



Analysis of the Factors Influencing Smallholder Rice Farmers' Access to Credit in the Upper East Region of Ghana

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Authors' contributions

This work was jointly carried out by all the authors. Authors Elisha Kwaku Denkyirah and EDO designed the study and wrote the protocol. Authors Elisha Kwaku Denkyirah, EDO and Elijah Kofi Denkyirah collected and managed the data. Authors Elisha Kwaku Denkyirah, AAA and DTA analyzed the data. Authors Elisha Kwaku Denkyirah, EDO and DTA drafted the manuscript. Author Elijah Kofi Denkyirah managed the literature searches. Authors EDO, AAA and Elijah Kofi Denkyirah reviewed and contributed to the editing of the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Smallholder rice farmers in the Upper East Region of Ghana lack access to credit and this can hinder adoption of technologies introduced in the region, eventually impacting on productivity of rice which is one of the major cereals cultivated and consumed in Ghana. A total of 140 rice farmers

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were sampled for the study in Kassena-Nankana district in the Upper East Region using a multi-stage sampling technique. This study employed the probit model to estimate factors that influence rice farmers' access to credit. The result of the study revealed that rice farmers invested the credit they access from formal and informal sources into non-agricultural activities which are mostly not what the credit was taken for. This implies a diversionary behaviour of farmers from what is expected. Also, majority of the farmers received cash credit below GH¢ 1000. The probit result revealed that age, marital status, membership of farmer based organisation, extension visit, record keeping and farm income were the significant variables that influenced rice farmers' access to credit. Age and farm income negatively influenced farmers' access to credit while marital status, member of farmer based organisation, record keeping and extension visit positively influenced farmers' access to credit. The study recommends that rice farmers should be encouraged and sensitized to use the credit for agricultural activities in order to increase productivity. Extension agents should train rice farmers on record keeping since record keeping was seen to be a key factor that positively influenced farmers to receive credit especially from formal credit sources. Lastly, rice farmers should be encouraged to form groups, given that it also positively influenced farmers' access to credit.

Keywords: Access to credit; smallholder rice farmers; probit regression model; Kassena-Nankana; Upper East Region; Ghana.

ABBREVIATIONS

*FBO : Member of Farmer Based Organisation
NRDS : National Rice Development Strategy
ICOUR : Irrigation Company of Upper Region*

1. INTRODUCTION

Agriculture has been a way of life for humans since time immemorial from the primitive man's hunting and gathering to establishment of small communities where farming was done on subsistence basis. This shows how inevitable agriculture is to the survival of man. Today agriculture has moved from subsistence to commercial basis, due to increased population dynamics among others and employs technology as integral part of its labour force. In Ghana, it is the most important sector of the economy and plays a sturdy role in poverty reduction. Agricultural products range from food (fruits, cereals, grains, root and tuber crops, nuts, vegetables) to non-food products (rubber, bamboo, timber). The cultivation of cereals especially rice is one of the most important sectors in Ghana's agriculture.

Rice is the second most important cereal after maize and it is one of the major cereals cultivated among farmers in the country [1,2]. From the year 2005 to 2009, rice accounted for more than half of cereal imports and a smaller percentage (5%) of total agricultural imports [3]. Generally, rice production and the area cultivated under rice is increasing. This expansion is encouraging and could be the result of various initiatives such as the national fertilizer subsidy

program introduced in 2008 and the passage of the National Rice Development Strategy (NRDS) in 2009, to which rice farmers have likely responded in order to develop the rice sector in Ghana. However, 30% of the potential yield estimated at 8 tons/hectare/year has been achieved [4]. As part of measures to increase productivity of rice in Ghana, new technologies have been introduced. An example is the System of Rice Intensification which is an enhancement over conventional growing techniques. It is however noted that the adoption of agricultural technology depends on availability and accessibility of credit [5].

