primary school education, and 33.5% had a complete primary school education. Furthermore, 11.75%

had an incomplete secondary school education, 20.2% had a complete secondary school education, 0.75% had a tertiary polytechnic education, 3.5% had a tertiary college education and 1% had a university education level.

On access to agricultural inputs and services, the proportion of respondents who had received training on farming and input use was 82.25%. The percentage of farmers within less than 1 kilometre, 1 to 1.9 kilometre, 2 to 4 kilometres and, 4 kilometres and above to the nearest agro dealer was 52.5%, 1.25%, 36% and 10.25% respectively. On the other hand, majority of the respondents (53.75%) were within less than 1 kilometre from agricultural extension officer, 0.25% 1 to 1.9 kilometres, 37.25% 2 to 4 kilometres and 8.75% 4 or more kilometres from agricultural extension officer. About 82.8% of the respondents were connected to an agro dealer via a murram, all weather or tarmac road. In addition, 82.3% of the respondents were connected to an agricultural extension officer via a murram, all weather or tarmac.

On awareness of the *Kilimo Plus* subsidy program, only 13% of the respondents were aware of it. This was of particular interest to the study since it is a determinant of the sample size that would be appropriate for subsequent analysis. Approximately 18% of the respondents who were aware of the *Kilimo Plus* subsidy program had leant of the program through a friend or neighbour, 12% through a farmer group, 11% through the radio, 7% through an agricultural officer and 4% through a Chief Baraza.

4.1.1. Perception of the Farmers towards the *Kilimo Plus* Program

The Cronbach's alpha was 0.871, meaning that there is 87.1% consistency in the thirteen questions in measuring perception. This is a good internal consistency as defined by Gliem and Gliem (2003: 87). Using a summated rating scale to analyse the perception, the sum was found to be 2,581. The sum lying in between 2028 (3*13*52) and 2704 (4*13*52), means that most of the respondents scored the program as "good" since the sum is in the good category. The mode and the median were both found to be 52 (4*13=52) showing that the respondents ranked the program at rank 4 which is "good" thus gave an exact category as suggested by Clason and Dormody (1994: 34). The ranking of the program as "good" by the farmers shows that the farmers were aware of benefits of being in the *Kilimo Plus* program. A study by Druilhe and Barreiro-Hurlé (2012: 10), also found that subsidies reduce the lack of knowledge of fertilizer use and benefits. The positive perception of farmers can also allude that the farmers would rather be in the *Kilimo Plus* program than not.

4.1.2. Tests for Multicollinearity and Heteroscedasticity

The variance-covariance estimator absolute values obtained were between 0.0006 and 0.7428 and since they are not above 0.75, there was thus no evidence of strong multicollinearity. For the Variance Inflation Factor (VIF), the values obtained were between 1.01 and 1.08 hence showing no obvious presence of multicollinearity. Econometric Results

4.1.3. Factors Influencing the Perception of Smallholder Farmers towards the *Kilimo Plus* Program

The results of an ordered probit regression on perceptions of the farmers towards the *Kilimo Plus* program are presented in Table 2. The model coefficients (cut1 and cut2) were -7.5905 and -5.2217. The log likelihood was -23.0861. Since it was not zero, it means that the model converged therefore meaning that the predictors' regression for the coefficients was not all together equal to zero. The number of observation was 52 respondents. This drop in the sample size came about because the regression was done conditional on the respondent being

aware of the *Kilimo Plus* program. This was done because studies have shown that there can be no perception without an interaction (awareness) with the object of perception whether through information or experience. Therefore only 52 respondents were aware of the program. The likelihood ratio (LR) *Chi*-square test was 53.49 with a degree of freedom of 22 (in parenthesis). Since it was not equal to zero, it meant that at least one of the variables' coefficient is not equal to zero. The probability of getting the likelihood ratio (LR) test statistic (Prob > chi2) extreme than the null hypothesis was 0.0002. Thus, testing at 0.05 (Stata default), then 0.0002<0.05 which leads us to not to accept the null hypothesis that all the regression coefficients in the model are equal to zero. This shows that the model was a good fit and that at least one of the coefficients is not equal to zero. The McFadden's pseudo R-squared (Pseudo R2) was 0.5367. This shows that 53.67% of the variables that influence perception were included in the model.

