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*Full Length Research Paper*

# Subsidies inputs policy implication in Rwanda

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**The main objective of the study was to examine the impact on inputs subsidies on the livelihood of smallholder famers in Rwanda. Improving agricultural productivity has received considerable policy intervention in these past years. The question remains to know the extent to which the policy contributes to the variation being upwards or downwards of the crop productivity. This study examines the variation of agricultural productivity to document the extent to which agricultural productivity has shifted due to input subsidies and its impact on the livelihood of smallholder farmers. Primary data were collected among 60 small holders' farmers in Kirehe district Eastern Province in Rwanda. To assess how the policy has contributed to the shifting of agricultural productivity and on their livelihood change 30 smallholder farmers received the inputs subsides and another group of 30 smallholder farmers considered as control group who did not take subsidized agricultural inputs for many different reasons was conducted in order to compare their agriculture productivity and livelihood. The collected data was analyzed using SPSS and findings showed that greater agricultural productivity grown in Kirehe District was observed mostly in the period 2009 after policy and this period coincides with specifically the introduction of the voucher system in that district. To validate these findings some tests were estimated to establish the marginal effects of this policy interventions on agricultural productivity. Findings show that the voucher system has significant marginal effects on change in crop yield at 5% level of significance, the F calculated (32.46) is greater than the critical F value ($F_{3,26,0.05}$=2.74), which shown us how those factors of production fertilizers, improved, and land size jointly have the contribution on the improvement of agricultural productivity. At harvest farmers sell the part of their production to pay back vouchers that they took before the agricultural season. Low production due to external factors which are uncontrollable may delay or fail to pay the voucher. Further studies policy innovations and interventions should focus on how farmers can maintain the same momentum themselves beyond policy interventions in Rwanda.**

**Key words:** policy, inputs subsidies.

## II INTRODUCTION

Rwandan smallholder farmers confront with many challenges which prevent them to maximize their agriculture output necessary for the increasing of their incomes. One of the most challenges they face is the lack of financial resources required to purchase improved inputs. The GoR adopted some strategies which will help smallholder farmers increasing their production and one the most strategies is to subsidies inputs. Specifically, the subsidy voucher system grant farmers access to certified access to certified fertilizers and improved seeds and was expected to have direct effects on the agriculture productivity which will lead to increase in farmers' income and consumption expenditure. The poverty reduction effects are also expected as a result of improved access to education and health services brought about by increase in income The government subsidizes fertilizer prices by 50% and farmers pay for the rest depending on a particular crop. Maize and Wheat farmers pay 50% while rice and Irish potato farmer pay 27%. As a result, the crop productivity has increased. The production of maize and wheat has increased by 6-fold, and that of Irish potato and cassava has tripled

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**Table 1**: Frequency distribution of farmers according to the level of education completed.

| | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| None level | 9 | 30.0 | 30.0 | 30.0 |
| Primary | 7 | 23.3 | 23.3 | 53.3 |
| Secondary | 12 | 40.0 | 40.0 | 93.3 |
| University | 2 | 6.7 | 6.7 | 100.0 |
| Total | 30 | 100.0 | 100.0 | 1 |

**Source:** Primary data 2013

**Table 2:** Frequency distribution of farmers according to years of farming experience and size of farm holding.

| | Frequency | Percentage |
|---|---|---|
| 1/5 ha | 4 | 13.3 |
| Ha | 10 | 33.3 |
| ‹ ha | 2 | 8.7 |
| › ha | 14 | 46.7 |
| **Total cultivated area** | | 100.0 |
| **Farming experience** | | |
| Under 10 years | 25 | 83.3 |
| Above 10 years | 5 | 16.7 |

**Source:** Primary data 2013

The production of rice and beans has increased by 30% in the past 4 years. However, there is dearth of information about the impact of the policy on the beneficiaries in relation to the overall livelihood of smallholder farmers. Hence this study investigated the impact of the subsidy voucher system of fertilizers and improved seeds on the livelihood of smallholder farmers.

