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# What Constrains Smallholder Farmers Decisions to Participate and use Agricultural Value Chain Financing in Rwanda? The Case of Smallholder Potato Farmers in Musanze and Nyabihu Districts

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**ABSTRACT**

Smallholder farmers contribute more to food security and poverty reduction in Rwanda. However, lack of agricultural finance is one of numerous challenges they face for improving productivity and increasing income along the value chain. The objectives of this paper were to determine the factors influencing the farmers' decision to participate and use agricultural value chain financing in Rwanda and to analyse the constraints hindering smallholder farmers' decision to participate and use agricultural value chain financing in Rwanda. Cross-sectional data were collected from a random sample of 585 smallholder potato farmers in Musanze and Nyabihu Districts. Results of probit model revealed that sex, age, marital status, education, farming experience, membership to farming associations, household income and distance to market significantly influence the farmers' decision to participate and use of agricultural value chain financing. The study also found that financing agricultural activities remain a key challenge for smallholder potato farmers. Fear of borrowing, lack of financial literacy, lack of skills in budgeting and unexpected production, interest rate and others loans charges, lack of collaterals, short repayment period and lack of financial literacy have been found to be the main factors constraining potato farmers' participation and use of agricultural value chain financing. Nevertheless, potato productivity will always result from the interaction between all potato value chain actors. The study recommended the government and value chain stakeholders to formulate integrated policies that facilitate smallholder farmers to access to convenient financing products in order to improve productivity and to meet the customer demands.

***KEYWORDS:*** *Agricultural value chain financing, smallholder potato farmers, Musanze and Nyabihu districts, Probit model*

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## 1. INTRODUCTION

Statistics have shown that Rwanda is an agricultural based economy. The sector is a key component of Rwanda's fast growing economy, improvement of food security and poverty reduction of local population. It employs 80 per cent of population, accounts for 32 per cent of the GDP growth, 45 per cent of Rwanda's exports earnings ( RDB, 2013; NISR, 2017) and 90 per cent of country's food needs (W.B, 2013). Furthermore, facing sharply increased food demand and consumption habits driven by demographic factors, many efforts are invested in shifting from largely subsistence agriculture to market oriented agriculture (MINECOFIN, 2013). This process is driven by increased investment in response to the presence of massive market opportunities (Martey *et al.*, 2012).

Potato (*Solanum tuberosum L.)* "Ibirayi" derived from "Uburayi" ("that which comes from Europe") is a new emerging crop that underpins the Rwanda's food security, nutrition, employment and socio-economic improvement of farmers (Tenge et al., 2012). It is one of the six priority crops (maize, wheat, rice, potato, cassava and beans) listed under crop intensification program (CIP) by the Ministry of Agriculture and Animal Resources (MINAGRI)(Kathiresan, 2011). Despite that Rwanda is ranked the sixth producer in Africa, the third in Sub-Saharan Africa and the second in East African community (FAOSTAT, 2017), the low productivity of 11 metric tons per hectare remains far below 30-40 metric tons per hectare attainable by research institutions (NISR, 2015). Research has shown that limited availability and accessibility to improved seeds and low access to fertilizers weaken the efforts of potato farmers to increase potato yields (Muhinyuza et al., 2012; Nshimiyimana et al., 2015). Though growing potato is entirely attractive (Ritter et al., 2017), the pace of agricultural financing remains slow and weak in Rwanda. Financial institutions are likely to operate with medium and large scale farmers, processors and traders and perceive smallholder farmers as not creditworthy, extremely risky and too difficult to provide loans (Oberholster *et al.*, 2015). This inefficiency of financial institutions to extend credit to farmers deprives the

smallholder farmers for improving productivity and marketing their farm produce (Patil et al., 2016).

Many studies have been only concentrated on identifying and finding solutions for quality seeds, pest and diseases to increase potato productivity (Muhinyuza et al., 2012; Nshimiyimana et al., 2015; Nelson et al., 2016; Ferrari et al., 2017; Uwamahoro, et al., 2018), but none have studied the constraints of smallholder farmers to access financial services to invest in potato activities and take advantages of the growing market demands. However, agricultural value chain financing framework was considered as the better way for smallholder potato farmers to mobilize resources for improving agricultural activities. This paper determined the factors influencing farmers to participate and use of agricultural value chain financing, and identified the constraints hindering the farmers to use value chain financing approaches in Rwanda.