Out of the twenty two variables used in the model, fourteen were significant. TREATMENT (whether one was in the program or not), MALE (the gender of the household head), respondent being the household head, respondent being a child of the household head, respondent being the parent of the household head and the respondent learning of the *Kilimo Plus* program from the farmer group were found to be significant at 10%. Increase in production, non-farm income, size of the farm, the respondent being a brother or sister in-law of the household head, the respondent having an incomplete primary school education, TRAINING (Training on farming and input use), the respondent learning of the *Kilimo Plus* program from a friend or neighbour and the respondent learning of the *Kilimo Plus* program from the radio were found to be significant at 5%.

The ordered probit coefficients give the predicted probability. Therefore the coefficients cannot be interpreted directly without further calculation as suggested by Greene (2002: 722) and Hogarth and Anguelov (2004: 69). Therefore, in order to know the amount of change in perception due to a unit change in the explanatory variable, marginal effects are used. Marginal effects are calculated by taking means of all the other explanatory variables. A negative value shows that an increase in the explanatory variable reduces the probability that perception will be in that specific category reduces while a positive value increases the probability that it will be in that category. The marginal effects results are presented in Table 2.

The results show that if the perception is average or good, a unit change in TREATMENT (whether one was in the program or not) increases the probability of the farmer's perception being average and good by 0.0016 and 0.2793 respectively if all the other factors are held constant at the mean. On the other hand, if all factors are constant at the mean, if the perception is excellent, a unit change in TREATMENT reduces the chance that perception is excellent by 0.2809. This may be explained by the groups' dynamics in the farmer groups that led to their collapse. Forming farmer groups was a precondition to accessing the subsidized inputs. Thus, the groups were not formed on the farmers' own initiative. Research done by Davis *et al.* (2004: 60) found out that farmer groups that were not formed by farmers on their own not only affected the groups' cohesiveness but also their perception of the group and their activities. Thus this may have led to the farmers in the program to rank the program as average or good rather than excellent. In addition, participants in the high altitude areas also complained of being given the wrong seed which may have contributed to the farmers'

perception. This is because the smallholder farmers are the consumers of the *Kilimo Plus* subsidy program inputs. Therefore, their preference in characteristics of the inputs affects their perception. In this case, the type of maize seed was not what the farmers preferred and thus affected their perception negatively

A unit change in the household head being a male raises the probability that perception is average by 0.0000 while it increases the probability that perception is good by 0.0541 and reduces the probability that perception is excellent by the same value *ceteris paribus*. This shows that the male household heads were less likely to rank the program as excellent as compared to the female household head. A unit change in production reduces the chance of a farmer's perception being average by 0.000, the chance that perception is good by 0.0620 and increases the probability that perception is excellent by 0.0620 when all the other variables are held constant at the mean.

When all factors are held constant, a unit change in non-farm income reduces the probability that a farmer's perception being average by $5.83e^{-09}$, the probability that perception is good by 0.0000 while it increases the probability that perception is excellent by and 0.0000. This shows that a person who had non-farm income was more likely to perceive the program as excellent. Most smallholder farmers' farm and non-farm income are usually integrated. Thus, an increase in non-farm income is geared towards increasing the farm income since farming is the households' primary activity as suggested by Mishra and Goodwin (1997: 886). Therefore, since the program increases the income of the farm through inputs, the farmers' who had a non-farm income would perceive the program as excellent.

A unit change in the farm size increases the probability that perception is average and good by 0.0000 and 0.0721 respectively while reducing the probability that perception is excellent by 0.0721 *ceteris paribus*. Thus, on the basis of farm size, farmers were more likely to perceive the program as average or good rather than excellent. Taking into consideration that the average land size for the sample is 1.38 acres then, farm size acts as a limitation to the farmers to produce more despite the program's initiative. A study done by Chand *et al.* (2011: 11) found out that small farms are more productive but inadequate in generating income and sustaining livelihood. The study also found out that land holding below 1.98 acres is inadequate to keep a farm family out of poverty despite high productivity if the farm is their only source of income. Shiferaw and Holden (1998: 244) also found out that the size of cultivatable land per capita affects perception of farmers negatively.

