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Socio-demographic Characteristics of Smallholder Farmers That Influence Their Competence in Rice Post-Harvest Value Addition, Southern Region of Sierra Leone

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Abstract This study on the influence of the socio-demographic characteristics of smallholder farmers on their competencies in rice post-harvest value addition was done in the Southern region of Sierra Leone. The study aimed at developing an extension training model to improve the capacity of smallholder farmers in rice post-harvest value addition with the view of identifying their required competencies. In addition, the farmers' competencies for rice post-harvest value addition technologies were also assessed. A quantitative approach with the use of an interview schedule was used to generate data. Four hundred smallholder farmers were selected by using Yamane's (1973) formula followed by a multi-stage proportional sampling technique. The Ordinary Least Squares (OLS) multiple regression analysis was used to analyse data. Results show that the OLS model predicted R-square value r=0.125 (12.5%) from the main source of labour, alternative livelihood, the key source of information, and main source of income as the best socio-demographic predictors of smallholder farmers' competencies in rice post-harvest value addition at $p<0.05$. Harvesting paddy with a knife (Mean=3.95), heaping paddy on tarpaulin (Mean=3.49), use of basket to transport paddy by humans (Mean=4.13) are some of the technologies where farmers acknowledged high competencies. The study, therefore, identifies that smallholder farmers in the study area have limited competencies in rice post-harvest value addition as they majorly rely on traditional technologies to manually harvest and process their rice after harvest. The Ministry of Agriculture and Food Security in Sierra Leone should therefore emphasise packaging, marketing, milling, and drying to promote rice post-harvest value addition among smallholder farmers.

Keywords Competence, Smallholder Farmers, Rice Post-Harvest Value Addition, Southern Region, Sierra Leone

1. Introduction

The term competence as defined by [1] is what a person knows and can perform in a specific situation when both knowledge and skills are required, either through training the learner or by experience and other means. Furthermore, the authors claimed in the same study that competence is "knowledge about an individual and what he can perform under ideal settings." Skill on the other hand is defined as a certain type of ability that is often innate among people or teams and is beneficial in some unique conditions or connected to the usage of specialised resources, whereas knowledge is the accumulation of an individual's belief system concerning random events [2]. Agricultural extension as a non-formal educational method offers consulting services by utilising a learning process to help farmers obtain the knowledge and skills they need to effectively address the requirements and issues unique to their local socioeconomic circumstances [3]. Today, a fundamental global concern that demands farmers' competence is ensuring food security for the world's rising population while also ensuring long-term sustainable development [4]. The competency motivation theory which informed this study is a social theory developed to explain why people are motivated to take part, continue with the practice, and put in a lot of effort in a context where they know they will succeed [1]. The fundamental tenet of the theory is that people are drawn to engage in activities, in which they feel competent or educated. In other words, people engage in tasks they believe they are capable of performing. According to Glaesser [1], "competence in both linguistics and psychology is believed to indicate capability and readiness, but competence in Weber's perspective means legal duty with related methods of enforcement". Regardless of the rice processing stages, all actors in the rice value addition processes must be competent if the value of rice products is to be improved. So, the core of the competence motivation theory is the hypothesis that farmers can be motivated to engage in activities that will help them grow or demonstrate their abilities [5]. Farmers will develop their competence as a result of their accomplishments when they complete difficult work with success and win praise from others. They will recognise control over their performance when they are successful in that specific act. The perception of motivation for competence will rise as a result of conviction, competence, and control. Elderly farmers are more competent and experienced in selling agricultural goods than younger farmers [6].