## 2. Concept of agricultural value chain financing

According to Oberholster *et al*. (2015) and Owusu ( 2017), the low productivity attributed to low investment can only be offset when the farmers are granted access to financial products and services, and this would be possible through appropriate value chain financing framework. The term value chain finance refers to the use of a value chain to flow financial products and services to one or more participants in the value chain in order to increase actors' returns, growth and competitiveness of value chain (Miller, 2012). Kaplinsky & Morris (2000) and Henriksen *et al.*, (2010) have described the value chain as idea of actors (public and private, including services providers) connected along the chain and undertake a series of activities including production, transformation, marketing and distribution to bring a product or a service that ultimately responds to consumer demand. In agriculture, the value chain is described as the flow of physical inputs and services in the production of final product and in terms of its concern with quantitative technical relationships (Kaplinsky & Morris, 2000). Agricultural value chain is built on good relationship between value chain actors, such as agricultural producers, inputs suppliers, processors, traders, exporters and retailers (Miller & Jones, 2010; ADB, 2012; Miller, 2012). Therefore, agricultural value chain finance relates to any or all of the financial products or services and support services flowing to/and or through a value chain to address the needs and constraints of those involved in the agricultural value chain (Fries, 2007). In brief, the concept of value chain financing is essentially of two approaches: financial sector approach and the value chain approach. The financial sector approach emphasizes on the important role of banks and other financing institutions in facilitating access to a broad range of financial services by the value chain actors while the value chain approach emphasizes on how value chain actors can improve their access to financial services (KIT & IIRR, 2010). Agricultural value chain financing is a comprehensive framework linking farmers, banks and other actors in chain. It helps to improve the quality and efficiency in financing agricultural value chain by identifying financing needed to strengthen the chain, adapting the financial products to the needs of participants , reducing the transaction costs and using the value chain linkages to mitigate the risks to the chain and its partners (Winn *et al.*, 2009; Miller, 2012).

### 2.1. Role of agricultural value chain financing in agricultural production

Studies have proven the positive impact of access to financing products through value chain financing to improve the agricultural productivity and wellbeing of farmers (Kopparthi & Nkubito, 2012; Fakudze & Machethe, 2015; Middelberg, 2017).

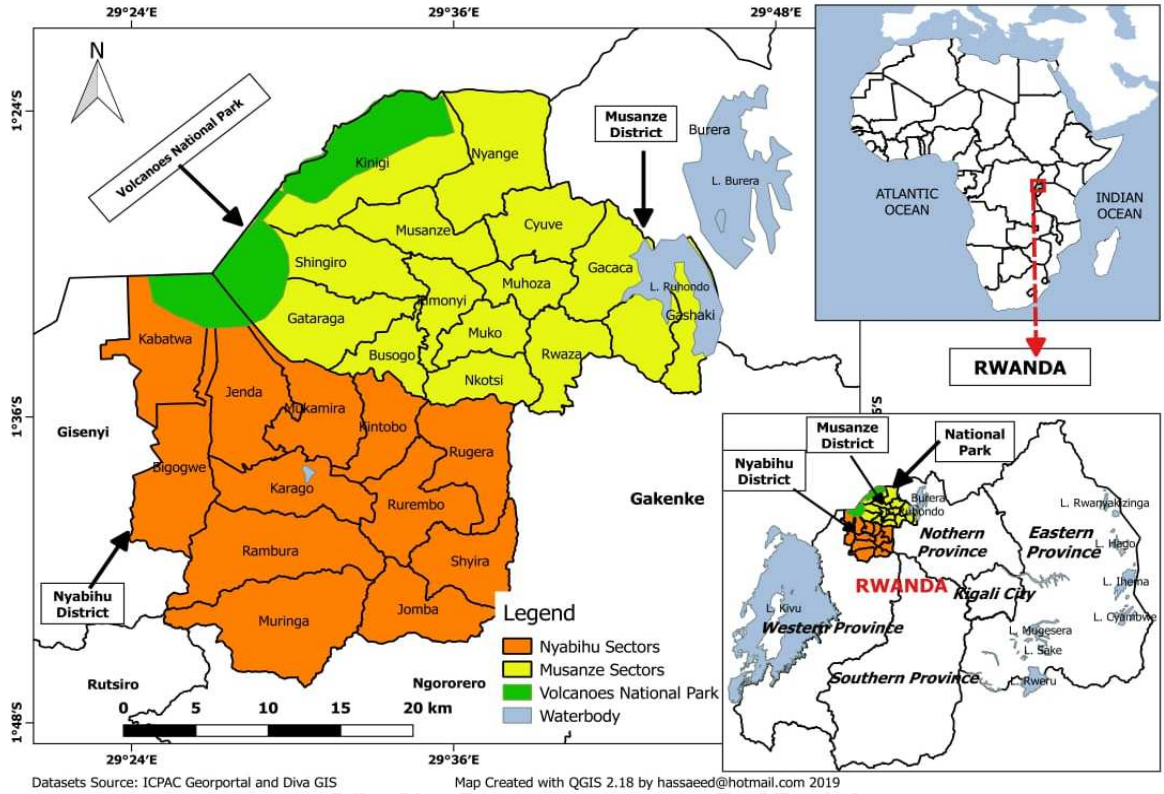
To demostrate the relationship between value chain financing and access to finance of smallholder farmers in Rwanda, Kopparthi & Nkubito (2012) have conducted a sudy on 122 rice farmers and staff from the microfiance institution. They have found that access to value chain financing products has improved the productivity and profits of farmers as well as the profit of microfiance institutions operating rice value chain in Mukunguli Mashland, Rwanda. Investigating on improving smallholder livestock farmers' income, Fakudze & Machethe (2015) have proved that, MAFISA-NERPO Livestock scheme which provided value chain fiancial products has impvoved the cash incomes of 80 per cent of participating smallholder livestock farmers in South Africa. They concluded that through value chain finance, the scheme adddressed the factors hindering the effectiveness and efficiency of financial institutions to expand credit to farmers. Middelberg (2017) also confirmed that the value chain financing increased access to agricultural finance for Zambian smallholder farmers as enabler to increase smallholder farmer's mechanization levels and to improve productivity. However, the author suggested a refinement of the value chain finance framework to enhance its effectiveness for both financial institutions and smallholder.