The respondent being the household head increases the probability that perception is average by 0.0791 and that it is good by 0.7517 while it reduces the chance that perception is excellent by 0.8308. The respondent being a child to the household head or a parent of the household head decreases the probability of perception being average by 0.0000 and reduces the probability of the perception being good by 0.0366 and 0.0462 respectively while it increase the perception being excellent by 0.0366 and 0.0462 respectively when all the other factors are constant. This shows that if the respondent was a child or parent of the household head, then they were more likely to perceive the *Kilimo Plus* program as excellent. This may be explained by the direct welfare benefits that a child or parent to the household head accrues from a participant of the program. A study by Breunig and Dasgupta (2003: 18) found that there is a direct welfare effect between the household income and the welfare of the children and elderly dependents such as parents. As a consequence, the child or parent would advocate

for programs such as the *Kilimo Plus* program due to the welfare that may emanate from the program. The respondent being a brother or sister in-law to the household head increases the probability that perception is average by 0.9924 while decreasing the chance that perception is good or excellent by 0.0002 and 0.9920 respectively.

A unit change in incomplete primary school education increases the probability that perception is average or good by 0.0153 and 0.5638 respectively while it reduces the probability that perception is excellent by 0.5791. This shows that the respondents who had an incomplete primary school education were more likely to rank the program as average or good instead of excellent. The level of education affects the willingness of an individual to learning and use of new methods and techniques as put forward by Adeogun *et al.* (2010: 14). Since the programs activities included training on farming and inputs use, this may have influenced the perception of the farmers who had an incomplete primary school education as to rank it as average or good rather than excellent.

A unit change in training on farming and input use decreases the probability that perception is average or good by 0.0595 and 0.7315 respectively while it increases the probability that perception is excellent by 0.7909. This shows that if farmers had been trained on input use, then they were likely to perceive the program as excellent. Nigeria (2010: 134), found out that training brought about a change in attitude of farmers leading to a good perception. This finding is also consistent with the study done by Yadav *et al.* (2011: 45) that found out that farmers who had a high perception of organic farming increased from 7.5% to 26.67% after training.

If the respondent learnt of the *Kilimo Plus* program from a friend or neighbour, farmer group or radio increases the probability that perception is average by 0.0191, 0.0017 and 0.3884 respectively, increases the chance that perception is good by 0.5972, 0.2832 and 0.5927 respectively while it decreases the probability that perception is excellent by 0.6163, 0.2849 and 0.9809 respectively. Thus farmers who had gotten information of the *Kilimo Plus* program through a friend or neighbour, farmers group or radio were less likely to rank the program as excellent. Research done by Alfred and Fagbenro (2007: 83) in Nigeria that showed the radio was the most effective way of communication to tilapia farmers as a source of information. Alfred and Fagbenro (2007: 83) also found out that friends as a source of information was the most affordable. However the difference in the findings can be attributed to the nature of research. In the case of Alfred and Fagbenro (2007: 82), the Likert scale asked the frequency of use and the effectiveness was measured by the level of farmer satisfaction while in this study, the farmer was asked of how they learnt of the *Kilimo Plus* program and no inference of effectiveness was derived from the answer. Radio as a source of information also depends with the language that is used. Radio is more effective as a source of information when it is in the farmers' language. Since the *Kilimo Plus* program is a government program, the information relayed on the radio is in the official languages. This may have resulted to a problem of language barrier especially to the unlearned population as found out by Agwu and Adeniran (2010: 28), and thus leading to the farmers perceiving the program as average or good rather than excellent. The negative coefficient in the farmers who learnt of the program from a farmer group can be associated with the negative perception created in the farmers because of the collapse of the groups.

5. CONCLUSION

5.1. Conclusions

This study found that the farmers had a positive perception towards the *Kilimo Plus* subsidy since they ranked it as good. This ranking indicates that the farmers perceived the program as beneficial and thus shows an increase in the knowledge of the benefits of fertilizer and certified seeds.