## METHODOLOGY

The study was conducted in Kiremera cell, Kigarama sector, Kirehe District, Eastern Province precisely at the South-East of the Republic of Rwanda located at 133 km of the Kigali the capital City

Both quantitative and qualitative data were collected using questionnaire, descriptive research design is chosen for this study in order to give a detailed description of the impact of inputs subsidies on the livelihood of smallholder farmers and Quantitative research method was used to describe variables; to examine relationships among variables; to determine cause-and-effect interactions between variables

In this research all members of cooperative who were supported by the government through the voucher system and non member of cooperative who were smallholder farmers who were not supported inputs subsidies policy. Sampling is the process of selecting elements from the total population in such a way that the sample size of 76 smallholder farmers of was obtained by using Slovin' s formula and 30 smallholder farmers not supported by the policy were selected randomly. The collected data was analyzed using SPSS software 16.0. The findings were discussed and presented in the form of frequencies tables and bar graphs.

## RESULTS AND DISCUSSION

### Socio-economic characteristics of farmers

Table1 shows the frequency distribution of farmers according to their level of education completed. A 30% of farmers interviewed who are supported by the Rwandan Government through the voucher system do not have any level in education and the number given by the District Development Plan of Kirehe (2008-2009) state that the total illiterates is estimated around 4.5% of Population of the District. That number has a great significance of the poor performance of the agriculture sector because the illiterate farmers can't interpret instructions on the use of agrochemicals, can't adopt modern agricultural technologies and can't take wise decisions on farming operations. 23.3% of them completed the Primary school, 40% completed the secondary school, and only 6.7 completed the university. The level of education of farmer not only increases his farm productivity but also enhances his ability to understand and evaluate new production techniques.

Table 2 shows the frequency distribution of farmers according to years of farming experience, and size of farm holding. The table shows that (83.3%) of the farmers had between under 10 years of farming experience, while (16.7%) had between above 10 years of farming

**Table 3:** Distribution of farmers according to household size, gender, marital status.

| | Frequency | Percentage |
|---|---|---|
| **Household size(Persons)** | | |
| 1-5 | 20 | 66.6 |
| 5-10 | 10 | 33.4 |
| **Gender** | | |
| Male | 22 | 73.3 |
| Female | 8 | 26.7 |
| **Marital status** | | |
| Single | 3 | 10 |
| Married | 26 | 86.7 |
| Widow | 1 | 3.3 |

**Source:** Primary data 2013

Table 4: The estimated coefficients of the independent variables.

| Model | Unstandardized coefficients $\beta i$ |
|---|---|
| Constant | 387.825 |
| X1 | 11.655 |
| X2 | -111.061 |
| X3 | 208.356 |

experience. With regard to size of farm holding, the table shows that (46.7%) of the respondents cultivate between below 1 hectare of farm land, (33.3%) cultivate one hectare, (6.7%) cultivate beyond one hectare, and (13.3%) cultivate 1/5 hectare.

This means that majority of the farmers operating in the area are small scale (cultivating less than 1 hectare of land). As stated in the KWAMP Project Design Report (2008) just over 86% of households own less than 1.0 ha of land, 46% own less than 0.5 ha. Small holdings can lead to more intensive and efficient use of land resources if properly utilized. Table 3 shows the frequency distribution of farmers according to household size, gender, marital status. The table shows majority (66.6%) of the farmers' have household size ranging between 1 and 5 persons and (33.4%) have household size ranging between 5 and 10 persons.

With respect to gender and marital status of farmers, the table also shows that even if the District Development Plan of Kirehe 2008-2009 states that the female population (52.7%) is slightly higher the male population(47.3%), in our sample we found that (73.3%), 26,7% are females and males respectively, while 86.7% of them are married.

## REGRESSION ANALYSIS

### Specification of the econometric model of the Agricultural productivity

The agricultural production of smallholder farmers depends on fertilizers, improved seeds and land size used. The agricultural production (Y) is the depend variable, while fertilizers ($X1$), improved seeds ( $X2$)and land size ($X3$)are explanatory variables in our model.

$$\gamma i = \beta 0 + \beta 1 Xi1 + \beta 2 Xi2 + \beta 3 Xi3 + \mu i$$

$\beta 0, \beta 1, \beta 2, \beta 3$ are the parameters of the model, where $\beta 0$ is the intercept and$\beta 1, \beta 2, \beta 3$ are slope coefficients which indicate the rate of change on the agricultural production of a unit change in fertilizers, improved seeds and land size used. Where $\mu$ known as the disturbance orb error term represent all those factors that affect the agricultural production but are not taken into account explicitly.

