

A Transaction Cost Analysis on the Acquisition of Rice Seed by Small-Scale Farmers in ECA Region: Generating Empirical Evidence in Tanzania

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Abstract: The present study is an attempt to develop empirical evidence of transaction costs that rice farmers incur in production and other factors that affect farmers' demand for seed and estimating the proportion of costs accounted for by transaction costs due to quality seed in the formal and informal sectors, and analyze how these costs affect sourcing decision. An agricultural household model was developed from the study area. To test the model, information was collected in a survey of 387 households. There is now empirical evidence that transaction cost in rice seed acquisition in Tanzanian agriculture is an added cost to the farmer in the process of purchasing seed. Descriptive analysis shows that about 18% of the total seed cost is accounted for transaction cost, which is 2% of the total variable cost in farmers' rice farming. Econometric model was fitted to the household data to determine the factors hindering farmers to use purchased quality seed. Factors that were significant in influencing transaction cost include information search, seed source, farmers' seed arrangements, trust, and distance from farmers' homestead to the seed source, location and age of the farmer. We recommend that, policy amendments inclined towards reduction of the transaction costs can improve the profitability of the rice enterprise by increasing the demand for inputs.

Key words: Transaction cost, small-holder farmers, seed market, seed acquisition, and quality seed.

1. Background Information

Use of improved seed is an important input in all crop-based farming systems, and is a key factor in determining the upper limit of yield, and therefore the ultimate productivity of all other inputs [1-3]. More importantly cereals are important staple food in Africa but yields have remained low partly because of limited use of improved seeds and small and highly fragmented seed markets [4]. See also for example in Ref. [5] who revealed that input and output markets for NERICA in Uganda did not seem to be working since seed shortages and lack of access to traders and rice millers discouraged farmers to grow rice.

The seed sector in the East Africa region has undergone major changes since the early 2000s, with

Tanzania government revising the Seed Act in 2003 followed by a Seed Regulation in 2007. The Act has allowed seed companies to open markets and sell seed without Ministry of Agriculture licenses. Despite this improvement the private sector has not been able to serve some of the important seed sub-markets like rice and the cost of seed has been relatively high making rice seed industry to be dominated by the informal seed sector [6]. In countries where legislation is not in place or where it is poorly enforced: it is posited that emerging seed companies and agri-input dealers are at risk from "unscrupulous traders who disseminate counterfeit seed varieties", which undermines farmer confidence and further investment in the sector.

The seed sector by which farmers acquire new seed can be loosely be categorized into informal and formal

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seed supply systems. Informal seed system refers to those in which seed originates from and is disseminated by small scale farmers while formal seed system typically supplies modern varieties developed by plant breeders and distributed by different institutions like the national research institutions, private and public seed companies, international organizations, NGOs and extension programmes.

In order to fully integrate farmers to markets it is important to choose the appropriate governance structure that minimizes such cost. Many authors [7-9] have encouraged the creations of farmer organizations as a means of solving the above problems. They argue that the advantage of organizing farmers into groups includes among other factors a reduction in the transaction costs of accessing input and output markets as well as improving the negotiation power of smaller farmers vis à vis large buyers or sellers.

The objective of the study is to investigate factors that influence farmers' transaction costs in relation to seed acquisitions. In transaction cost economics (TCE) the term "transaction costs" has been defined as "the costs incurred by participants in an exchange in order to initiate and complete the transactions [11-12]. For instance, consider buying a banana from a store; to purchase the banana, your costs will be not only the price of the banana itself, but also the energy and effort it requires to find out which of the various banana products you prefer, where to get them and at what price, the cost of traveling from your house to the store and back, the time waiting in line, and the effort of the paying itself. Thus, the costs above and beyond the cost of the banana are the transaction costs.

Transaction costs are subdivided into search or information costs (costs of obtaining information about the product and its price as well as about trading partners); negotiation costs (costs of negotiating and carrying out the transaction); and monitoring or enforcement costs (costs of ensuring terms of transaction) and are specific to each market participant.