The credit that farmers access for their daily on-farm or off-farm activities can be grouped into two; cash credit and non-cash credit. Cash credit is the one which farmers access from recognized financial institutions. Non-cash credit is what farmers access in the form of inputs which are normally supplied by either individual entrepreneurs/businessmen or companies. The payback of this kind of credit is done after the farmers have harvested their produce. The current study concentrated on the cash credit. The ever-increasing importance of credit in agriculture in the world at large can never be overemphasized. Credit is one of the principal components of all the activities under agriculture. Access to credit potentially ensures increased output and enhances food security, serving as a major driving component for increased agricultural production [6-8]. The problem however, is that smallholder rice farmers in Upper East Region of Ghana lack access to credit and this potentially hinders their adoption

of new technologies such as the System of Rice Intensification which has been introduced in the region. It is believed that access to credit is one of the major challenges faced by smallholder farmers especially those in developing countries for their day-to-day farming activities [9]. Majority of smallholder farmers cannot adopt any innovation to boost their farming activities to help them obtain higher output, unless they get access to production credit [10]. Similarly, other studies such as [11-13] report that adoption and use of improved inputs reduces and have adverse effect on farm profit and investment when farmers are constrained by access to credit. Farmers' lack of access to credit is a result of several factors [14-19]. It is therefore imperative to analyse the factors that limit farmers' access to credit, since various studies have shown that credit is important in agricultural production. The study seeks to address the following objectives;

1. Identify the major sources and uses of credit by rice farmers in the study area.
2. Identify the amount of credit rice farmers received in the study area.
3. Examine the factors that significantly influenced rice farmers' access to credit.

Considering the fact that studies have revealed the importance of access to credit on adoption of agricultural technologies and agricultural productivity, it is crucial to assess rice farmers' access to credit in order to promote the adoption of technologies among rice farmers which would help boost rice production in Ghana. This study seeks to add to already existing knowledge by uniquely identifying factors that limit access to credit in the particular research area and address it to mitigate its challenges, thus, providing plausible recommendations for policy makers.

The word credit has diverse meanings. Some people term credit as "loan" while others refer to it as 'borrow'. Credit refers to a loan which is used to purchase goods and/or services and paid at a future date. Credit could be distinguished from loan, as the term credit refers to an asset or a financial reserve which can be used to exchange for a loan [20]. This means for a farmer to obtain a loan, he/she needs to have a security which is credit. Credit transaction requires a form of security in order to obtain a loan where interest charges are paid on the loan obtained, except for loans obtained from friends and relatives [21]. Credit could also mean "monetary" or financial aspect of capital resource

(goods employed but necessarily used up to the course of production [22]. Other studies also refer to credit as the process of having control over the use of money, goods and services or a tool for ensuring the transfer of purchasing power from an individual or organization to another temporarily, with a promise to repay at a future date as credit [23,24]. In general, credit can be termed as a cash or non-cash item used for goods and services with a promise to repay at a future date.

Several studies have shown that farmers' access to credit is influenced by several factors. [25] used probit regression model in identifying the determinants of credit constrained condition of farm households in the rural areas of central Sulawesi, Indonesia. The result of their study indicated that education, age and annual income significantly determined whether or not a farmer would have access to credit. [26] revealed that age, gender, farm size, level of education, marital status, access to extension service, land acquisition and income of household head significantly determined farmers' access to credit. [27] in assessing factors influencing smallholder farmers' access to agricultural microcredit in Northern Ghana revealed that gender, household income, farm capital, improved technology adoption, contact with extension, the location of the farm, and awareness of lending institutions in the area were the significant variables. [28] showed that age, gender, education and dependency ratio of farmers are significant variables that influenced farmers' access to credit. [29] used the probit model to analyse farmers' access to formal credit in the rural areas of Nigeria. The result of the study revealed that level of income, collateral, educational attainment and marital status have significant positive influence on farmers' access to formal credit. [30] used the logistic regression model to estimate the factors that influenced agricultural credit demand in northern Ghana and found out that age, education, group membership and source of credit significantly influenced agricultural credit demand. [31] in their study on social capital and access to credit among cassava farming households in Ogun State, Nigeria, found out that age, payback period and household size significantly influenced access to credit. [32] used the probit model to analyse factors affecting small-scale farmers' decision to take credit in the Greater Letaba Local Municipality in South Africa. The result of their study revealed that farming experience, gender and marital status, farmers' age, education level and membership to