In Sierra Leone, Mansaray [7] discovered that the mean age of farmers is 45 years in their study examining food security issues in the country. The more smallholder farmers advance in age, the greater their rice post-harvest value addition competencies (all things being equal) and this means that older farmers face more risks than younger farmers [8]. For choice of ecology, many individual farmers take full advantage of wetland ecologies for their socioeconomic gains. For instance, the majority of Ghanaian farmers rely on swamplands for agricultural activities and this provides them with an income and improved livelihood [9]. Rice cultivation, for example, is mostly done in the lowlands, and rice farmers are largely reliant on this environment, which accounts for around 78.0% of domestic rice yield in Kenya [10]. Since this type of ecology is characteristic of high rice yield, farmers will be encouraged to carry out their anticipated rice post-harvest value addition activities to some extent. Roy [11] observed significant associations between the level of education, source of income for the family, post-harvest knowledge, extension service contact, attitude toward value addition, membership in self-help groups (SHG), and their knowledge of value addition as the dependent variables in Bangladesh. Likewise, a significant association occurs between the educational level, post-harvest knowledge, attitude toward value addition, and participants' skill level as the dependent variables.

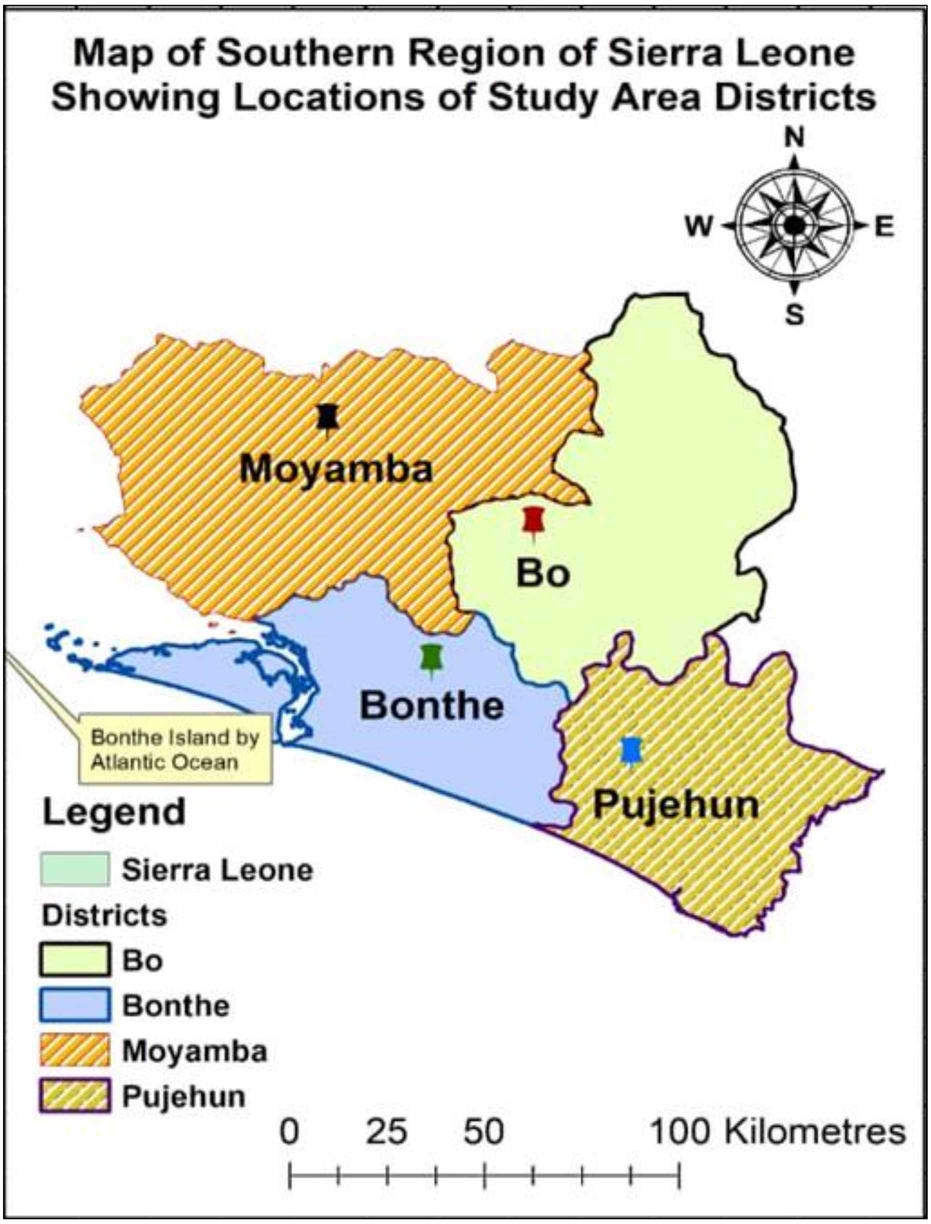
The study aims to create an extension training model for improving the capacity of smallholder farmers in rice post-harvest value addition. The study specifically seeks to determine the socio-demographic characteristics of smallholder farmers that influence their competence and to assess these competencies for rice post-harvest value in general.