In the study on access to credit and its impact on Welfare in Malawi, Diagne & Zeller (2001) have also revealed that agricultural financing has a significant positive impact on agricultural productivity as it enables farmers to acquire the necessary inputs such as improved seeds, fertilizers and labour in order to raise the productivity of farmers. Similarly, Dong *et al.*(2010) in their study on the effects of credit constraints on productivity and rural household income in China conducted on 511 households from Heilongijiang Province, using endogenous switching regression model, they have shown that agricultural productivity can be increased by 31.6 per cent with the removal of credit constrained conditions. The skills and knowledge of farmers cannot be fully used as far as they are under credit constrained conditions. The study concluded that productivity and income of credit unconstrained farmers are higher than the productivity and income of credit constrained farmers. This has also been confirmed by Duy (2015) in his research on the role of access to credit in rice production efficiency of rural households in the Mekong Delta, Vietnam. His study has concluded that technical efficiency and rice yield were positively influenced by accessed to credit, education and technology, and access to formal credit sector had a lager effect on rice production than access to informal credit. Parvadavardini & Nagarajan (2015) have also demonstrated a positive impact of agricultural financing on the farmer's productivity through a sustainable use of extension practices. Nevertheless, the value chain financing is an opportunity to expand finances for agricultural activities. It also strengthens the linkages among the participants in value chain. By drawing lessons from potato farming in Musanze and Nyabihu districts, this

paper identified the constraints hindered smallholder farmers to use agricultural value chain financing in Rwanda.

## 3. Methodology

The study was conducted between September and December 2019, in Musanze and Nyabihu districts situated in the North West volcanic zone. This is a highly agricultural potential zone in Rwanda, characterized by steeply sloping hills, high altitude, fertile volcanic soils and abundant rainfall favourable for potato crop. Musanze district is located in Northern province at geographical coordinates 1°30' 27'' S 29°36' 24'' E, Nyabihu district is located in Western Province at geographical coordinates 1° 39' 10" S 29° 30' 25" E respectively(https://www.citipedia.info/province/general/Rwanda). In this zone, potato is grown and harvested three times a year and it produces more than 60 per cent of the national production (FAO, 2016; Mogabo *et al*., 2018). The two districts were purposively selected for their agro ecological potentials including volcanic soils, high altitude, and abundant rainfall favourable to potato production (figure 1 shows the study area).




Datasets Source: ICPAC Georportal and Diva GIS  Map Created with QGIS 2.18 by hassaeed@hotmail.com 2019

**Figure 1: Map of Africa and map of Rwanda showing the study area**
**Source: ICPAC Georportal and Diva GIS**

However, to make the sample more representative three sectors from each District were selected, two of the three were considered as treated group and one of the three considered as control group. Through administrated structured questionnaires, the cross-sectional data were collected from 585 smallholder potato farmers' households randomly selected from the lists of exiting potato farming organizations. The sample was divided into two groups of farmers, 275 consisted of farmers who used agricultural loan to meet the liquidity requirements to purchase inputs such seeds, fertilisers and other production costs and 310 farmers who did not use agricultural loan. 6 focus groups discussions, each group comprised of 8 to 10 people and 10 key informant interviews were conducted to enrich the data (Table 1 shows the distribution of the sampled potato farmers). The study also used secondary data collected from internet, academic journals, and reports relevant to this study. SPSS 16.0 and STATA 13.1 statistical packages were used respectively for descriptive statistics and econometrics outputs.

**Table1: Distribution of sampled potato farmers**

| District | Sectors | Non-Participants (N=310) | | Participants (N=275) | | Pooled (585) | |
|---|---|---|---|---|---|---|---|
| Musanze District | Gataraga | 151 | 48.71 | 0 | 0.0 | 151 | 25.81 |
| | Kinigi | 0 | 0 | 65 | 23.64 | 65 | 11.11 |
| | Nyange | 0 | 0 | 66 | 24.00 | 66 | 11.28 |
| Nyabihu Ditrict | Jenda | 0 | 0 | 80 | 29.09 | 80 | 13.68 |
| | Karago | 159 | 51.29 | 0 | 0.0 | 159 | 27.18 |
| | Mukamira | 0 | 0 | 64 | 23.27 | 64 | 10.94 |

**Source: Author's Field work 2019/2020**

### 3.1. Analytical methods

This study used a Probit regression model based on the utility theory to determine the factors influencing potato farmers' decision to use agricultural financing.