The first category involves gathering information about potential sellers of the seed, price offers, delivery mode, terms of payments. The second category involves building consensus on the price, quantity, quality, terms of payments and mode of delivery. While, the third category involves making sure that what has been agreed upon in the contract is adhered to.

Farmers are faced with constant challenge of deciding at which point they should buy their seed. This decision is based on the benefits and costs involved which relate to transport to the market place, the certainty of getting sellers, the quantity of seed, price expected, ability to germinate, payment terms, capacity to store the seed and governance structure. In the current study, transaction costs will be looked at in a broad sense and may include other costs or "sacrifices" that farmers may have to incur to carry out a seed transaction—even if unsuccessful. These include opportunity costs in terms of time, loss of prestige, risk assumed or other. Several literature for example [7, 9], etc. have concluded that, the characteristics of smallholder agriculture in developing countries have led to market failure. For instance, as smallholder farmers are often dispersedly located and have limited access to transport, loosely organized, and thus the transaction costs of acquisition of services, etc. are typically high.

On the other hand Badstue [11] argues that the risk of crop failure due to inadequate seed should be considered a transaction cost, the same way, risk of getting the wrong product or in this case rice seed due to lack of information would be considered a transaction cost. As regards to governance structure, there are arguments that accord those in Ref. [7], which argues that belonging to a group empowers farmers to bargain and negotiate for better trading terms and thus form part of influencing transaction cost.

As also reported in Ref. [13], farmers have different needs and require seed of diverse landraces with

multiple traits in particular combinations. Thus, finding seed that meets the individual farmer's particular requirements is not always easy. First, the farmer has to find out who grows what rice variety and investigate the characteristics and performance of the rice of interest. Then he/she must make sure that the information offered is trustworthy and the seed is reliable. Finally, he/she has to negotiate the conditions of the transaction with the seed provider. Under such conditions it seems reasonable to expect that acquisition of seed of diverse rice varieties entails high transaction costs to individual farmers.

The above arguments are supported in Ref. [14] who revealed that, from a transaction cost perspective trust is expected to reduce transaction costs because of the reduced threat of opportunistic behavior. They conclude that this may lead to an increase in efficiency which in turn enhances the performance of agricultural input supply. This would imply that farmers will trust the seed sellers who are located in their vicinity and thus build mutual relationship in seed transaction. Although farmers inspect the seed before acquiring it, thereby limiting the chance of bad seed quality, this does not provide a guarantee that the seed will germinate. In various regards, farmers must still rely on the information given by the seed provider and depend on its trustworthiness. In Ref. [13] concludes that this behavior constitutes an important reason for farmers to prefer to acquire seed from somebody they know and trust.

Physical isolation and nature of road infrastructure can also influence the flow of information, i.e. the further away from the village the less flow of information. These arguments are supported in Ref. [14] who, using road quality as proxy for transaction costs consistently found to have a significant impact on the adoption of improved varieties in the area of their study and that information deficit may be an important limiting factor to adoption.

The study is focusing on local rural markets in Tanzania where seed is exchanged between a buyer

and a seller in a voluntary transaction. Seeds from either the formal or informal sector are involved in the transaction (e.g. certified or non-certified seeds). The focus is on retail transactions—e.g. the farmer is the purchaser of the seed. The study therefore, endeavors to identify the costs, sacrifices or concerns, which farmers experience in relation to seed transactions costs and through using empirical data we model the transaction costs the small scale farmers incur in the pursuit of improved rice seed. We look at transaction costs in a broad sense as dictated by transaction cost economics, and we include other costs or “sacrifices” that farmers may have to incur to carry out a seed transaction.