Due to limited literature on the assessment of the socio-demographic elements which impact the smallholder farmers' competencies in rice post-harvest technologies, their competency is synonymous with their participation in rice development programmes [12]. This suggests that many studies have not addressed the socio-demographic characteristics that influence the competencies possessed by smallholder farmers in rice post-harvest value addition in Sierra Leone. In Ghana, for example, Abdulai [13] discovered that farmer characteristics such as age, level of education, marital status, access to the income of the head of the household, the market price of rice, knowledge about rice varieties, access to credit facilities, and farm sizes all significantly influence farmers' level of participation instead of their competence in rice farming. Likewise, the ability of rice farmers to share their knowledge rather than their competence in rice post-harvest technologies is significantly correlated with their level of farming experience. A study by Roy [11] in Sri Lanka shows that farmers' farming experiences have a beneficial impact on information sharing (knowledge), with a correlation coefficient of 0.209.

According to a study by Adisa [14], farmers in Nigeria exhibited the following skills: milling rice (Mean=4.54, Standard Deviation=1.19), threshing paddy on tarpaulin/mat, removing dirt/stones, immature grains (Mean=4.32, Standard Deviation =1.22), preventing paddy from falling on the bare ground when heaped, threshing and winnowing (Mean=4.16, Standard Deviation=1.43) and maintenance of moisture content of paddy at 13.0-14.0% (Mean=3.69, Standard Deviation=1.60).

2. Materials and Methods

The study embraces descriptive and quantitative methods. This study was conducted in the Southern Region of Sierra Leone comprising Bo, Bonth, Moyamba, and Pujehun districts (Figure 1) where the investigation was done between May to July 2021. The land coverage of the region is 19,694 km ^{2}with 1,438,572 inhabitants [15]. The region was purposively selected because it serves as the main bowl of rice production which hosts the biggest rice mill (Tomabum rice mill) in the country. The population of the study comprises smallholder rice farmers in the region. The sampled respondents were selected using a multi-stage random sampling technique from districts to chiefdom levels. As a sampling procedure for the study, Yamane's (1973, p. 886) formula was used for determination of the sample size of smallholder farmers at each level. Based on a sampling frame of 157,114 Households [15], smallholder farmers were chosen. Subsequently, four hundred households were drawn, from which four hundred smallholder farmers formed the sample size of the study, whereby each household represented a sample farmer. The primary data collection instrument was a structured interview schedule. The instrument allowed smallholder farmers to rate items on a 5-point Likert-type scale based on the farmers' perceived level of competence such as: 1=incapable, 2=less capable, 3=moderately capable, 4=capable, 5=highly capable.



Source: Author's Construct (2021)

Figure 1. Map of Southern Region showing locations of districts

2.1. Validity and Reliability of the Instrument

The rice farmers, enumerators, Agricultural extension agents, researchers, and other students as colleagues confirmed the face validity of the instrument. The thesis advisors made sure that all objectives, constructs, and variables were operationalised for measurement to guarantee the contents and construct validity.

The reliability of an instrument is the degree to which an instrument produces consistent, replicable estimates of what is developed to measure. The Cronbach's alpha reliability coefficients from the pre-tested data for smallholder rice farmers were computed for the determination of the internal consistency/reliability of the items in the quantitative instruments measured on a 5-point Likert-type scale. The Cronbach's alpha coefficient (α) was computed by correlating the score for each Likert scale item with the total score of items for each observation from smallholder farmers by comparing it to the variance for all item scores of the respondents as shown in Table 1 below.

