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SMALLHOLDER RICE FARMERS' CONTRACTUAL CHOICE UNDER COOPERATIVE IRRIGATION SCHEMES IN COAST AND MOROGORO REGIONS, TANZANIA

*[1]Kangile, R. J and [2]Mpenda, Z. T

[1]Chollima Agricultural Research Institute, P.O. Box 1892, Morogoro, Tanzania

[2]School of Agricultural Economics and Business Studies, Sokoine University of Agriculture (SUA), P.O. Box 3007, CHUO KIKUU, Morogoro, Tanzania.

*Corresponding Author

ABSTRACT

Smallholder rice farmers purchasing inputs through irrigation scheme cooperative is vital since collective purchasing of production inputs reduces unit input cost and economizes transaction cost. This study was conducted to analyze factors underlying farmers' decision making level on choosing (contractual choice) whether to purchase production inputs through the cooperative or other input providers. It also ascertains whether it makes differences in production cost for farmers purchasing inputs through cooperative and those who do not. Data were collected from 200 farmers that are members of rice specialized irrigation schemes in Morogoro and Coast regions. Descriptive statistics and choice model (logit model) were used for data analysis. Results revealed that, distance from the cooperative to the nearest town, number of organizations in which a farmer is a member, extension services, input quality satisfaction and availability of cash and credit as payment mode at the irrigation scheme cooperative are factors influencing smallholder irrigated rice farmers' choice of production inputs provider. It was shown further that, farmers purchasing inputs through irrigation scheme cooperative have lower production costs than farmers purchasing from other input providers. It is therefore plausible to encourage farmers to purchase inputs through irrigation scheme cooperative of which will contribute to reduction of their production costs. This can be enhanced through ensuring that, inputs provided are of satisfactory quality and both cash and credit payment methods are used. In encouraging farmers to purchase inputs through the irrigation scheme cooperative, it is important to provide price incentive in the purchase of inputs.

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1. INTRODUCTION

Irrigated production in Tanzania utilizes 0.93% only of the 29.4 million hectares potential for irrigation. Rice is the major irrigated crop using 75% of the irrigated land (NBS, 2012). In irrigated rice production, smallholder farmers are the main driver with exception of few large scale producers. Smallholder irrigated rice production is done in irrigation schemes which are either managed privately or through collective action. Collective action is concerned with the provision of goods and services that are collectively consumed through the collaboration of two or more individuals and involve pooled decisions. Individuals under collective action choose actions in an interdependent situation (Araral, 2009).

In Tanzania, few irrigation schemes are privately managed and these are under large scale farmers. Collective action is the common method used to manage common pool resources like water in various countries (Janssen and Anderies, 2013). Smallholder farmers in Tanzania, manage irrigation schemes through collective action in two distinct forms; through irrigators' associations and cooperatives (cooperative irrigation schemes).

The irrigation scheme association is the group of farmers using water for irrigation in an irrigation scheme, having their own leadership and enforcing formal and informal rules such as social sanctions (URT, 2010). The irrigation scheme association is more concerned with allocation of water, operations and maintenance of the irrigation scheme with minimal or no involvement in marketing activities.

In cooperative irrigation schemes (collection of individual farmers organized to supply small scale irrigation), the cooperative board manages the scheme on behalf of its members (farmers). Marketing activities are done in addition to maintenance, operation and management of the scheme. Marketing activities are usually done on the side of inputs. Available evidence indicates that, farmers rarely engage in collective marketing on the side of outputs. Farmers keep their own stocks and do private marketing (Kilimo Trust, 2014; RCT, 2015).

On the side of inputs (fertilizer, seeds, herbicides and pesticides), the cooperative board purchases in bulk and sells to members or facilitates on getting suppliers of inputs to members. The inputs are made available for members of irrigation scheme cooperatives to purchase. This is done as an effort of irrigation schemes to economize on transaction costs (market exchange costs) lowering production costs of farmers. Farmers are not forced but encouraged to purchase production inputs through the cooperatives hence are under liberty of choosing (contractual

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choice) whether to purchase through the cooperative or other input providers. Other input providers includes private agricultural input shops, micro-credit institutions such as Opportunity Tanzania Limited and BRAC and own input materials that is farm yard manure for fertilizer and recycled seed materials.

Purchasing inputs through irrigation scheme cooperative is vital since collective purchasing of production inputs reduces unit input cost contributing to reduced cost of production, thus smallholder farmers avoiding purchasing inputs through the irrigation scheme cooperative impends the core function of cooperatives; economization of transaction cost.