Following on Schultz (1964), we postulate that farmers are expected to act rationally within the context of available resources and technology. Therefore, the demand for credit is defined as the utility that the farmer is expecting from the credit which can be expressed as:

$U= U(X_1, X_2,\ldots\ldots X_n)$ ……(1)

Where U is the total individual utility, it is assumed to be a function of goods and services to be consumed. $X_i$ being the individual household demand to consume or invest, *i=1,2,……..n.* Knowing that nothing is offered freely, let $p_1, p_2 \ldots p_n$ represent the prices of goods and if household income is equal to its expenditures, then total income can be represented as:

$Y= p_1 X_1, p_2 X_2, \ldots p_n X_n$ ……(2)

Farmer has the full right to request for a loan from any sources. According (Petrick, 2004), the maximum amount that he /she can borrow depends on many factors including income, socioeconomic and production characteristics, the fulfilment of the loan requirements and other factors important to determine the farmer's decision to use agricultural loan.

However, to participate and use of agricultural loan depends not only on the farmer's observable characteristics. It also depends on some unobservable characteristics which if not controlled for can overestimate, underestimate or report impact where none exists at all. The variable that may constrain farmer household's decision to use agricultural loan includes socioeconomic, demographic, institutional, and financial and market factors (Baltenweck *et al.*, 2006, Shili & Umali, 2007, Sirak & Bahta 2007).

The Probit model assumes the estimated probabilities of using agricultural loan are 0 and 1. Therefore, farmers are portioned into two categories: farmers who participated and used agricultural loans and farmers who did not. $P_{it}$ can be expressed as follows:

$P_{it}= f(X_1, X_2, \ldots\ldots \ldots X_n)$ ……(3)

Where $P_{it}$ takes the value 1 if the farmer's marginal utility of using agricultural loan is greater than 0, $P_{it}$ takes the value 0, if otherwise. $X_1, X_2, \ldots X_n$ being the farmer household characteristics and other factors important to determine the farmer's decision to use the loan. While we observe the values 0 and 1 of variable $P_{it}$, there is a latent unobservable continuous variable $P^*_{it}$ that determines the binary censoring, expressing the utility the smallholder farmer get from participating in agricultural loan. Assume $P^*_{it}$ represent the critical decision point for a farmer to use agricultural loan or not. $P^*_{it}$ can be specified as follows:

$P^*_{it}= \beta_o+ \beta_1 X_1+ \beta_2 X_2+\ldots. + \beta_n X_n+ \mathcal{E}_{it}$……(4)

and that $P_{it} =1$ if $P_{it} *>0$,

$P_{it} =0$ if $P_{it} * \leq 0$

From (4) $Pr(P=1)= Pr (\beta_o+ \beta_1 X_1+ \beta_2 X_2+\ldots. + \beta_n X_n+ \mathcal{E}_{it} >0)$…… (5)

Farmer *i* will use loan if $P_{it}>P^*_{it}$ , $P^*_{it}>0$; farmer *i* will not use the loan if $P_{it}<P^*_{it}$, $P^*_{it}\leq 0$

The error term is assumed to be normally distributed so that probability that $P_{it} \leq P^*_{it}$ can be computed from the cumulative normal probability function.

$P^*_{it}$ reveals the willingness of farmer to use agricultural loan, X1, X2,…., $X_n$ explanatory variables are factors influencing to take decision to participate and use agricultural loan, coefficients $\beta_1$, $\beta_2$ … $\beta_n$ provide consistent estimates of the explanatory variables and $\varepsilon_{it}$ the error term normally distributed with constant variance.

Based on the conceptual framework, the empirical model is estimated using farmer's characteristics assumed to influence their agricultural loan decisions. These include farm and farmer's characteristics such as age, sex, marital status, household size, education level, Log household income, household assets, total land size, membership to farming associations, training in potato practices, farming experience and distance to markets. The empirical model used to determine the factors influencing farmer's decision to participate and use agricultural value chain financing was as follows:

$P_{it} =\beta_o+ \beta_1$ *age*$+ \beta_2$ *Sex*$+ \beta_3$ *marital status*$+ \beta_4$ *Household size*$+\beta_5$ *Education*$+ \beta_6$ *Household income*$+ \beta_7$ *asset household (Land)* $+ \beta_8$ *asset household (house)* $+ \beta_9$ *asset household (livestock)* $+ \beta_{10}$ *asset household (transport equipment)* $+ \beta_{11}$ *Total land size*$+ \beta_{12}$ *Membership to farming associations* $+ \beta_{13}$ *training in potato practices* $+ \beta_{14}$ *Farming experience of household head in potato practices*$+ \beta_{15}$ *distance to markets* $+\mathcal{E}_{it}$.