The gender of the household head being male, farm size, being in the *Kilimo Plus* program, being the household head, having an incomplete primary school education and learning of the *Kilimo Plus* program through a friend or neighbour, farmer group and the radio, were found to influence the perception of the farmer negatively. While increase in production and training on farming and inputs use influenced the farmer's perception positively. The study also concludes that the relationship of the respondent to the household head determines their perception of the *Kilimo Plus* program. This was deduced by the fact that being a niece of the household head, brother or sister in law of household head influenced perception negatively while being a child to the household head or being a parent of the household head influenced perception positively.

Even though the farmers had a positive perception of the *Kilimo Plus* program, implementation challenges such as group collapse, late supply of inputs and provision of wrong seeds contributed to some farmers perceiving the program negatively. As such, there is need for the government to be more careful on the design, structure and implementation of such subsidy programs. careful of the seeds they supply. In addition, the study also found out that the male household head perceived the program negatively. Since the household heads are the principle decision makers in the household, there is need to intervene on the male household heads' negative perception given that this be lead to shunning of such programs by such economically vulnerable households. This may include formulating subsidy programs that are flexible and appealing to the male household heads' schedule and that does not overburden them through increase in activities.

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8. APPENDIXES

Table 1: Description of Factors that Influence Smallholder Farmers' Perception of *Kilimo Plus* Program

Variable	Variable Description	Measurement of Variable	Expected Sign
Perception	Perception of the smallholder farmers towards the *Kilimo Plus* subsidy program	Ordered responses between0 to 4 where: 0 is poor, 1 fair, 2 average, 3 good and 4 excellent	Dependent variable
TREATMENT	Treatment variable (Whether you were in the *Kilimo Plus* program or not)	Dummy Variable Participants = 1,Non-participants = 0	+
HOUSEHOLDSIZE	Household size	Continuous Variable	+/_
MALE	Gender of the household head	Dummy Variable Male=1, Female =0	+
AGE	Age of the household head	Continuous Variable	+
PRDNINC	If production increased (how much was the surplus maize)	Continuous Variable (Bags)	+
FARMINC	Farm income	Continuous Variable (Kshs)	+
NONFARMINC	Non-farm income	Continuous Variable (Kshs)	+/-
FARMSIZE	Size of farm	Continuous Variable (acre)	+/-
RELHHHEAD	Household head	Dummy Variable Household head = 1, Otherwise =0	+/-
RELHHSPOUSE	Spouse of the household head	Dummy Variable Spouse of the household head = 1, Otherwise =0	+/-
RELHHCHILD	Child of the household head	Dummy Variable Child of the household head = 1,	+/-

Variable	Variable Description	Measurement of Variable	Expected Sign
		Otherwise =0	
RELHHPARENT	Parent of the household head	Dummy Variable Parent of the household head = 1, Otherwise =0	+/-
RELHHNIECE	Niece of the household head	Dummy Variable Niece of the household head = 1, Otherwise =0	+/-
RELHHBROSISINLAW	Brother-in-law or Sister-in-law of the household head	Dummy Variable Brother-in-law or Sister-in-law of the household head = 1, Otherwise =0	+/-
INCOMPLETEPRIMARY	Having an incomplete primary school education	Dummy Variable Incomplete primary school education = 1, Otherwise =0	-
COMPLETEPRIMARY	Having completed primary school education	Dummy Variable Complete primary school education = 1, Otherwise =0	+
INCOMPLETESECONDARY	Having an incomplete secondary school education	Dummy Variable Incomplete secondary school education = 1, Otherwise =0	+
COMPLETESECONDARY	Having completed secondary school education	Dummy Variable Complete secondary school education = 1, Otherwise =0	+
TRAINING	Training on farming and input use	Dummy Variable Trained = 1, Not trained =0	+
LEARNSOURCEFRIENDNEIGH	Learnt of the *Kilimo Plus*	Dummy Variable	+/-

Variable	Variable Description	Measurement of Variable	Expected Sign
	program from friend or neighbour	Learnt from friend or neighbour = 1, Otherwise =0	
LEARNSOURCEGRP	Learnt of the *Kilimo Plus* program from farmer group	Dummy Variable Learnt from farmer group = 1, Otherwise =0	+/-
LEARNSOURCERADIO	Learnt of the *Kilimo Plus* program from the radio	Dummy Variable Learnt from the radio = 1, Otherwise =0	+/-