The present study thus investigated smallholder farmers' decision making level on purchase of production inputs. The study presents the comparison on costs of production to ascertain whether it makes differences in production cost for smallholder irrigated rice farmers purchasing inputs through the irrigation scheme cooperative and those who do not. The factors influenced smallholder irrigated rice farmers' choice of production inputs provider in cooperative irrigation schemes were also determined.

2. METHODOLOGY

2.1 Description of the Study Area

The study was conducted in Morogoro and Coast regions focusing on cooperative managed and rice specialized irrigation schemes. In Morogoro region, it was conducted in Mvomero district in Dakawa and Mlali irrigation schemes while for Coast region, it was conducted in Bagamoyo district in BIDP (Bagamoyo Irrigation Development Project) and Ruvu irrigation schemes.

2.2 Data Collection, Sampling Procedures and Sample Size

Data were collected using semi-structured questionnaire and the sample of 50 farmers was drawm from each irrigation scheme using probability proportional to size making the total sample size of 200 farmers. The sample was stratified into two groups; farmers purchased inputs through the irrigation scheme cooperative and those who did not. Systematic Random Sampling (SRS) was implemented by selecting each fifth member in the list of members after reshuffling it.

2.3 Analytical Framework

Different methods were used to summarize, analyze and present findings from this study as per objectives. Chi-square method was done using cross tabulation for comparing contractual choice options against level of specialization and socio-economic characteristcis of smallholder farmers.

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Cost of production was quantified using enterprise budgeting technique according to Debertin (2012) in order to compare costs of production for smallholder irrigated rice farmers purchasing inputs through the irrigation scheme cooperative and those who do not. Differences in costs of production were tested using independent sample T-test.

Normality test is one of the requirements for implementation of T-test. The data suitable for T-test should be normally distributed. Shapiro Wilk test was used to test the normality of costs of production. It tests the null hypothesis that the observed distribution fits the normal distribution against the alternative hypothesis that the observed distribution does not fit the normal distribution.

Contractual choice on purchase of production inputs involve individuals making choices. An individual choice follows the *homus economicus* assumption that, if an individual chooses a particular action or object it means the action or object maximizes the utility of that individual. Utility is the total or overall satisfaction which an individual derives from making a certain choice (Nicholson and Snyder, 2008). The choices are inferred using the Random Utility Model (RUM) framework since there is no direct measurement of how much utility a person may gain from making a particular choice. The possible way thus is to make inference from the person's behavior of either buying production inputs through irrigation scheme cooperative or other input providers.

Logit and Probit are common models using the RUM framework. The choice of which model to use depends on the assumption about the distribution of the error term though seem to give similar results in many empirical studies (Greene, 2012). Probit has a normal distribution and logit has a logistic distribution. Logit is flexible and gives better results when there is a mix of categorical and continuous variables (Kirui and Njiraini, 2013). Therefore, this study used logit model to infer choices of smallholder irrigated rice farmers in cooperative irrigation schemes.

RUM framework guides an individual to make a choice between two alternatives by choosing the alternative which maximizes utility such that; U_{1i} is the utility that individual i gets if alternative 1 *(buying production inputs through irrigation scheme cooperatives*) is chosen and U_{0i} is the utility that individual i gets if alternative 0 *(buying production inputs through other input providers)* is chosen.

The choice of a particular alternative by an individual is influenced by various factors (Xi) thus the regression equation 1 below (Index or latent model) could be estimated.

$Y_i^* = \underset{\sim}{X}'_i \underset{\sim}{\beta}_k + \varepsilon_i$; $\varepsilon_i \approx$ Logistic distribution…………………… ……………………… (1)

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The problem with the above model is that Y_i^* is unobservable as the utility of an individual cannot be observed, but choices made by individuals gives some information such that, if y_i =1 then Y_i^* >0 and If y_i =0 then $Y_i^* \leq 0$. This implies that, if an individual makes choice 1 it must be the case that utility of alternative 1 is the highest. The probability of an individual making choices can be determined by combining the regression equation for the unobservable Y_i^* and the equations that links y_i and Y_i^*. An individual choses alternative 1 in such a way that, y_i=1; Y* > 0 and applying probabilities gives equation 2.