### Empirical Results

### The Regression Model

It has been assumed that a linear relationship exist between the dependent variable Agriculture production and three variables Fertilizers (X1), improved seeds (X2), and the land size(X3). By applying ordinary least square estimation procedure, the estimated coefficients of the independent variables are found as follows:

$$\hat{Y}_i = 387.825 + 11.655 X_{1i} - 111.061 X_{2i} + 208.356 X_{3i}$$

It is evident that 78.6% variation in agricultural production

**Table 5:** Anova.

| Model | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Regression | 1284171.547 | 3 | 428057.182 | 32.464 | .000[a] |
| Residual | 342828.453 | 26 | 13185.710 | | |
| Total | 1627000.000 | 29 | | | |

Source: Primary data.

can be explained by the variation in the independent variables. As our coefficient of determination $R^2$is closer to 1, our sample regression line fits well the data.

As the use of fertilizers increase, so does the agricultural production, and as the land size become bigger, the production increases. However, as farmers use more seeds in field, their production decreases which is important for the agronomists to help farmers knowing the exact quantity of fertilizers to put into the field according to their land size.

### The Standard Error of Y Estimate and $\beta_i$

For the study, the standard error of Y estimates is S =114.82905. In general, we know that the smaller the standard error (S) of Y estimates for any model, the better is the model and more precise. From the above estimate, we see that the S (=114.82905) is smaller, so it is better and more precise model.

### TEST OF HYPOTHESIS

### TESTING THE OVERALL SIGNIFICANCE

The F test aims to test the "global significance" of the model. More formally it is a test of whether all our coefficients are jointly equal to zero. If they are, effectively your model is not really explaining anything.

$H_0=\beta_1=\beta_2=\beta_3=0$

$H_1$: One or more slope terms is none zero

Let our level of significance $\alpha$ be 5%.

For 3 degrees of freedom in the numerator, and 26 degrees of freedom in the denominator, then the critical F value is 2.74

$F_{3,26,0.05}=2.74$

For our F calculated greater than the critical value founded, we reject the null hypothesis. So, our finding is statistically significant.

### TEST OF INDIVIDUAL SIGNIFICANCE

Broadly speaking, a test of individual significance is a procedure by which sample results are used to verify the individual influence of every independent variable on the dependent variable in the model.

Pr [$\beta_1^*$- $t_{\frac{\alpha}{2}}$ Se ($\widehat{\beta_1}$) ≤ $\widehat{\beta_1}$ ≤ $\beta_1^*$+ $t_{\frac{\alpha}{2}}$ Se ($\widehat{\beta_1}$)] =1-$\alpha$

If we let $H_0$= $\beta_1$ = $\beta_1^*$= 0

$H_1 = \beta_1 \neq 0$

### For fertilizers

$\beta_1$ = 11.65, t = 3.061, Se ($\widehat{\beta_1}$) = 3.808, $t_{\frac{\alpha}{2}}$ = 2.045, $\alpha$ = 5%

Pr [-7.79 ≤$\widehat{\beta_1}$≤ +7.79] = 95%

Given the confidence coefficient 95% in the long run, in 95 out of 100 cases intervals like [-7.79, +7.79] will contain the true $\beta_1$

Since the observed $\widehat{\beta_1}$lies in the critical region, we reject the null hypothesis that true $\beta_1$ is equal to zero. Our finding is statistically significant

If we let $H_0$= $\beta_2$= $\beta_2^*$=0

$H_1$= $\beta_2 \neq 0$

### For improved seeds

Pr [-65.77≤$\widehat{\beta_2}$≤+65.77] = 95%

Given the confidence coefficient 95% in the long run, in 95 out of 100 cases intervals like [-65.77,+65.77] will contain the true $\beta_2$. Since the observed $\widehat{\beta_2}$ lies in the critical region, we reject the null hypothesis that the true $\beta_2$=0. Our finding is statistically significant