Hence

$$\alpha = n - 1(\sigma X^2 - \sum i = 1 n \sigma i^2)$$
$$\sigma X^2$$

Where n is the number of items
σX^2 is the total test score variance, and
σi^2 is the item variance.

The aforementioned values demonstrated that nearly every construct or item in the instruments that measured Cronbach Alpha level to be equal to or higher than 0.7 was regarded as reliable and hence approved.

The study data collected were cleaned of all outliers which might interfere with the validity of the results with the aid of the IBM SPSS version 25.0. The competencies of smallholder farmers in rice post-harvest value addition were the dependent variable whilst their socio-demographic characteristics as the independent variables. Data were analysed using the means, standard deviations, Multiple Linear Regression, and Ordinary Least Squares (OLS) to determine the relationship in rice post-harvest value addition. The purpose was to determine the socio-demographic characteristics that influenced the competence of smallholder farmers in rice post-harvest value addition. The independent variables used in the regression model (Table 2) were the Age of the farmer (X_1), Level of Education (X_2), Main source of labour (X_3), Type of education (X_4), Sex (X_5), Variety (X_6), Key source of information (X_7), Main source of income (X_8), Alternative livelihood (X_9), Type of ecology (X_{10}), Type of land ownership (X_{11}), Access to credit (X_{12}), Main occupation (X_{13}), Years of farming (X_{14}) and Member of FBO (X_{15}).

Table 1. Cronbach Alpha reliability test coefficients

Constructs	Cronbach's alpha (α) reliability coefficients	Number of items
Value addition activities	0.942	15
Quality of extension services	0.822	5
Farmers' livelihood	0.619	5
Harvesting paddy	0.746	6
Heaping of harvested paddy	0.971	3
Threshing of paddy	0.786	8
Transportation of paddy	0.674	8
Parboiling of paddy	0.713	8
Drying of paddy	0.714	8
Milling of paddy	0.926	5

Source: Pre-Tested Data (2021)

Table 2. Variables and their measurement included in the OLS Model

Dependent Variable	**Measurement scale**	**Sign**	**Explanation**
Competence of smallholder farmers	5-Point scale		Knowledge and skill of smallholder farmers to perform a task
Independent Variables			
Age of farmer (X_1)	Number of years	+	Age at last birthday
Level of education (X_2)	Education level	+	Higher education increases the level of competency
Source of labour (main) (X_3)	Family = 1, Others = 0	+/-	Sources of labour (individual, family, hired, rotatory)
Education (type) (X_4)	Formal = 1, In-formal = 0	+/-	Type of education attained (Formal, Non-formal, Informal education)
Sex (X_5)	Female = 1, Male = 0	+/-	Sex of respondent
Variety (X_6)	Improved = 1, Others=0	+	Variety of rice grown (Improved, local, both)
Source of information (key) (X_7)	AEAs=1, Others=0	+	AEAs, media, colleague farmers, traders/marketers, service providers
Source of income (main) (X_8)	Income/month of the farmer	+	Higher income raises competency
Alternative livelihood (X_9)	Farming=1, Others=0	+	Formal employment, micro-business, cottage industry
Type of ecology (X_{10})	Upland=1, Others=0	+	Upland, IVS, Boliland, mangrove
Land ownership type (X_{11})	Personal=1, Others=0	+	Personal, family, rented, leased
Access to credit (X_{12})	Yes=1 No=2	+/-	Monetary aid for farming
Occupation(main) (X_{13})	Farming = 1, Non-farming = 0	+/-	Occupation of farmers (Primary)
Farming years (X_{14})	# of farming years	+	Prolong farming years increase competence
Farmer Based Organisation (FBO) membership (X_{15})	Member =1, Not a member = 0	+/-	Membership to FBO

Source: Field Data, Kamanda (2021)

2.2. Collinearity Diagnostic Test from the Competencies of Smallholder Farmers and their Socio-Demographic Characteristics in Rice Post-Harvest Value Addition