$$P[yi=1]=P[\mathrm{Y}^*>0] \quad \text{..... (2)}$$

But from equation 1 above, $Y_i^* = \underset{\sim}{X}'_i\underset{\sim}{\beta}_k + \varepsilon_i$ thus replacing Y_i^* in equation 2 gives;

$$P[yi=1]=P[\underset{\sim}{X}'_i\underset{\sim}{\beta}_k+\varepsilon_i>0] \equiv P[yi=1]=P[\varepsilon_i>-\underset{\sim}{X}'_i\underset{\sim}{\beta}_k] \quad \text{..... (3)}$$

The logistic distribution is symmetric such that,

$$P[yi=1]=P[\varepsilon_i>-\underset{\sim}{X}'_i\underset{\sim}{\beta}_k] \equiv P[yi=1]=P[\varepsilon_i \leq \underset{\sim}{\beta}\underset{\sim}{X}'] = \Lambda\left(\underset{\sim}{X}'_i\underset{\sim}{\beta}_k\right) \quad \text{..... (4)}$$

The model in equation 4, $\mathrm{P}[y_i=1]=\Lambda\left(\underset{\sim}{X}'_i\underset{\sim}{\beta}_k\right)$ is the logit model and was estimated using STATA software. The ratio of making choice 1 to making choice 0 is known as odds ratio. In logarithmic form is known as log of odds ratio (equation 5).

$$\mathrm{Ln}\left[\frac{\mathrm{P}(y_i=1)}{\mathrm{P}(y_i=0)}\right] = \underset{\sim}{X}'_i\underset{\sim}{\beta}_k = \beta_0+\beta_1 x_{i1}+\beta_2 x_{i2}+\ldots\ldots\ldots\beta_k x_{ik}+\varepsilon_i \quad \text{..... (5)}$$

Logit model was used and the dependent variable was type of inputs provider such that, y_i=1 if the farmer purchased inputs through the cooperative, 0 otherwise.

$$\mathrm{P}[y_i=1]=\Lambda\left(\underset{\sim}{X}'_i\underset{\sim}{\beta}_k\right)=\frac{e^{\underset{\sim}{X}'i\underset{\sim}{\beta}k}}{1+e^{\underset{\sim}{X}'i\underset{\sim}{\beta}k}} \quad \text{..... (6)}$$

Where $i=1,2.....8$; that is $X_1, X_2 \ldots\ldots X_8$ being explanatory variables as described in Table 1 below, and $k=0,1,2.....8$; that is $\beta_o, \beta_1, \beta_2 \ldots\ldots \beta_8$, as parameters that were estimated.

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The expected signs of the explanatory variables for the logit model (Table 1) implies that; if the sign is positive, the explanatory variable under consideration increases the likelihood of the farmer to purchase production inputs through the irrigation scheme cooperative and vice versa. Distance from the cooperative to the nearest town is expected to increase the likelihood of the farmer to purchase inputs through the irrigation scheme cooperative due to limited number of input providers in villages that are far away from town. Experience of the farmer in the irrigation scheme cooperative is also expected to increases the likelihood of the farmer to purchase inputs through the irrigation scheme cooperative.

Availability of credit facilitated by the irrigation scheme cooperative is expected to increase the likelihood of the member of irrigation scheme cooperative to purchase inputs through the cooperative as the result of increased purchasing power on inputs. Extension services are expected to bring eager of adopting use of proper inputs. It is thus expected that, number of times the farm manager or the extension officer of the irrigation scheme cooperative visits increase the likelihood of purchasing inputs through the irrigation scheme cooperative.

On the other hand, number of organizations in which a farmer is a member is expected to reduce the likelihood of purchasing inputs through the irrigation scheme cooperative due to extended social capital that enables the farmer to get inputs from other organizations.

Satisfactory quality of inputs and education of the cooperative members are expected to increase the likelihood of purchasing inputs through the irrigation scheme cooperative. Education as measured by number of years of formal training (0 years being did not attend any formal training; less than 7 years implies that the cooperative member attended primary school but did not complete; 7 years implying attended primary education; 8 years being received training after primary school; 9-14 years being attended secondary school and 15-16 years being received training after secondary school either through technical colleges or universities) is expected to increase the awareness of farmers on the importance of collective purchases.

Lastly, input payment mode (cash only, credit only or both credit and cash) is also expected to increase the likelihood if both credit and cash payment options are available at the irrigation scheme cooperative.