farmers' association significantly influenced farmers' decision to take credit. This study employs the probit model and estimates the effect of gender, age, educational level, marital status, extension visit, member of farmer based organization, record keeping, farm size and farm income on farmers' access to credit.

2. METHODOLOGY

2.1 The Study Area

The Kassena-Nankana East District in the Upper East Region of Ghana is among one of the thirteen Municipalities and Districts in the Upper East Region. The Kassena-Nankana East District lies within the Guinea Savannah woodlands. The District shares boundaries with West Mamprusi to the South, Bongo District and Bolgatanga Municipal to the East, Builsa South District, Builsa District and Kassena-Nankana West District to the West and to the North with Burkina Faso. About 68.7% of the working population is employed by agriculture which is the main occupation in the District. Trading, food processing and small-scale artisans are other occupations that employ the remaining 31.3% of the working population. During the dry season, farms are irrigated by an irrigation scheme (Tono irrigation scheme) in the District. The most cultivated crop is cereal. Other crops cultivated in the district include vegetables, legumes and root tubers. The savannah ochrosols and groundwater laterite are the two main types of soil within the District. The Savannah ochrosols is suitable for cultivation of cereals, legumes and vegetables. The arable land sites including most parts of the Tono Irrigation Project sites where both wet and dry season farming activities are concentrated constitute the Savannah ochrosols.

2.2 Sampling Technique and Sample Size

The multi-stage sampling technique was used to select the respondents for the study. The multi-stage sampling technique helps in designing a smaller sampling frame to make the study practicable in terms of cost and time. This sampling technique employs more than one stage and combines a number of sampling techniques. The specified number of stages depends on the study undertaken [33]. The multi-stage sampling in this study entailed four (4) stages. The first stage was purposively selecting the Upper East Region because of the predominance of rice production in the region. The second stage was randomly selecting the Kassena-Nankana East District out of the several

rice producing district in the Region. Third stage, seven (7) communities were randomly selected in the district. The communities are: Wuru, Bonia, Biu, Yogbania, Gaani, Kapania, and Korania. The fourth stage, twenty (20) farmers were randomly selected from each community. A total of 140 rice farmers were sampled for the study.

2.3 Data Source and Collection

Data was collected from two sources; primary and secondary sources. The primary data was collected from rice farmers in the study area using a well-structured questionnaire which was pre-tested. The secondary data were obtained from relevant publications such as journals, books, articles and reports.

2.4 Empirical Model

The probit or logit model was developed to analyse regression framework which have a dichotomous dependent variable. The dichotomous dependent variable takes the form of a dummy where 1 is yes and 0 is no. Between the two models, economists tend to prefer the probit model over the logit model because of the normality assumption of the probit model, given that several specification problems are more easily analysed because of the properties of the normal distribution [34]. Again, the error term for the probit model is assumed to have the standard normal distribution [35]. Furthermore, the probit model has the ability to resolve the problem of heteroscedasticity and also constrain the utility value to lie between 0 and 1 [36]. The probit model makes the assumption that while we only observe the values of 0 and 1 for the dependent variable Z_i , there is a latent, unobserved continuous variable Z_i^* that determines the value of Z_i [32]. We assume

Z_i^* can be specified as:

$$Z_i^* = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_n X_{ni} + \varepsilon_i \quad (1)$$

$Z_i = 1$ if $Z_i^* > 0$
 $Z_i = 0$, otherwise.