If we let $H_0$= $\beta_3$= $\beta_3^*$=0

$H_1$= $\beta_3 \neq 0$

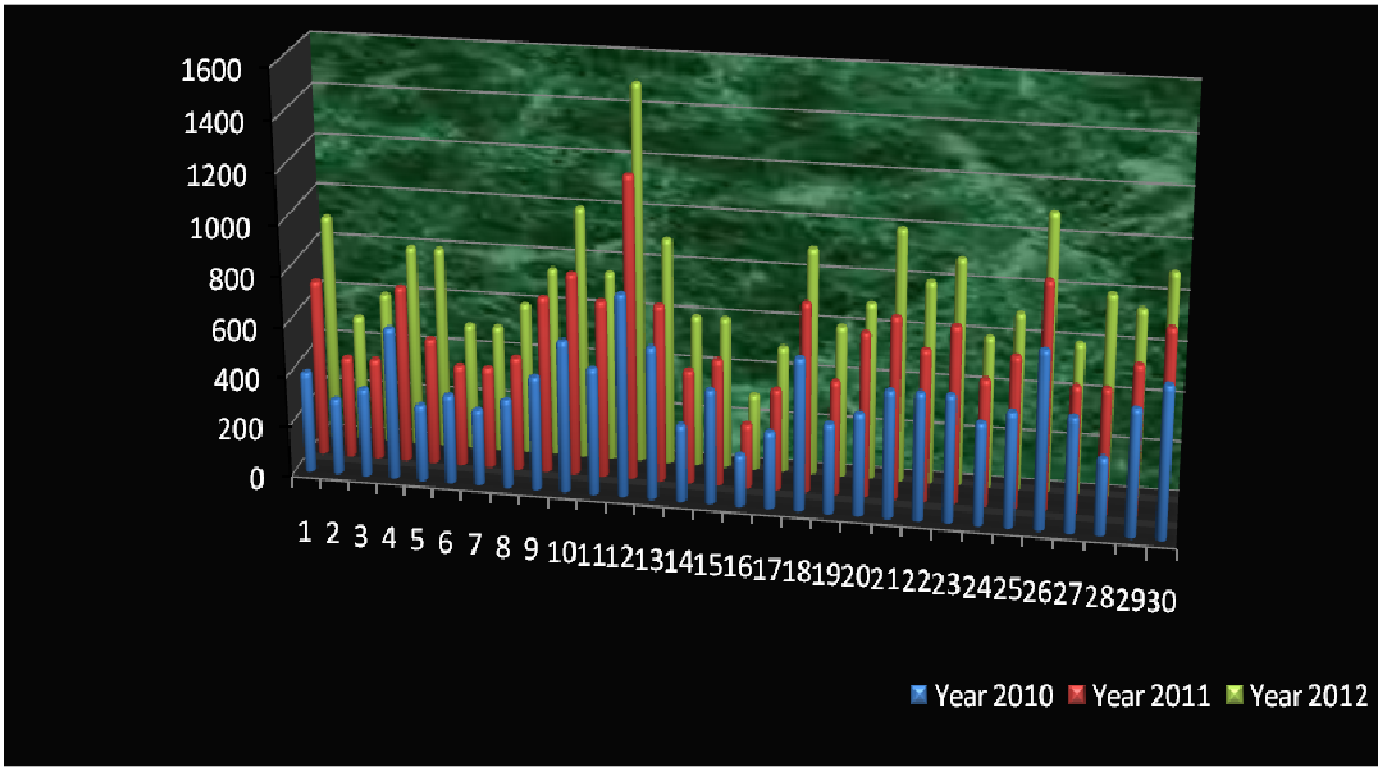


**Figure 1**: Agricultural productivity three years after the beginning of the voucher system
Source: Primary data, 2013

**For the land size**

Pr [-378.12255≤ $\widehat{\beta_2}$≤+378.122] = 95%

Given the confidence coefficient 95% in the long run, in 95 out of 100 cases intervals like [-378.122,+378.122] will contain the true $\beta_3$. Since the observed $\widehat{\beta_3}$ lies in the critical region, we reject the null hypothesis that the true $\beta_3$=0. Our finding is statistically significant.