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Table 1: Description of explanatory variables for the choice of input provider

Variable	Description	Expected sign
X_1 = Distance	Distance from the cooperative to the nearest town in kilometres	+
X_2 = Experience	Farmer's years of experience in cooperative	+
X_3 =Credit accessibility(Dummy)	If a farmer obtained credit in a year facilitated by the irrigation scheme cooperative	+
X_4 = Membership	Number of organizations a farmer is a member	-
X_5 =Extension	Number of times visited by extension officer or farm manager from the irrigation scheme cooperative in a season	+
X_6 =Input quality (Dummy)	Input quality satisfaction	+
X_7 =Education	Years spent in formal training	+
X_8 =Input payment mode (Dummy)	Credit and cash based purchase system	+

3. RESULTS

3.1 Socio-economic characteristics and contractual choice options

Participation in input purchases was found to be independent of gender of the irrigation scheme cooperative members. The study found more male to have not purchased inputs through the irrigation scheme cooperative than female but the difference was not significant.

Experience was found to influence the participation of members of the irrigation scheme cooperative in input purchases ($p<0.05$). Results show that, more members with high level of experience purchased inputs through irrigation scheme cooperative than members with low level of experience.

Level of education in cooperative irrigation schemes was found not to influence participation of members in input purchases. There was no direct association between participation in input purchases and level of education. Furthermore, participation in input purchases was found to vary with the primary occupation of the farmer in which, more farmers with crop production as

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their primary occupation did not participate in input purchases than farmers with wage employment, business or self-employment as their primary occupation.

Table 2: Socio-economic characteristics and contractual choice options

Variable name		Contractual choice		χ^2 value (n=200)
		Purchased input through irrigation scheme cooperative	Purchased input from other input providers	
Gender (%)	Male	52.8	57.6	
	Female	47.2	42.4	
				0.468
Years of experience (%)	Low level experience (<5 years)	6.5	20.7	
	Experienced (5-10 years)	44.4	38	
	High level experience (>10yeras)	49.1	41.3	
				8.824**
Level of education (%)	No any formal training	1.9	2.2	
	Primary education	70.4	67.4	
	Secondary education	20.4	22.8	
	Training after secondary education	7.3	7.6	
				0.232
Primary occupation (%)	Crop production	72.2	87	
	Wage employment	12.1	5.4	
	Business and other self-employment	15.7	7.6	
				6.509**

**significant at 5% level

3.2 Contractual choice and level of specialization

Level of specialization indicated the percentage of the total land that the farmer allocated to rice production. It ranged from less than 25% to 100%. Level of specialization being 100% implies that the farmer allocated 100% of land owning to rice production. Results indicate that, level of specialization did not vary with contractual choice and increased with level of specialization in all contractual choice options.

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Table 3: Contractual choice and level of specialization

	Contractual choice		
Level of specialization	**Cooperative**	**Other input providers**	**Total**
<25%	13 (50.0)	13 (50.0)	26
25-50%	28 (45.2)	34 (54.8)	62
>50%	23 (71.9)	9 (28.1)	32
100%	44 (55.0)	36 (45.0)	80
Total	108(54.0)	92(46.0)	200
Statistical test	**χ^2 (3, n=200) =6.261; p=0.099**		

( ) Values in brackets are percentages

3.3 Differences in production costs

Normality test for the production costs was conducted using Shapiro Wilk test on the null hypothesis that the observed distribution fits the normal distribution against the alternative hypothesis that the observed distribution does not fit the normal distribution. The test confirmed the data on production costs to be normally distributed as the null hypothesis was not rejected (P>0.05). Furthermore, Levene's test for equality of variance was conducted and found that, variations of production costs were equal in each group and between the two groups; farmers purchasing inputs through the cooperative and farmers who do not purchase inputs through the cooperative. These tests confirmed the suitability of the independent samples T-test for group mean comparison of the production costs.

Results on the T-test revealed that, the costs of production in Tanzanian Shillings (TAS) per hectare of farmers purchasing inputs through the cooperative are lower than that of farmers who purchased inputs from other input providers. Thus the hypothesis of no statistical difference in costs of production between farmers purchasing inputs through the cooperative and those who do not purchase through the cooperative was rejected (two tailed p-value<0.05).

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Table 4: Mean comparison on production costs

Group	Obs	Mean (TAS/Ha)	Std. Err.	Std. Dev.	95% confidence interval	
Purchased from other input providers	92	2256284	29919.68	286979.5	2196852	2315716
Purchased input through cooperative	108	2145531	24394.87	253519	2097171	2193891
Combined	200	2196477	19401.2	274374.5	2158219	2234735
Diff.		110753.4*	38223.38		35376.23	186130.6
t=2.8975, df. 198		**Ho: Diff=0;**	**Ha: Diff≠0**		**Pr.(|T|>|t|)=0.0042**	

*Significant at 5%.