Where X_i represents a vector of explanatory variables, β is a vector of unknown parameters and ε_i is a random disturbance term [37].

The probit model is specified for this study as:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \varepsilon \quad (2)$$

Y = dependent variable (1= access to credit and 0= otherwise)

β_0 = coefficient of constant term
 $\beta_1 - \beta_9$ = coefficient of the independent variables
 $X_1 - X_9$ = explanatory variables
 ε = error term

2.5 Explanation of Variables

2.5.1 Gender

Gender was measured as a dummy with male farmers=1 and female farmers=0. Gender is hypothesized to be positive. This is due to the fact that male farmers are well endowed with resource such as land than their female counterparts, hence, the resource they are endowed with serves as collateral security in accessing credit. Therefore, male farmers are more likely to have access to credit.

2.5.2 Age

Age of the farmer was measured in number of years and is hypothesized as negative. This is due to the fact that financial institutions are reluctant to lend out money to old people for the fear that they may not live long enough to pay back the money [38]. Therefore, younger farmers are more likely to have access to credit.

2.5.3 Educational level

The educational level is expected to positively influence farmers' access to credit. This is because the farmers who attain higher levels of education are able to accumulate knowledge and have better access to information [39]. Therefore, educated farmers are more likely to have access to credit [40].

2.5.4 Marital status

Marital status was measured as a dummy variable with 1=married and 0=otherwise. It is

hypothesized to negatively influence farmers' access to credit. This could be explained by the fact that married farmers use part of their income to cater for their large household and therefore, have higher expenditures which threaten their credit worthiness and therefore do not have access to credit [41].

2.5.5 Extension visit

Extension visit which was measured in number of visits in a production year is hypothesized to positively influence access to credit. This is because farmers gain better access to information from extension agents. Also, extension agents help link farmer groups to credit sources [42,43,27].

2.5.6 Member of farmer based organisation (FBO)

Membership of FBO is hypothesized to be positive. It was measured as a dummy variable where 1=member of FBO and 0=otherwise. Just like extension service, FBOs disseminate information to their members and also, there is a joint guarantee by association members [44,19].

2.5.7 Record keeping

Record keeping was measured as dummy where 1=keeping record, 0=otherwise. It is expected that keeping record would positively influence access to credit. This is because financial institutions require proper documentation of business activities in order to better assess the financial performance of the business over the years and to inform them whether the business is capable of paying back the credit. Hence, farmers who keep records have better access to credit.

Table 1. Description of variables, measurement and a-priori expectation of the variables used in the probit model

Variable	Measurement	A priori expectation
Gender	1 if male, 0 otherwise	+
Age	Years	-
Educational level	1=No formal education, 2=Primary, 3=JHS, 4=SHS, 5=Tertiary	+
Marital status	1=married, 0=otherwise	-
Extension visit	Number	+
Member of FBO	1=member, 0=otherwise	+
Record keeping	1=yes, 0=otherwise	+
Farm size	Acres	+
Farm income	Ghana cedi	+

2.5.8 Farm size

Farm size which is the total land size cultivated by the farmer was measured in acres. It is expected that the larger the farm size, the more likely a farmer have access to credit since land serves as collateral. Therefore, farm size would positively influence farmers' access to credit [32].

2.5.9 Farm income

It is expected that farm income would positively influence access to credit. A farmer who obtains higher farm income is more likely to have access to credit. Farmers who have higher income are seen to have the ability to repay the credit they access and would therefore have access to credit [45].

3. RESULTS AND DISCUSSION

3.1 Socio-economic Characteristics of Rice Farmers

The socio-economic characteristics of rice farmers who had access to credit and those who did not have access to credit are presented in Table 2. Males constitute 64.8% for rice farmers who had access to credit and 58.0% for rice farmers who had no access to credit. Females constitute 35.2% for rice farmers who had access to credit and 42.0% for rice farmers who had no access to credit. In general, the results on the gender of the respondents revealed that there are more males in rice farming than females in the study area. This could be due to the fact that rice farming is more labour-intensive. Therefore, women are not able to meet the needed effort to cultivate the crop.