A collinearity diagnostic test was performed on the competencies of smallholder farmers and their socio-demographic characteristics. To investigate variance inflation factors (VIF) and tolerance of the independent variables utilised in the regression analysis, a collinearity diagnostic test was performed. According to Ogwuike [16] theory, collinearity occurs when the independent variables in a regression analysis have an excessive amount of correlation and start to impact one another. In a similar vein, O'Brien [17] pointed out that collinearity can raise estimates of parameter variance in a model where no variables are statistically significant despite having a high R^2. When trying to understand how each independent variable relates to the dependent variable, collinearity can produce unexpected study results. In addition, VIF estimates the degree to which the parameter estimate is inflated by the high correlation of the independent variables. The VIF will be very large for the variables employed if there is a collinearity problem. As a result, some variables will need to be eliminated to change the tolerance and VIF values. Bosompem [18] stressed in a study that a VIF close to 10 should raise red flags whereas a tolerance of 1 shows no collinearity problems. However, a tolerance value of 0 indicates that there is a serious collinearity problem. According to Pallant [19], correlations of 0.80 or higher would indicate a breach of the multicollinearity assumption. As a result, the study estimated collinearity by looking at the VIF and tolerance values of the independent variables.

Table 3 presents the results of the multicollinearity test. The variables indicate a VIF of 1, which was discernible from the multi-collinearity diagnostic test results. This means that the variables used to do the regression analysis did not have any problems with multi-collinearity. The variables are therefore included in the regression model.

Table 3. Multi-collinearity diagnostic test values for smallholder farmers

Independent variables	**VIF**	**Tolerance**
The main source of labour	1.057	.946
An alternative livelihood	1.054	.949
The key source of information	1.035	.966
The main source of income	1.017	.983

Source: Field Data, Kamanda (2021)

3. Results and Discussions

3.1. Socio-Demographic Predictors of Smallholders' Competence in Rice Post-Harvest Value Addition

Table 4 presents the results of the Ordinary Least

Squares (OLS) multiple regression on the socio-demographic characteristics of smallholder farmers and their competencies in rice post-harvest value addition. From the results, the OLS model predicts 12.5% (R-square value r=0.125) of variance in competencies of smallholder farmers in rice post-harvest value addition. Four independent variables namely, the main source of labour, alternative livelihood, the key source of information, and the main source of income are the best predictors of competencies acquired by smallholder farmers in rice post-harvest value addition. Further, the relationships between the competencies of smallholder farmers in rice post-harvest value addition and their socio-demographic characteristics are investigated. From the Multi-collinearity diagnostic test values on the socio-demographic characteristics of smallholder farmers, four of the independent variables (the main source of labour, alternative livelihood, the key source of information, and the key source of income) significantly predict competencies acquired by smallholder farmers in rice post-harvest value addition (Table 4).

Specifically, main source of labour is a significant positive predictor (*P*=0.000) of the competence of smallholder farmers in rice post-harvest value addition. The beta coefficient (β= 0.336) suggests that smallholder farmers who have a family as their main source of labour are 0.336 times more likely to increase their competence in rice post-harvest value addition by controlling all the other variables. Household heads have greater control of family labour as compared to hired and rotatory sources of labour in the study area. As a result, family labour is deeply anchored in territorial networks and local traditions and they spend their earnings mostly in local markets, generating a large number of agricultural and non-agricultural jobs and promoting environmental sustainability. The results on the sources of farm labour support the findings of Rasheed et al. [20] who state that the use of family labour is the most readily available source of labour for most families because household members are not directly paid to work. On the other hand, if family labour is used to perform most farming tasks, the farmers may not have enough time to attend training during post-harvest value addition to rice in order to increase their competencies.

Alternative livelihood is also a significant positive predictor (*P*=0.004) in determining the smallholder farmers' competence in rice post-harvest value addition.