Table 2: Ordered Probit Regression Results on Factors Affecting Perception of Farmers towards the *Kilimo Plus* Program

Variable	Coefficient	Marginal effects		
		Average	Good	Excellent
		dy/dx	dy/dx	dy/dx
TREATMENT (whether one was in the program or not)	-3.3632(1.3187)*	0.0016(0.0047)	0.2793(0.2658)	-0.2809(0.2695)
Household size	-0.1796(0.1379)	2.86e-06(0.0000)	0.0074(0.0122)	-0.0074(0.0122)
MALE (Gender of the household head)	-2.4891(1.1305)*	0.0000(0.0001)	0.0541(0.0698)	-0.0541(0.0699)
Age of the household head	0.0071(0.0238)	-1.13e-07(0.0000)	-0.0003(0.0011)	0.0003(0.0011)
Increase in production	1.5105(0.4753)**	-0.0000(0.0001)	-0.0620(0.0862)	0.0620(0.0863)
Farm income	0.0000(0.0001)	-5.80e-10(0.0000)	-1.50e-06(0.0000)	1.50e-06(0.0000)
Non-farm income	0.0004(0.0001)**	-5.83e-09(0.0000)	-0.0000(0.0000)	0.0000(0.00000)
Size of the farm	-1.7556(0.6474)**	0.0000(0.0001)	0.0721(0.1024)	-0.0721(0.1025)
Household head	-4.8692(2.1357)*	0.0791(0.1858)	0.7517(0.1709)***	-0.8308(0.3154)**
Spouse to the household head	-2.3770(1.5299)	0.0025(0.0091)	0.3247(0.3960)	-0.3272(0.4039)
Child to the household head	4.4367(2.3262)*	-0.0000(0.0001)	-0.0366(0.0549)	0.0366(0.0550)
Parent of the house hold head	3.8953(1.9729)*	-0.0000(0.0001)	-0.0462(0.0656)	0.0462(0.0657)
Niece to the household head	-0.4759(2.1309)	0.0000(0.0003)	0.0318(0.2122)	-0.0318(0.2124)
Brother or sister in-law to the house hold head	-7.2057(2.7168)**	0.9924(0.0460)***	-0.0002(0.0422)	-0.9920(0.0170)***

Variable	Coefficient	Marginal effects		
		Average	Good	Excellent
		dy/dx	dy/dx	dy/dx
Incomplete primary school education	-2.9669(1.0529)**	0.0153(0.0361)	0.5638(0.3090)*	-0.5791(0.3369)*
Complete primary school education	0.1658(0.8020)	-2.11e-06(0.0000)	-0.0061(0.0274)	0.0061(0.0274)
Incomplete secondary school education	0.7405(1.4151)	-4.59e-06(0.0000)	-0.0171(0.0331)	0.0171(0.0331)
Complete secondary school education	-2.1694(1.4683)	0.0018(0.0070)	0.2871(0.3860)	-0.2889(0.3921)
TRAINING (Training on farming and input use)	4.7811(1.6507)**	-0.0595(0.1119)	-0.7315(0.1948)***	0.7909(0.2751)**
Learnt of the program from a friend or neighbour	-3.7149(1.2355)**	0.0191(0.0419)	0.5972(0.2989)*	-0.6163(0.3307)*
Learnt of the program from a farmer group	-2.0509(0.9493)*	0.0017(0.0058)	0.2832(0.3048)	-0.2849(0.3096)
Learnt of the program from the radio)	-5.3492(1.8778)**	0.3884(0.5164)	0.5927(0.4577)	-0.9809(0.0652)***
cut1				-7.5905(2.5143)
cut2				-5.2217(2.3347)
Log likelihood				-23.0861
Number of observation				52
LR chi2(22)				53.49
Prob > chi2				0.0002

Variable	Coefficient	Marginal effects		
		Average	Good	Excellent
		dy/dx	dy/dx	dy/dx
Pseudo R2				0.5367

Source: Survey data, 2013.

Note: Figures in the parentheses are the standard errors associated with the coefficients and marginal effects. ***P < 0.01, **P < 0.05 and *P < 0.10 mean significant at 1%, 5% and 10% probability levels, respectively.