***Agricultural Productivity of smallholder Farmers after being supported by the Government through the Voucher program***

As stated in CIP report, 2011, there was an increase on the production of maize by 6-fold, in the past 4 years. These outputs have pushed Rwanda to the verge of becoming a food secure country.

Also as stated by Dr. Alfred R. BIZOZA[i] and Patrick BYISHIMO in their research on agricultural productivity and policy interventions, the voucher system has significant marginal effects on change in crop yield (measured by farmer's perception) at 5% level of significance.

The survey asked farmers if they perceive improved crop productivity or yield for the period 2006-2012 and particularly the period after 2009 when the voucher system was introduced in Kirehe District ( Yes=1, and 0 if otherwise).

s shown in the graph below, farmers after being supported by the government through the voucher system in 2009 their productivity increased on a good level according to the land size of every one and to the climate, which help them to increase their income and hence reducing poverty.

**Comparison between the Agricultural productivity before and after the Voucher system**

As postulated in CIP Report, 2011 the low productivity is mainly attributed to the low use of inputs. In a vicious cycle, the low productivity continue to prevent farmers from using the inputs, as many farmers barely produce sufficient food to feed their family with no surplus, and therefore have no income with which to purchase yield enhancing inputs. The graph below shows us the big difference between the productivity of farmers one year before being supported through the voucher system and two years after getting those inputs subsidies.

Their productivity increased but it's according to the season when the period is good they get a higher productivity but also sometimes the climate deceive them and they get losses that causes a big problem on the