## 4. Results and Discussions

### 4.1. Socio economic characteristics of sampled potato farmers

The descriptive statistics of potato farmers presented in table 2 showed that the mean age of sampled potato farmers was 41.4855 years ranging between 26 years and 63 years. This implied that potato farmers were in their productive years. The age of household head is an important element in decision making process whereby the older farmers are more experienced farmers than the young farmers. The age might influence either positively or negatively the decision of the farmer to participate or not to participate to the agricultural financing to improve the wellbeing of their family members. The table also

demonstrated that farmers' participant to agricultural financing have more family members (5.05) than farmers' non-participant to agricultural financing (4.89). This implied that participants might have advantages of family labour in potato production than non-participants. The mean household size of potato farmers in study area was 4.96 members per family, which did not deviate much with average household size of 4.3 members at national level (NISR & MINECOFIN, 2014).

**Table 2: Socio economic characteristics of farmers in the sample**

| Variables | | Non-Participants N=310 | | Participants N=275 | | Pooled sample N=585 | |
|---|---|---|---|---|---|---|---|
| | | Mean | Standard deviation | Mean | Standard deviation | Mean | Standard deviation |
| Age (years) | | 41.48547 | 8.767949 | 41.70545 | 8.631368 | 41.4855 | 8.76795 |
| Household size | | 4.893548 | 1.467542 | 5.050909 | 1.525079 | 4.96752 | 1.495646 |
| **Variables** | | **Frequency** | **Percentage** | **Frequency** | **Percentage** | **Frequency** | **Percentage** |
| Sex of the respondent | Female | 110 | 35.48 | 115 | 41.82 | 225 | 38.46 |
| | Male | 200 | 64.52 | 160 | 58.18 | 360 | 61.54 |
| Marital status of farmers | Single | 7 | 2.26 | 14 | 5.09 | 21 | 3.59 |
| | Married | 279 | 90.00 | 235 | 85.45 | 514 | 87.86 |
| | Widow | 23 | 7.42 | 25 | 9.09 | 48 | 8.21 |
| | Separated | 1 | 0.32 | 0 | 0.00 | 1 | 0.17 |
| | Divorced | 0 | 0.00 | 1 | 0.36 | 1 | 0.17 |
| Education | No formal education | 54 | 17.42 | 26 | 9.45 | 80 | 13.68 |
| | Primary education | 180 | 58.06 | 130 | 47.27 | 310 | 52.99 |
| | Secondary education | 76 | 24.52 | 119 | 43.27 | 195 | 33.33 |
| Experience in potato farming (Years) | Below 1 | 21 | 3.6 | 3 | 0.5 | 24 | 4.1 |
| | Between 1-5 | 44 | 7.5 | 24 | 4.1 | 68 | 11.6 |
| | Between 6-10 | 83 | 14.2 | 89 | 15.2 | 172 | 29.4 |
| | Between 11-15 | 93 | 15.9 | 109 | 18.6 | 202 | 34.5 |
| | Above 15 | 69 | 11.8 | 50 | 8.5 | 119 | 20.3 |

**Source: Field work 2019/2020**

Table 2 also revealed that from 585 interviewed households, 87.86 per cent of the sampled farmers were married, 12.14 per cent were unmarried (widow, single separated and divorced). The married non-participants were 90.00 per cent while the married participants were 85.45 per cent. The high percentage of married non-participants may delay the decision making. As far as agricultural financing is concerned, there is always need for the consent of spouses. The table also showed that 61.54 per cent of sampled households were male headed while 38.46 per cent were female headed. About 35.48 per cent and 64.52 per cent of the non-participants were respectively female and male headed households, while 41.82 per cent and 58.18 per cent of the participants were respectively female and male headed households. This shows the domination of male in decisions relating to potato production.

As illustrated in table 2, 195 (33.33 per cent) of sample farmers had attended high schools while 310 (52.99 per cent) attended primary education and 80 (13.68 per cent) had no formal education. Among those who attended high school, the non-participants were 76 (24.52 per cent) while the participants were 119 (43.27 per cent). However, the low level of education of non-participants farmers had a negative impact of participating and utilizing the agricultural value financing. According to NISR (2012), the 2012 Rwanda Population households Census (RPHC) showed that 68 per cent of Rwandan population aged 15 and above were literate, with 12.4 per cent attended secondary education. This implied that the level education of potato farmers in the study area was considerably improved comparatively to the average of persons with secondary education level in Rwanda. The results confirmed with the findings of different researchers who found that the education contributes positively to credit worthiness of the farmers (Arene, 1993; Enimu, Eyo, & Ajah, 2017) and to adopt the agricultural technology to produce more (Sebatta *et al.*, 2014) and decide on the access to the agricultural financing, than non-educated farmers. Similarly, from the interviewed sample, 4.1 were below 1 year of farming experience, 11.6 per cent were between 1-5 years of potato farming experience while 84.2 were above 5 years and more experienced potato farming. In Rwanda, financial institutions do not have much experience in financing agricultural sector. Therefore, the longer experience in farming might increase the abilities of a farmer to whether to opt or not for the agricultural loan and increase their creditworthy from lending institutions.