Rice farmers who were married and had access to credit constitute 94.4% while 72.5% of rice farmers who were married did not have access to credit. Again, for rice farmers who had access to credit, 5.6% were single while those who did not have access to credit constitute 27.5%. Majority of the rice farmers (83.6%) are married, indicating that people who undertake agricultural activities are married. This may be due to the emotional, psychological and physical support they get from their spouses [46].

The educational level of the rice farmers revealed that 29.6% of the rice farmers who had access to credit had no formal education while 33.3% of the rice farmers who did not have access to credit had no formal education. Again,

for rice farmers who had access to credit, 22.5% had primary education, 22.5% had Junior High School (JHS) education, 18.3% had Senior High School (SHS) education and 7.0% had tertiary education while 23.2% of rice farmers who did not have access to credit had primary education, 15.9% had JHS education, 17.4% had SHS education and 10.1% attained tertiary education. In general, rice farmers who had access to credit have higher levels of education than those who did not have access to credit.

Majority (85.9%) of rice farmers who had access to credit were members of Farmer Based Organizations (FBO) while 14.1% were not. It is noted for a fact that farmers get linked to credit sources being a member of FBO [19]. For rice farmers who did not have access to credit, 71.0% were members of FBOs while 29.0% were not. Other factors could have led to majority of farmers who were members of FBOs but did not get access to credit.

Rice farmers who kept records and had access to credit were 42.3% while 13.0% kept records but did not have access to credit. Although 57% of rice farmers had access to credit without record keeping, the majority (87.0%) of farmers who did not have access to credit as a result of the failure to keep record shows that record keeping is an important factor in accessing credit. In general, the results show that majority (72.1%) of rice farmers did not keep records of their farming activities.

Majority (98.6%) of rice farmers who had access to extension had access to credit. This shows that extension agents are reliable sources of information to farmers and help linked farmers to credit sources [43].

3.2 Sources and Uses of Credit

Majority (70.4%) of the rice farmers obtained their credit from friends and relatives, 29.6% obtained credit from financial institutions in the district and 41.4% obtained credit from both sources. This shows that access to bank credit in particular by the rice farmers is out of reach [47-49]. The rice farmers also obtained credit in kind such as land for production. The land is given to them for cultivation by the Irrigation Company of Upper Region (ICOUR). The farmers used the credit obtained for agricultural and non-agricultural purposes. About 85.9% of the farmers used the credit they obtained for non-agricultural purposes while 14.1% used the

Table 2. Socio-economic characteristics of rice farmers

Variables	Description	Access to credit (%)	No access to credit (%)
Gender	Male	64.8	58.0
	Female	35.2	42.0
Marital status	Single	5.6	27.5
	Married	94.4	72.5
Educational level	No education	29.6	33.3
	Primary	22.5	23.2
	Junior High	22.5	15.9
	Senior High	18.3	17.4
	Tertiary	7.0	10.1
Member of FBO	Yes	85.9	71.0
	No	14.1	29.0
Record keeping	Yes	42.3	13.0
	No	57.7	87.0
Access to extension	None	1.4	17.4
	One	19.7	39.1
	Two	46.5	11.6
	Three	15.5	30.4
	Four	16.9	1.4

Source: Field data, 2015

credit for agricultural purposes. This means that farmers use credit to engage in non-farm activities, which are likely to have higher returns than agricultural production [50]. The amount of credit received by farmers in the year under review (2015) is presented in Table 3. The rice farmers received a maximum of GH¢ 2000 as cash credit. Majority (56.3%) of the farmers received credit below GH¢ 1000. This shows that the rice farmers are credit constrained.