The beta coefficient (β=0.302) suggests that an increase in the alternative livelihood of smallholder farmers will result in a 0.30 time increase in their rice post-harvest value addition competence controlling all the other variables. This implies that farmers who have an alternative livelihood are more capable to acquire training in rice post-harvest value addition that will increase their competencies for increased productivity. The source of information was another significant positive predictor (*P*=0.002) in determining farmers' competencies in rice post-harvest value addition. Furthermore, the result reveals that farmers who receive information from agricultural extension agents (AEAs) seem to be more likely to increase their competencies in rice post-harvest value addition. That is, for every unit increase in smallholder farmers' sources of information, their competencies in rice post-harvest value addition will increase by 0.174 holding all the other variables constant. There are different sources of information available to farmers. For the reliability and technological effectiveness of rice post-harvest value addition source of information, it is obvious that AEAs are the right medium to provide such relevant information for farmers.

The main source of income is a significant negative predictor (*P*=-0.089) in determining smallholder farmers' competencies in rice post-harvest value addition. Also, the beta coefficient suggests that for every unit increase in the source of income, a -0.89 decrease exists in the competencies of the farmers in rice post-harvest value addition. This implies that, in some cases, the more sources of income farmers have, the lesser their competencies to get involved into rice post-harvest value addition activities. This is because as farmers engage in various activities that provide them with multiple sources of income, the time available to attend training to improve their competencies will be reduced due to their engagement in other activities for income. In Sierra Leone, increasing farm productivity and facilitating farmers' access to money are necessary to enhance socioeconomic conditions for farmers and the efficiency of communication with them. Farmers are encouraged to establish farmer group associations and to file their registrations with the Ministry of Agriculture and Food Security [21]. In this way, farmers who have identified themselves with registered groups and networks would together quickly attract the attention of the government for access to training and supplies necessary to achieve post-harvest value addition for rice.

Table 4. Multiple linear regression of the socio-demographic variables of smallholders that influence competencies

Variables	Beta	Std. Error	R^2	Adj. R^2	S. E. E	F Ratio	*P*. value
(Constant)	2.357	.074	.125	.116	.53099	4.877	.000
The main source of labour	.336	.055					.000
Alternative livelihood	.302	.105					.004
The key source of information	.174	.055					.002
The main source of income	-.089	.040					.028

Source: Field Data, Kamanda (2021) n=400, p<0.05

3.2. Rice Post-Harvest Value Addition Competencies of Smallholder Farmers

The competencies of smallholder farmers in rice post-harvest value addition are investigated using means and standard deviations. The results from Table 5 show that the smallholder farmers generally have moderate competence in the entire rice post-harvest value addition technologies (Overall Mean=2.60, Standard Deviation =1.16) in the study area. This generally means that the farmers are moderately capable of undertaking rice post-harvest value addition technologies. However, there are varying degrees of capabilities of the farmers concerning the various categories and specific activities of the rice post-harvest value addition competency areas, with milling (Mean=1.52, Standard Deviation =0.94) and packaging and marketing (Mean=1.78, Standard Deviation =0.98) recording the lowest levels of competencies. These results are slightly different from that of Adisa [2] where smallholder rice farmers in Osun State, Nigeria rated themselves as more competent to undertake rice post-harvest value addition technologies than in this study.

The results show that the farmers generally are less capable of using the harvesting technologies during rice post-harvest value addition (Mean=2.41; Standard Deviation =1.01). This is particularly so with technologies including using planting calendars, moisture metre and combine harvesters. They were, however, moderately capable of using handheld sickles and cutting panicles at the recommended length and capable of using a local knife in harvesting. These technologies are common to farmers. As a result, farmers do not require special skills or knowledge in their use as in the case of cropping calendars, moisture meters, combine harvesters, and threshers, among others. In the study area, locally available technologies such as handheld sickles and knives are the ones farmers have competencies in their use as compared to those technologies which are largely unavailable to farmers.

In the area of heaping, farmers have a moderate capability of heaping paddy (Mean=3.10, Standard Deviation=1.19). Yet, they have the capability of heaping paddy on a tarpaulin. For the transportation of paddy, farmers also have a moderate capability (Mean=3.09, Standard Deviation =1.52) to transport paddy from the field after harvest to the threshing site. Even though farmers are incapable of using power tillers to transport paddy, they seem to have high capability in using baskets and bags to transport paddy. This is not surprising because the use of baskets and bags to transport paddy does not require any special skills as compared to power tillers. Power tillers may be expensive and require skills to operate them. Hence, only those farmers who are closer to the agricultural business centers (ABCs) and have been using power tillers can effectively operate them in the study area.