3.4 Factors Influencing Contractual Choice Decisions

Collinearity diagnostics was conducted prior to estimation of the logit model. The results gave the allowable Variance Inflation Factor (VIF) which is tolerable (VIF<5), indicating no multicollinearity problem in the data. Furthermore, the square root (SQRT) of variance which tells how much larger the standard error is, compared with what it would be if that variable were uncorrelated with the other predictor variable in the model were also low. The logit model fitted well the data as it was confirmed by Person's goodness of fit test. The null hypothesis of the model being fitting the data was not rejected (P>0.05).

The Maximum Likelihood (ML) estimate of the logit model was obtained with the HCE correcting for any heteroscedasticity. Results revealed that; the choice of production input provider by smallholder irrigated rice farmers in cooperative irrigation schemes is influenced by distance from the cooperative to the nearest town, number of organizations in which a farmer is a member, extension services, input quality satisfaction and payments mode available at the cooperative. These were the variables found significant (P<0.05). Years of experience in the cooperative, credit accessibility and education were not significant (Table 5).

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Table 5: Odds ratio and marginal effect of the logit model

Variable	Odds ratio	Robust Std. Err.	Z	P>|z|	$\partial y/\partial x$
Constant		0.8234	-2.07	0.038	
Scheme distance	1.2324*	0.0823	2.54	0.011	0.05069*
Coop experience	1.0004	0.2936	0.01	0.988	0.00011
Credit accessibility	1.4088	0.4571	0.75	0.453	0.8242[d]
Membership	1.8483*	0.2502	2.45	0.014	0.1490*
Extension visit	0.8705**	0.5101	-2.72	0.007	-0.03365**
Input quality	3.6957*	0.6372	2.05	0.040	0.3141*[d]
Education	0.9066	0.0615	-1.59	0.111	-0.02377
Input payment mode	23.506**	0.6888	4.58	0.000	0.5465**[d]
Number of observations =200; Wald chi^2(8)= 49.69; prob> chi^2 =0.0000; log pseudo likelihood= -94.4496; McFadden's Pseudo R^2=0.3155					

**Significant at 1% probability level; * Significant at 5% probability level; ([d]) $\partial y/\partial x$ is for discrete change of dummy variable from 0 to 1.

4. DISCUSSION

Gender and level of experience varied with the contractual choice options. Gender indicated that, level of female participation is higher than that of male. This result is similar to the one obtained by Kirui and Njiraini (2013) who reported female to have high participation in collective actions. Results show also that, more members with high level of experience purchased inputs through irrigation scheme cooperative than members with low level of experience. This finding is similar to the one obtained by Vanni (2014) who found experience in collective action to improve participation and devotion to voluntary action of those shared interests. It was also found by Nugussie (2013) in the study of membership in agricultural cooperative in Ethiopia that, experience influences the level of participation in the cooperatives. On the other hand, level of specialization did not vary with contractual choice and increased with level of specialization in all contractual choice options.

Level of education in cooperative irrigation schemes was found not to influence participation of members in input purchases. There was no direct association between participation in input purchases and level of education. This could be due to the availability of extension services that are usually offered at the time of purchase of the agricultural inputs through the irrigation scheme cooperative.

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In regard to costs of production, results implies that, farmers purchasing inputs through the irrigation scheme cooperative had lower production costs than that of farmers who purchased inputs from other input providers. This justifies that, collective purchasing of production inputs economizes transaction costs leading to reduced costs of production.

Distance from the cooperative to the nearest town, input quality and payment modes had their expected signs that are positive. It should be noted that, all irrigation scheme cooperatives are closer to the farms hence the increase of the distance from the cooperative to the nearest town increases the likelihood of the farmer to purchase inputs through the cooperative. This implies that if the distance between the cooperative and the nearest town is short and there happen to be issues on inputs quality and price differences, the farmer would prefer to purchase in town where there are many input providers. Input quality being satisfactory and the availability of both credit and cash as payment mode increase the possibility of farmers to purchase inputs through the cooperative.