One of the most important factors for increasing rice productivity is use of improved rice seed by small scale farmers [15]. Without this, attaining food security in the country will remain a dream. Currently the number of farmers that are using improved rice seeds is very small (less than 20%) which is due to their low purchasing power and high prices of rice seeds. Costs in rice seed production include quality control, storage, processing, and purchase of other inputs, marketing and transport costs. Since the purchasing power of smallholder farmers is low any additional costs including transaction costs, hinders farmers from using the inputs. Seed providers consider these costs and they are factored in seed prices they offer. Therefore, transaction cost analysis and developing policy options would be a starting point to advice the governments in reducing rice seed prices. It is therefore, widely recognized that some of the problems that prevent producers and traders from achieving a fair income from their activities can be related to transaction costs.

The majority of empirical research in transaction cost economics is that organizational mode is often treated as the dependent variable, while transactional properties and other particular control variables serve as independent variables, as also indicated in Ref. [16]. The analysis of the current study diverts from that

approach but instead treats seed purchase choices as dependent variable by treating the independent variables in the same manner. In Tanzania, limited empirical data-oriented studies have been conducted on transaction costs in seed acquisition and factors that are of influence. The only data that are available have been describing the seed sector performance in qualitative terms (see for instance [11, 16]). Thus the study has the purpose of applying empirical analysis to identifying the factors that influence the transaction costs of acquiring seed for rice growing small-scale farmers in Tanzania.

2. Research Methodology

Formal seed distribution has yet to develop in Tanzania and farmers depend mostly on informal seed sources. This perhaps can be explained from the fact that seed production is low which would hamper seed trade and thus increase transaction cost. On the basis of this context the analysis is a kind of mix up between formal and informal seed sectors.

The study was conducted in year 2012 focusing on local rural markets where seed is exchanged between a buyer and a seller in a voluntary transaction. A seed from either the formal or informal sector was involved in the transaction (e.g. certified or non-certified seeds). The focus is on retail transactions—e.g. the farmer is the purchaser of the seed. The study was carried out in Tanzania in three agro-ecological zones, covering four regions including Mbeya, Morogoro, Kilimanjaro and Arusha. These regions were selected because they are good pool of crop genetic diversity, potential for rice growing, availability of farmers buying quality seed and presence of stockists selling improved seed. Both primary and secondary data were used.

In analysis of potential factors that hinders farmers from using improved seed due to transaction costs in seed markets, a mix of quantitative and qualitative approaches to collecting data were considered appropriate and necessary. To this purpose a survey and group interviews at household and community

level of analysis were adopted. Qualitative data gathering took place primarily in the form of a series of informal, semi-structured interviews—group and key informants interviews.

An informal interview guide was used to solicit information from randomly selected farmers in the Rice growing villages as well as from rice breeders, officials of Seed Agency, Seed Certification Agencies and seed stockists. Quantitative survey instrument using a questionnaire was administered to interview selected individual farmers growing rice. Sampling frame was developed from randomly selected rice farmers obtained from Village Executive Officers (VEOs). A total of 387 farm households across 19 villages from six districts were randomly selected and interviewed. In the study area men were 62.8% (243) and women 37.2% (144).

Data collection was based on the theory of TCE in regards to understanding the effect of transaction costs in seed acquisition and the role that farmers play in the decision making process; soliciting the kind of information farmers consider important about the seed and/or the seed provider and choice of seed source: how to get this information? What determines which type of transaction is used and the costs involved? Specifically, data collected include:

- (1) Farmers' characteristics: Farmer's characteristics may have bearing on transaction costs. These may include education level, sex, age and marital status;
- (2) Location of seed market: The far the distance from where the farmers can purchase seed increases difficulties in acquiring the seed and thus high transaction cost;
- (3) Village distance: distance in km from a farmer to a place of seed sale is used as a measure of transportation costs for information search. This variable was measured in kilometer;
- (4) Information: It is important to explore the degree to which farmers receive the necessary information regarding the seed by asking whether they have access to information or otherwise. Radio ownership was considered as source of information—access to

information—as measures to search for information. All categorical or nominal variables were dummies. The coefficient of the radio variable is expected to have positive sign due to the priori that a farmer will acquire information about seed through a radio and thus decide to buy. In addition, one proxy for transactions costs (road quality) was used. We attempt to factor these dimensions in the transaction cost analytical model to assess their potentially influence in the Tanzanian rice seed marketing.