Table 3. Amount of credit received by the rice farmers

Amount of credit received (GH¢)	Percentage of farmers
≤ 1000	56.3%
1100 - 1500	28.2%
1600 - 2000	15.5%

Source: Field data, 2015

3.3 Analysis of the Factors that Influence Rice Farmers' Access to Credit

Table 4 presents the probit regression results of the factors influencing access to credit. The significant variables were age, marital status, member of FBO, record keeping, extension visit and farm income. The probit model had a log likelihood value of -73.648 and a χ^2 value of 46.76 at 1% significance level ($p < 0.01$).

Age was negative and statistically significant at 10%. This followed the expected sign which was

negative. This indicates that older farmers are less likely to access credit. This could be due to the fact that financial institutions and other lenders will not like to lend out money to old people for the fear that they may not live long enough to pay back the money [38].

Marital status was statistically significant at 1% and positively influenced farmers' access to credit. This did not conform to the a-prior expectation which shows that marital status negatively influences farmers' access to credit. However, the result is consistent with the findings of [32].

Member of FBO was found to positively influence farmers' access to credit and was statistically significant at 5%. This conformed to the a-prior expectation which shows that member of FBO positively influenced access to credit. This means that farmers get better access to information and credit sources being a member of FBO [44,19].

Record keeping had a positive relationship with access to credit and was statistically significant at 1%. This followed the expectation sign which was positive. This means that farmers who keep records have better access to credit since financial institutions require proper documentation of business activities in order to better assess the financial performance of the business and to inform them whether the business is capable of paying back the credit.

Table 4. Probit regression results of the factors influencing access to credit

Variables	Coefficient	Std. error	P-value	Marginal effect
Gender	0.349	0.252	0.166	0.139
Age	-0.019	0.010	0.056*	-0.008
Marital status	1.179	0.396	0.003***	0.416
Educational level	-0.063	0.101	0.537	-0.025
Member of FBO	0.706	0.305	0.021**	0.271
Record keeping	0.863	0.308	0.005***	0.328
Extension visit	0.274	0.118	0.020**	0.109
Farm size	0.261	0.276	0.345	0.104
Farm income	-0.000	0.000	0.032**	-0.000
Constant	-0.785	0.751	0.296	-
Number of observation (140)	LR Chi ² (46.76)	Prob > Chi ² (0.000)	Pseudo R ² (0.241)	Log likelihood (-73.648)

***, **, * at 1%, 5% and 10% significance levels

Source: field data, 2015

Extension visit was statistically significant at 5% and had a positive relationship with access to credit. This also conformed to the expected sign. Extension visit could be explained by the fact that farmers gain better access to information from extension agents. Also, extension agents help linked farmer groups to credit sources [42,43,27].

Farm income had a negative relationship with access to credit and was statistically significant at 5%. This could be due to the fact that although higher farm income increase farmers' access to credit due to their credit worthiness, they may be limited in their access to credit as a result of lack of collateral.

All the variables followed the expected sign except for education which was expected to positively influence access to credit but showed otherwise. A plausible explanation for this result could be due to the fact that educated farmers know the repercussion of borrowing [51,52].

4. CONCLUSION AND RECOMMENDATIONS

Majority of the rice farmers accessed credit from family and friends (i.e. informal sector). The rice farmers used the credit they received for non-agricultural activities. Majority of the rice farmers received cash credit below GH¢ 1000. Age, marital status, member of FBO, extension visit, record keeping and farm income were the significant factors that influenced farmers' access to credit. Age and farm income negatively influenced farmers' access to credit while marital status, member of FBO, record keeping and extension visit positively influenced farmers' access to credit.

The study provides the following recommendations:

- Rice farmers should use the credit for agricultural activities in order to increase productivity and ensure food security.
- Extension agents should train the rice farmers on record keeping, since record keeping was seen to be a key factor that positively influenced farmers to receive credit, especially, from formal credit sources.
- Extension agents should educate rice farmers on the need to form groups since it also positively influenced farmers' access to credit.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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