Number of organizations in which a farmer is a member and extension services had unexpected signs. It was expected that, the increase in number of organizations in which a farmer is a member such as Rotating Saving and Credit Associations (ROSCAs), Village Community Bank (VICOBA), Agricultural Marketing Cooperatives (AMCOs) and SACCOS would reduce the possibility of purchasing inputs through the cooperative as a result of networking and the fact that, some organizations offer input credit to farmers. The results indicate that, as a farmer becomes a member in many organizations, the likelihood to purchase inputs through the cooperative increases. This is due to the fact that, many organizations provide access to credit which is the component that enhances the purchase of inputs through the cooperative.

It was also expected that, increase in number of times a farmer is visited by extension officer increases the possibility of purchasing inputs through cooperative but results showed the opposite. This is because there are quality issues with the inputs purchased through the cooperative and extension services that created awareness on quality and good agricultural practices hence reducing possibility of farmers to purchase through the cooperative.

In terms of the ratio of making choices between two options; purchasing inputs through the cooperative and purchasing from other input providers (odds ratio), a one kilometre increase in distance from the cooperative to the nearest town where farmers could access many input providers and a unit increase in number of organizations in which a farmer is a member, the chance (odds) in favour of purchasing inputs through the cooperative increases by 1.2324 or (1.2324-1)*100% which is 23.24% and 1.8483 or (1.8483-1)*100% which is 84.83% respectively.

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This signifies that, networking which creates social capital is essential for the farmers to take part in collective action initiatives. However, a unit increase in number of extension visit to the farmer, the odds in favour of purchasing inputs through the cooperative decreases by 12.95% *ceteris paribus.*

Input quality and payment mode are also essential for the farmers to purchase inputs through the cooperative. Input quality being satisfactory, the farmer is 3.6957 times more likely to purchase inputs through the cooperative than if the input is not satisfactory. Availability of both credit and cash based payment mode at the cooperative are 23.506 times more likely to make a farmer purchase inputs through the cooperative than if only one mode of payment (cash or credit) is available provided that, all other things remains constant.

Similarly, the marginal effect ($\partial y/\partial x$) shows the extent on which the factors change the probability of the farmer to purchase inputs through the cooperative as shown (Table 5). Example the scheme distance factor implies that, a one kilometre increase in distance from the cooperative to the nearest town will produce a 0.0507 increase in the probability of the farmer to purchase inputs through the cooperative. In case of the discrete change in dummy variables, it shows how much more or less likely a situation coded 1 would increase or reduce the probability of the farmer to purchase inputs through the cooperative. It is the means of comparison between two situations of the factor.

The payment mode factor implies that, the predicted probability of a farmer to purchase inputs through the cooperative is 0.5465 greater for both cash and credit payment mode being available than for cash or credit based only, other things remains constant. Fischer and Qaim (2012) using payment timing to measure payment mode had similar observation in the study of marketing of banana in Kenya. Likewise, the predicted probability of a farmer to purchase inputs through the cooperative is 0.3141 greater if the input quality is satisfactory to the farmer than being not satisfactory.

5. CONCLUSION AND POLICY RECOMMENDATIONS

The study found that, factors influencing smallholder irrigated rice farmers' choice of production inputs provider (contractual choice) in cooperative irrigation schemes are distance from the cooperative to the nearest town, number of organizations in which a farmer is a member, extension services, input quality satisfaction and availability of cash and credit as payment mode at the irrigation scheme cooperative.

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The study found further that, under *ceteris paribus* entering in only one other organization increases the likelihood of purchasing inputs through the irrigation scheme cooperative by about 85% and input quality increase the likelihood of farmers to purchase inputs through the irrigation scheme cooperative to about 4 times if there is input quality satisfaction.

Comparison between farmers purchasing inputs through irrigation scheme cooperative and those who do not showed that, farmers purchasing inputs through the irrigation scheme cooperative have lower production costs than farmers purchasing from other input providers. It is therefore plausible to encourage farmers to purchase inputs through the irrigation scheme cooperative of which will contribute to reduction of their production costs. This can be enhanced through ensuring that, inputs provided are of satisfactory quality and both cash and credit payment methods are used.

In encouraging farmers to purchase inputs through the irrigation scheme cooperative, it is important to provide price incentive in the purchase of inputs by ensuring that there is significant price difference between the inputs purchased through irrigation scheme cooperative and from other input providers in nearby towns. Farmers need also to be encouraged to form or enter into other organisations such as AMCOS, SACCOS and ROSCAs to improve networking, credit access and create social capital that can make them benefit from sharing agricultural information.

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