Another important variable in the TCE is trust. In this respect farmers were asked whether trust is considered to be one of the factors in seed acquisition. Trust to those providing seed. This variable was captured as dummy transformed from Likert scale.

The decision of whether to buy good quality seed is central for any agricultural household and is the focus of the model. In this context, the empirical analysis was motivated by an agricultural household model that generates empirically testable hypotheses concerning the role of improved seed characteristics and transaction costs in determining farm households' choice of seed acquisition and the source of seed [14]. It also draws on recent literature investigating links between market imperfections or transactions costs and households' participation in various markets [7, 14, 17]". Descriptive statistical analysis was used to gain an insight of description of the study area and individual farmers' characteristics which allowed describing the conclusion resulting from logit model. The model is general enough to be useful as a tool for studying different circumstances faced by farmers and different problems encountered in the context of choice of buying seed and choice of seed source studies. In the present study we are interested in choice of buying seed.

Both qualitative and quantitative analyses were employed. Quantitative analytical methods used involved using non-linear econometric models—the logit. The model was used to determine factors farmers consider to increase transaction costs and thus

hinder them from purchasing seed. In one scenario, the dependent variables were qualitative by assigning 1 (1 = buying improved seed) and 0 (0 = not buying improved seed) as proxy to transaction cost to the series of independent variables capturing transaction cost elements.

The logit model can be expressed as:

$$\ln\left(\frac{D_i}{[1 - D_i]}\right) = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \beta_k x_k + \varepsilon_i \quad (1)$$

where, $\beta_0, \beta_1, \beta_2, \dots, \beta_k$ denoted as estimated coefficients; x_1, x_2, \dots, x_k denoted as independent variables and D_i denoted as probability of event (buy seed = 1, not buy seed = 0), which in this treatment is a dummy variable, where as ε is error term or disturbance with zero mean and constant variance. We implement the model using data collected in a survey of 387 farmers located across 34 villages in three distinctly different rice ecosystem including upland, lowland and rainfed.

Based on dataset available these are the variables that are considered as important TC variables and proxies for transaction costs and they were used in the logit estimation together with other farmer characteristics. The binary response model—logistic regression is used. This process contributes directly towards examining the effects of transaction costs on the discrete decision of smallholder farmers to purchase improved seed.

3. Results and Discussion

Information on several variables that accords transaction cost was obtained in the survey. They include information reported by farmers on distances to markets, travel time, time of bargaining, and travel costs. Because different farmers living in the same village have reported different market places for their purchases, distances from each village to the closest market town or city where seed suppliers exist, compensations to farmers due to seed failure, transportation costs, information search through phone calls were also estimated. Farmers were enquired

about germination percentage of the seed bought which was estimated as the proxy variable for transaction cost to be modeled together with other important covariates.

3.1 Household Characteristics Related to Seed Purchase

On the basis of rice seed transactions that relates to the context of the study area there was a mix up of formal and informal seed sectors, with the latter taking prominence. Descriptive statistics indicates that about 97.8% of the total respondents were not linked to any seed arrangements, while about 2.2% were connected to seed through contracted farmer groups. About 81.6% of the total respondents were acquiring seed by direct purchase, 13.9% through seed exchange while smallest proportion were acquiring through input subsidy and input credit (4.5%).

The result shows that approximately 47% of the total respondents were purchasing quality seed. Out of these, 20.2%, 16.3% and 10.3% were from Morogoro, Mbeya and Kilimanjaro regions, respectively (Table 1). Almost all farmers in Arusha region were not purchasing seed (0.5%). The observed differences were statistically significant ($p = 0.000$) at 5% level. These results would be expected because in Morogoro there have been many interventions due to both physical and institutional infrastructure and being closer to technology sources such as KATRIN, Dakawa, Sokoine University of Agriculture and Agricultural Seed Agency. These results are consistent with level of use of improved seed. In the context of

Tanzanian rice farming, the proportion of farmers buying seed (47%) may look high, which was due to approach of the study of deciding to include farmers who exchanged seed with their fellow farmers, treating this as seed transaction.