### 4.2. Factors influencing potato farmers' decision to participate to the value chain financing

Probit model was adapted to determine the factors that influence potato farmers' decision to participate and use the value chain financing in Musanze and Nyabihu District.

The factors were found through regression of farmer' use of agricultural value chain financing ($P_{it}$ (0,1)) versus sex, age, marital status, household size, education, household income, asset household (Land), asset household (house) asset household (livestock), asset household (transport equipment), total land size, farmers' membership to farming association, training in potato practices, farming experience of the household head and distance to markets. Table 4 illustrates the result of statistical analysis of the independent variables influencing farmers to use value chain financing.

**Table 3: Probit estimates for factors influencing potato farmers' decision to participate to the value chain financing**

| Variable | Coef. | Robust Std. Err. | z | P>z |
|---|---|---|---|---|
| Sex of household head (1=Male, 0 otherwise) | -0.405*** | 0.124 | -3.270 | 0.001 |
| Age of household head | 0.014* | 0.008 | 1.800 | 0.072 |
| Education level | | | | |
| Primary education | 0.303* | 0.177 | 1.710 | 0.087 |
| Secondary Education | 0.724*** | 0.196 | 3.690 | 0.000 |
| Marital status ((1=Married, 0 otherwise) | -0.388** | 0.178 | -2.180 | 0.029 |
| Farming experience | -0.098** | 0.050 | -1.970 | 0.049 |
| Household size | 0.054 | 0.040 | 1.350 | 0.176 |
| Log household income | 0.388*** | 0.080 | 4.880 | 0.000 |
| Farm size | 0.008 | 0.085 | 0.100 | 0.923 |
| House assets (1=Yes, 0 otherwise) | 0.552 | 0.369 | 1.490 | 0.135 |
| Livestock assets (1=Yes, 0 otherwise) | 0.157 | 0.120 | 1.310 | 0.192 |
| Transportation assets (1=Yes, 0 otherwise) | 0.196 | 0.289 | 0.680 | 0.497 |
| Membership to farming association (1=Yes, 0 otherwise) | 0.444*** | 0.127 | 3.500 | 0.000 |
| Training in Potato practices (1=Yes, 0 otherwise) | 0.003 | 0.126 | 0.020 | 0.981 |
| Distance to the market | 0.024*** | 0.005 | 4.420 | 0.000 |
| Constant | -6.584*** | 1.136 | -5.790 | 0.000 |

*, ** and *** denotes that the coefficients are significant at 10, 5 and 1 per cent levels respectively.

The model has given the variables which influence positively and negatively the farmers' decision to participate to agricultural financing at different levels of significance 1per cent, 5 per cent and 10 per cent . The results revealed that Sex and age are significant at 1 per cent and 10 per cent respectively. The sex and age are important variables that may establish the individual characteristics of different decision makers. Sex had a negative and highly significant relationship with participation and use of agricultural finance. This is consistent with the finding of Abdul-Hanan *et al.* (2015) who found gender significantly and negatively related to decision to access agricultural credit by farm households. This indicated that female headed households were more likely to receive agricultural loan than male headed households. Given that the government and most development finance institutions focus on women, they developed more financial packages that might be factors for women entrepreneurs to improve in agricultural value chain development. The result was consistent with the finding of Akudugu (2012) who found that though female are considered disadvantaged, creditworthy and more likely to opt for credit than their male counterparts.
With respect to age, the results revealed that farmers' decision to participate and use agricultural loan increases with the age of the farmer. This result is understandable, given that active age group is important factor for decision making. Financial providers are likely to supply loans to mature borrowers with ability to use and repay the loan. The finding is consistent with the findings of Kosgey (2013) and Abdul-Hanan *et al.* (2015) who found that access to agricultural loan is influenced by farmers' age. The study also found that older farmers were expected to have experiences in farming, much information about various sources of finance and much credibility with loan providers than younger farmers. Marital status is negative; this implied that unmarried farmers (single, separated, divorced or separated) were more likely to participate to agricultural financing than the married counterparts. Married household may not unilaterally decide to participate to agricultural financing without consent of the partner. Despite the fact that the government of Rwanda prone for social and labour equality between spouses, the female right on household property is still limited and thus limited access and use of credit. Particularly in Musanze and Nyabihu districts where the husbands have social, political power and domination in decisions affecting the household resources. A significant and positive relationship was also observed between household income and participation and use of agricultural financing. This implied that in the study area farmers with high income were more likely to participate and use agricultural finance compared to those with lower income. Farmers with higher income were socially and economically better off and creditworthy to loan providers compared to farmers with lower income. In addition banks and other financial provider might be willing to supply loan to wealthier farmers economically productive and with lower risk of default (Asante-Addo et al., 2017). The results showed a positive significant relationship between education and participation to agricultural finance. The education level enables farmers to have updated information on the economical and efficient ways of production. It enhances the abilities of farmers to adopt more advanced technologies and crop management techniques of increasing productivity (Rosegrant & Cline, 2003). High educated farmers have capacity to find and read financial market signals and find the less scaring signals to request for loan compared to low educated farmers. Educated famers have a clear plan on how to increase the investment capital in potato production and hence participate and use agricultural financing. The result of the study was consistent with Diagne & Zeller (2001) who found a positive relationship between education level of the household head with making informed decisions about borrowing.