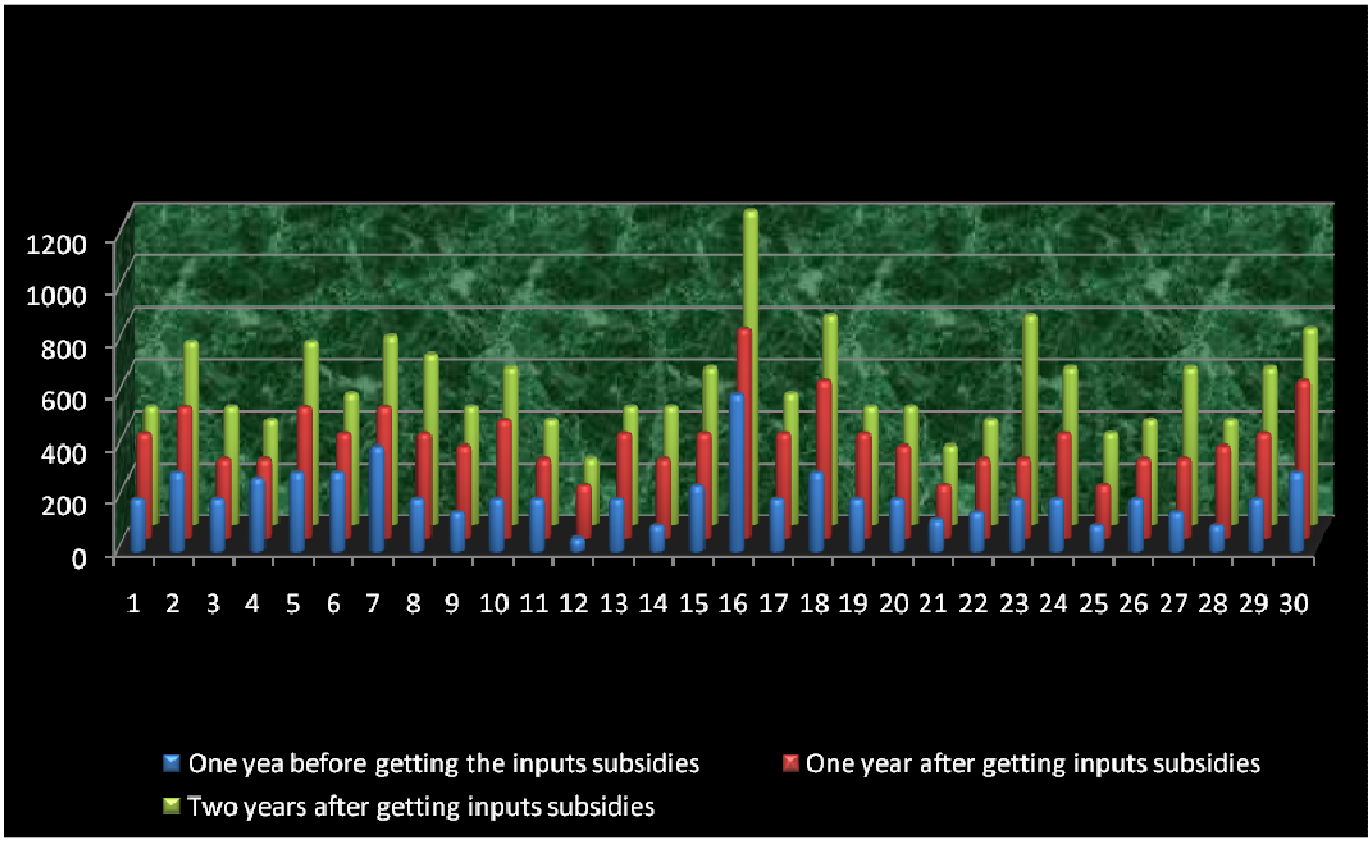


**Figure 1:** policy implication on Agricultural productivity after three years

**Source:** Primary data**, 2013**

payment of the subsidies they got.

## CONCLUSION

This study has attempted to investigate how the inputs subsidies impact the livelihood of smallholder farmers in Rwanda. Information used for the analysis was collected on 30 smallholder farmers in Ibyizabirimbere Cooperative who are supported by the government through the voucher system and other 30 smallholder farmers who are not supported by government through the voucher system, located in Kiremera cell of Kirehe District. Using SPSS software, descriptive results show relatively positive growth of agricultural productivity from the period 2009 to 2012 that's the period after being supported by the government through the voucher system. The comparison of mean the agricultural productions of those farmers between the period before the voucher system and the after show that the agricultural productions for the two periods are very statistically different due to the use of fertilizers and improved seeds given to those farmers. We found how with the inputs subsidies, the agriculture move from being subsistence to the market oriented due to the obligation that those farmers have to pay the vouchers they took before the agricultural season. After harvest the Cooperative buys their produce and search the market those farmers. With a good climate those farmers pay easily their vouchers they took and they save the rest of money in Banks or in Umurenge Sacco. For our research main objective, from our empirical analysis, the inputs subsidies impact highly the livelihood of smallholder farmers in this way: The rest money after the payment of vouchers drive change on their livelihood but especially the nutritional sufficient, in education like paying school fees of their children, paying the health insurance. With the inputs subsidies other government policies to improve the rural area will be possible.

## RECOMMANDATION

We cannot end our study without formulating some recommendation that constitute a set of solutions to improve the inputs subsidies policy. The following recommendations have been suggested:

(i)Farmers should be organized in the cooperative to make easier the formulation of inputs subsidies contracts.

(ii) Strengthen the management of the existing cooperative in order to prevent losses.
(iii) Promoting the agriculture extension services in the region precisely using the system that can help famers knowing who to use fertilizers and improved seeds they took, simply the system which help famers to know the life of crops for a good management of them. That system is the farming systems research and extension.
(vi) Improving the infrastructures like roads in Kigarama sector in order to help the cooperative sell very easily their produce and to attract very easily foreign buyers.
(v) The government must oblige cooperatives to have a president who has a Bachelor degree for the good management, good negotiation with buyers on prices and to be able to go outside the country searching for markets.
(vi) Encouraging private sectors to invest in agriculture.
(vii) Finally, I recommend that further policy innovations and interventions should focus on how farmers can maintain the same momentum themselves beyond policy interventions in Rwanda.

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