A source of seed would greatly influence a farmer to purchase. Farmers were asked to which source of seed they preferred and the reasons. About 25.7% of the total respondents indicated that they prefer buying from stockists and the reason given was attached to distance. This is evident because in areas visited most of stockiest were located in villages. It was followed by NGO 19.3%, Seed Agency 18.3%, research institution 15.6%, training institute 11.0% and farmer group were about 10.1%. Interestingly, when they were enquired about the source of their seed during the previous season it showed that out of 47.3% of those purchased seed most of them were getting from fellow farmers (27%) and less than 5% each from other sources including stockiest (5%), research institutions (4%), seed agency (3%), training institutions (2%) and 2% each from farmer groups and NGOs.

Wealth farmers would be considered to be in a better position to purchase seed, suggesting that its measurement would provide an insight to factors that influence seed acquisition. Based on asset indexes generated as proxy measure of wealth, the descriptive results showed that farmers who had higher asset index are inclined to significantly increase purchasing of seed.

Table 1 Percent of respondents who purchased improved seed.

District	Region % of respondents			
	Morogoro	Mbeya	Kilimanjaro	Arusha
Mbarali		8.3 (50.0)		
Kyela		8.0 (44.9)		
Kilombero	8.3 (48.5)			
Mvomero	11.9 (71.9)			
Moshi rural			10.3 (62.5)	
Monduli				0.5 (3.3)
Total	20.2	16.3	10.3	0.5

Note: Figures in parenthesis denote % of respondents within district.

3.2 Seed Purchase Decisions and Management

As regards to transportation means, we observed mainly use of bicycles to nearby villages or towns and sometimes public shuttle buses are employed. A farmer in one of those localities will usually leave early in the morning and return sometime in the afternoon. In those cases, then, a day of farm work is lost every time a farmer goes to the market. For villages that are close to the main roads, bus service is more frequent and the amount of time needed to go to the market was found to be lower.

Transaction costs may also make seed more difficult to obtain and hence more expensive because of time spent searching. One critical observation through interviews was that farmers tend to buy seeds around planting time, while disregarding the fact that seed prices are often higher at that time. It is possible that some of the farmers have no practice of storing seed for next season as all of the harvests are consumed, and when the season becomes imminent they start searching for seed. The main reason that is advanced is that smallholder farmers may be fearful of losing seeds during storage due to various risks involved such pests, wildfires and thefts. This is a result of inadequate storage facilities or agrochemicals for save seeds, suggesting that transaction cost would be high. This behavior has benefited stockists and traders as they use this opportunity to sell seed at higher prices during planting time, suggesting an increase of transaction cost to smallholder farmers.

However, most farmers mentioned not having any problem finding seed. They mentioned that seed can be found in stores in the main towns, but most importantly the market relied on is farmer-to-farmer from within their localities secured as recycled seed. Searching costs were thus not found to be important regarding seed. Transaction costs for seed purchases were mentioned as mainly related to transportation costs.

Issues of information about rice seed, seed

transaction negotiation and enforcement are examined from a small-scale farmer perspective through the use of quantitative data. Results show that farmers' perceived transaction costs are low to negligible in most cases where seed transactions take place locally, and trust at which there seed exchange among farmers, is indicated as a factor which serves to reduce transaction costs to a minimum. Though maybe not a transaction cost in the conceptual sense, the risk of crop failure due to inadequate seed was found to be main concern for farmers in relation to seed transactions.

In general, searching for information is one situation in which farmers draw on their various social networks. The access to information etc. was found to be heavily influenced by the nature of one's networks of social relations, as well as the farmers own social and political standing or connectedness. Physical isolation also influenced the flow of information, i.e. the further away from the village the less flow of information. It was noted that a common form of obtaining information is through direct observation of rice in other farmers' fields. According to informants, farmers gather information when moving about in their communities while paying attention to the crops other people grow, their performance, management and growing conditions.