The result revealed also positive and significant (at 1 per cent ) relationship membership to farming association with the probability of a farmer to participate to agricultural loan. The idea behind joining the farming association is to increase the credit worthiness with financial providers. This implied that when farmers adhered to farming associations, were not required to provide collateral for the loans contracted with the loan providers. Members of the farming associations jointly served as guarantee for each other. This was consistent with Akudugu (2012) and Lukytawati (2009) who found that membership to solidarity association is fundamental for farmers to request for loan.

Surprisingly, farming experiences was found significant at 5 per cent but negatively related to participation and use of agricultural loan. This implied that the probability of farmers to use credit decreased with the increase in farming experience. Though contrary to study expectation, the result was reasonable as accumulated income from previous production is reinvested to purchase inputs needed. Therefore, the increased income accumulation would result in the decreased willingness of the farmer to request for investment loan. However, the finding contradicted with the find of Kgowedi et al. (2002) who associated the increased credit with increased income generation. Result on distance to market was significant at 1 per cent and positive with influence of participating to agricultural financing. The significant relationship between distances from the farm gate to market implied the importance of additional financing for farmers operating further away from the market to economically exploit the economies of scale associated with large land holdings. Larger land holdings from urban areas are actually less likely to be converted into commercial plots (urban houses or infrastructure), but very attractive to lenders as less risk collateral.

### 4.3. Constraints faced by smallholder farmers to participate and use agricultural financing for potato production

Agricultural financing and much investment in potato production is an innovative approach that helps farmers to increase production, improve efficiency and respond to consumer demands. It offers opportunities for potato farmers to expand financing for potato productivity and improve efficiency through use agricultural technology including the use of the high yielding seeds, organic and inorganic fertilizers and other agricultural equipment needed in their production processes.

However, small potato producers remain victims of various constraints of access to agricultural financing to increase production. The pooled means in Figure 1 were considered to sort out the critical constraints that limit farmers from accessing to agricultural financing.

**Afraid to borrow,**

Both participants and non-participants were afraid to borrow. Participants in the agricultural loans were more afraid than non-participants. The farmers show that they are not confident in accessing agricultural loans provided by different financial providers particularly Banks. The fear of borrowing arose from little experience of using loans in the production of potatoes.

**Interest rates and other loan charges are too high for an agricultural loan,**

High interest rates charged by financial providers made accessing agricultural loans more risky for the farmers. From this study, it has been realized that Microfinance institutions charge more than 20 per cent while commercial banks charge between 15-20 per cent. The high interest rates disappointed smallholder farmers to use agricultural financing in the production of potatoes.

**Unexpected production,**

The productivity of potato requires much investment in improved seeds, use of fertilisers and weather conditions. Smallholder farmers hesitated of good production primarily due the lack of improved seeds and shortage of fertilisers which lead to low productivity. The farmers also reported that their potato plots were subjected to weather and climatic risks. The uncontrolled natural disasters, droughts and floods, disturbed their production planning. The unexpected productions lead to wastage of resource and constituted barrier to participate to agricultural financing.

**Short repayment period for the loan provided for agriculture,**

Farmers complained about the short time required to pay back the loans. These complaints relate to the growing, harvesting and marketing periods of the potatoes for the farmers can to repay the loan contacted with the donors. Potato growers have always called for a grace period between loan acquisition and harvesting, but financial providers' willing to increase profits made it difficult for farmers to easily apply for a loan to increase their productivity.

**Uncertainty of payment**

Though agricultural loans are important in potato production, farmers have revealed their uncertainty of paying back their loans on time. This uncertainty is based to production constraints including lack of improved seeds, low access to fertilisers, weather and climate change and price market volatility.

**Lack of collaterals**

Farmers have difficulties in guaranteeing their loans. The financial providers' attitude is fully centred on tangible collaterals, land and houses of high values to recover the loans. However, the fear of farmers to engage the family properties to secure loans worsened their access to agricultural financing. Moreover, farmers' saving attitudes constituted another limitation to farmers to access of agriculture financing.

**Lack of financial literacy and lack of knowledge and skills in project budgeting**

The little education, little knowledge of how modern lending institution work, lacks of knowledge and skills in project budgeting limited financial providers to allocate loans to potato farmers.