Some of the farmers interviewed exchanged seed which have been saved one year or more, which is the point of the risk that one may acquire seed, which has already lost some of its germination ability. Farmers were more trustworthy among themselves rather than seed stockists. The truth is that they have really good rice regardless of whether they are improved or local varieties. But sometimes it's the lack of confidence, like, if one does not have rice [seed].

"What if they sell me the one from two years ago?". They do not trust others. Farmers cited situations by saying that some people or stockists are difficult and unpleasant to deal with. In theory, this could represent a transaction cost in terms of humiliation and

embarrassment, if one approached them in order to acquire rice seed from them. However, as long as farmers prefer to acquire seed from people they know and trust, this does not necessarily represent any addition to farmers' transaction costs in relation to seed acquisition.

One important dimension which possibly explains the small holder framers is that there were no contractual agreements in seed business with owners of stores. This would lead to paucity of transparency, enforcement of regulations and encouraging business environment in the detriment of farmers securing low quality seed. This can be explained from the fact that informal seed sector has not developed and thus indicates characteristics of small seed business. Opinions resulted from traders interviews indicated that seed traders start business, as the seed production increases or becomes available, which decreases transportation cost per unit for traders and thus would increase demand for the service by farmers.

3.3 Transaction Cost Estimation

The results show that a farmer was spending a total of TZS 4,035 of seed as transaction cost higher than the cost of purchasing seed for a farmer having an average of 2.75 acres. The transaction cost to a farmer was ranging between TZS 200 to 33,500. Depending on the variety or type of seed, average price per kg was Tzs 1,123. A farmer used 7.4 kg of improved seed in one acre. In average a farmer in the study area was growing 2.75 acres, which need a total 20.35 kg of purchased seed. With the cost of purchasing seed of 1,123 TZS per kg, it implies that he/she will spend a total of TZS 22,853, inclusive of transaction cost.

Further arithmetic shows that TZS 198 per kg was spent as TC, implying that about 18% of the total seed cost is accounted for transaction cost. On the other hand, about 2% of the total variable cost in rice production accounted for transaction costs. These results are far less than those for instance [14, 18] who revealed that the percentage share of transaction costs

of total variable costs of production was 34% while the results from Agricultural Council of Tanzania study of the cost of inputs for rice ranged between 10%-30% [19]. Other transaction costs such as contracting and waiting do not appear to be very important which may be explained as due to the small volume of purchases and undeveloped seed business in the area. Intuitively, we can refer to the TCE theory that posits that transaction costs influence the structure of markets and the nature of intermediary networks. Economic theory informs us that when transaction costs are low, a more complex intermediary network tends to arise. However, from the study area there were fewer networks—small and unofficial traders involved in the seed exchange. Presumably, this context can be explained by small size of rice enterprises in terms of smallholder farmers and rudimentary farm sizes, which is a cause for low transaction costs.

One way in which small farmers may reduce searching costs and may obtain more bargaining power when faced with rice seed traders is to market collectively through organized groups or cooperatives. Farmers in all areas, however, seem to be constrained by group decisions as very few (13.8%) belong to an organization. Even those belonging to organized groups, they have no any arrangement to make seed purchases collectively. That may be explained to be causing huge transaction costs and thus hindrance to purchase quality seed. While transaction costs are expected to be smaller in regions with relatively good infrastructure because of a better transportation network and a more active rice trading system, however, it was highest in Morogoro (TZS 10,000) than the other regions. The comparatively estimated low transaction cost (TZS 5,000) in Arusha, Mbeya (TZS 4,300) and Kilimanjaro (TZS 6,300) can be contextually explained with good infrastructure in those areas. Better road quality and a greater volume of market activity in Arusha, Kilimanjaro and Mbeya are lower transportation costs.

3.4 Determinants of Transaction Costs

In this section we examine transaction cost and farmers' choice of sources to buy rice improved seed. Farmers are faced with challenges of making decisions from where they can be able to obtain seed with underlying quality and price. This section outlines the estimation procedures used in examining the effect of transaction costs on the farmers decision from where the seed can be sourced. In the analysis, the underlying regression is to determine the relationship between seed purchase, a dummy and a set of independent variables which influence a farmer to buy good quality seed. Specific variables capturing transaction costs are included among independent variables and a regression analysis catering for selectivity bias is performed to obtain coefficient estimates.

The logit model is run to determine the coefficient estimates of the underlying regression equation and the selection equation using STATA 11 software. The

results show that out of the thirteen variables used in the model, only seven had significant influence in transaction cost (Table 2). They include information search (radio, farmer to farmer conversation, etc.), seed source, farmers' seed arrangements (contracted or individual seed production), trust of the seed source, and distance from farmers' homestead to the seed source, location and age of the farmer. Generally, the estimated coefficients have expected signs.

Ingredients of TC including transport, and regions transport system are insufficiently competitive and transport is unreliable making purchase of quality seed a market failure phenomenon. As regards to contract enforcement we found out that it is non-existent. This would be particularly due to small scale of the rice enterprises and small size of farms—nature of subsistence farming lender it difficult the legal systems that do not work.

One proxy for transactions costs—road quality—was found to have a significant positive Impact on the purchase of quality seed, which is the case

Table 2 Determinants of farmers' transaction cost in seed purchase: logit model.

Variable	Logit results	
	Coefficient	S.Ea
Age	0.057*	2.348
Road quality	3.005	1.712
Sex	2.489	0.066
based group (1 = yes, 0 = otherwise)	-8.884	1.485
District	3.222**	2.015
Distance from homestead to seed source (km)	14.512**	5.348
Farmers asset (asset index)	16.546	1.7500
Bargaining power (time spent)	20.054	1.746
Information search (phone calls)	-6.546**	1.788
Seed source (1 = yes, 0 = otherwise)	-5.750**	4.065
Farmers' seed arrangement	-4.950***	2.036
Trust of the seed source	3.903***	2.141
Farmers asset index	0.009	0.009
Road quality (dummy)	-0.2485	0.764
Constant	-2.857	0.994
Log likelihood = -28.669		
Number of observation = 124		
Likelihood Ratio Chi square = 85.01		
Probability > Chi square = 0.0000		
Pseudo R-square = 0.8760		

Notes: *, **, *** denote significance at 1%, 5% and 10% level respectively.

of equivocal dimension for future research. A question arises in this regard as to whether the negative relationship between information search, road quality and buying seed is due to difficulties in accessing inputs or to high costs of searching information (or both). The parameters trustworthy of seed suppliers and seed production arrangements a farmer is involved in terms of contracting or individual significantly increases the probability of purchasing quality seed.

4. Conclusion

The present study has used data from a sample of 387 smallholder farmers to analyze transaction cost issues in quality rice seed purchase. A proportion of cost that accounts for transaction costs is derived employing descriptive statistics. Using logistic regression, determinants of transaction costs to farmers in attempt to purchase quality seed are highlighted. One distinguishing feature of our work is that we have derived empirical data on rice seed transaction costs which have had limited literature in Tanzanian rice farming. The study has identified policy implications surrounding current seed market failure in support of acquiring the seed at right time, right choice and at affordable prices. Policy messages are developed regarding farmers on transaction costs within the rice smallholder farming communities.

5. Recommendations

Since the scope of the study was limited to seed purchase combining both informal and formal seed sectors and the fact that farmers do buy other inputs such as fertilizer, pesticides at a go from input stores, it is recommended that further studies should cover all inputs and comprehensively outputs. But most importantly, is drawing a distinct behavior to gain insight between informal and formal seed sectors regarding transaction cost as a focus for further research. Nonetheless, the identified policy implications and developed policy messages if taken

up may lead to increased seed marketing efficiency and improved livelihoods of both farmers and seed traders in the East African region.

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