The study also found that lack of enough saving, lack of information on availability of loans for agriculture, long application procedures for cultivation loan compared to other loan, many documents required to process the agricultural loan and relatively low loan provided that could not cover the farmers' needs constituted other threats for potato farmers to use agricultural financing in their production activities.

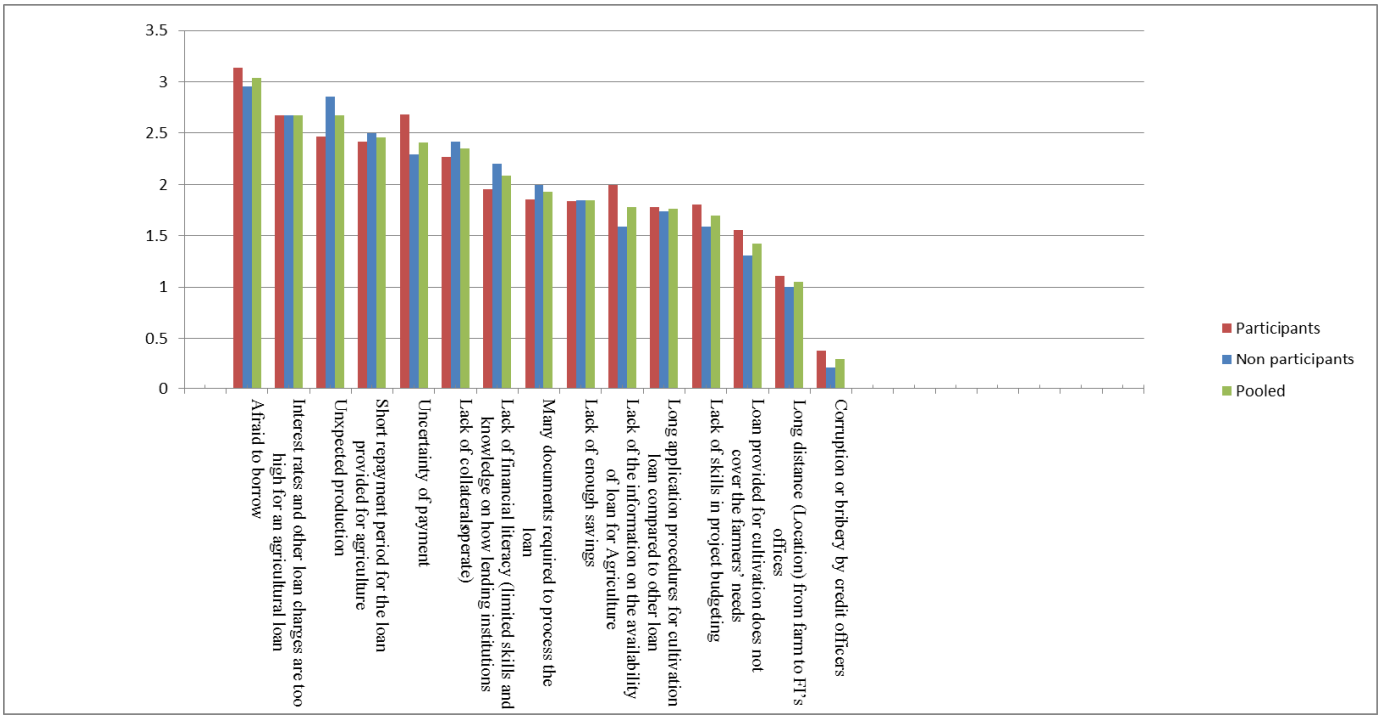



**Figure 1: Constraints faced by smallholder potato farmers to participate and use of agricultural financing**

## 5. Conclusion

This study has determined the factors that influence the farmers' decision to participate and use agricultural value chain financing. The study found that sex, age, education, farming experience; the household head income; membership to farming associations significantly influence farmers' decision to participate and use agricultural value chain financing. The study has also analysed the constraints that limit smallholder potato farmers' decisions to participate and use agricultural value chain financing. The study found that financing agricultural activities remain a key challenge for smallholder potato farmers. Some of constraints faced by farmers were under the farmers own control, such as fear of borrowing, lack of financial literacy, lack of skills in budgeting and unexpected production. While others were beyond their control, such as high interest rate and others loans charges, lack of collaterals, short repayment period lack of financial literacy and lack of collaterals, long application procedures and documents required for agricultural loans compared to other loans. To overcome those constraints, farmers need to be always linked to their business partners including suppliers of quality seeds, suppliers of fertilizers, traders and financial institutions that are inclusively willing to develop the value chain. The government and the relevant value chain stakeholders are also recommended to formulate integrated policies that facilitate smallholder farmers to access to the convenient financing products in order to improve productivity, increase food security and to meet the customer demands.

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## Conflicts of interests

The authors declare no conflict of interest

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