The results show that farmers in general, demonstrate moderate capability (Mean=3.08, Standard Deviation=1.28) in threshing technologies. In detail, farmers are highly incapable of the use of threshing machines. They, however, have a moderate capability in all of the other specific threshing technologies except to whip paddy straws on the floor with sticks to remove grains where farmers have the capability. As indicated by Khan [9], paddy rice can be threshed by hand, foot, or by swinging, beating, and whipping on a framed object. These results are expected because the latter is the traditional practice of threshing paddy by farmers in the study area, as compared to the use of threshing machines, which is costly to hire and requires training. However, the traditional methods of whipping paddy break the grains, destroy grain quality and reduce the market value of rice.

Farmers also have a moderate capability in winnowing paddy (Mean=2.83, Standard Deviation=0.88). The detailed results show that even though farmers are capable of using round/oval shape-weaved bamboo-strip manual winnowers, they are incapable of using oscillating sieves and aspirators (mechanical winnowers). Although locally made winnower is available for farmers, they demonstrate moderate competence in its use. This suggests that farmers need training in winnowing as most farmers cannot operate the mechanical winnower. Parboiling as a key value addition technology is where farmers also have a moderate capability (Mean=2.66, Standard Deviation=1.14). With the use of specialized parboiling containers and rice separators/nets to sieve broken grains from paddy, farmers have less capability in their use. Specialized parboiling containers are not only expensive to farmers but also require training in their use. Similarly, farmers do not use rice separators because rice grading is not a common practice among farmers, which results in the sale of ununiformed sizes of grain. Thus, farmers do not effectively sort long grains from shorter ones, and training in the use of these technologies is necessary for smallholder farmers in the study area. The above findings are in sharp contrast to the findings of Adisa [2] who found farmers in Nigeria with high competence in milling, threshing, and maintenance of moisture content in paddy.

Farmers also have a moderate capability in drying paddy (Mean=2.61, Standard Deviation =1.29). They are however less capable to use mechanical dryers, and moisture meters to test for moisture content in the paddy. Paddy drying technologies such as mechanical dryers and moisture meters are not available and affordable to farmers in the study area. Also, farmers require training to be capable of their use.

Table 5. The rice post-harvest value addition competencies of smallholder farmers

Competency item		Mean	Standard Deviation
Harvesting technologies			
Harvest paddy with a knife to select panicle		3.95	1.04
Harvest paddy with handheld sickles		2.69	1.27
Cut paddy straws 4-5 cm above ground level		2.56	1.20
Determine the harvesting date by using the planting calendar		2.23	0.98
Determine moisture content by using a moisture meter		1.61	0.85
Harvest paddy with a combine harvester		1.41	0.73
	Composite Mean	***2.41***	***1.01***
Heaping technologies			
Heaping paddy on tarpaulin		3.49	1.20
Using coned heap style in packing paddy		2.95	1.18
Heaping harvested paddy for not more than a day		2.85	1.20
	Composite Mean	***3.10***	***1.19***
Transporting technologies			
Using hampers/baskets to transport paddy by humans		4.13	0.85
Using baggage in transporting paddy by humans		3.85	0.59
Using a power tiller to transport paddy by humans		1.29	3.12
	Composite Mean	***3.09***	***1.52***
Threshing technologies			
Whip straws of paddy on the floor with sticks		3.90	1.01
Thresh paddy with feet on a mud floor		3.33	1.79
Use of feet to thresh on tarpaulin		3.33	1.09
Threshing paddy the very day it is harvested		3.20	1.34
To beat paddy straws in bags to remove grains		3.13	1.27
To thresh with feet on the concrete or drying floor		3.05	1.02
Dry wet paddy before it is threshed		3.04	1.32
Use threshing machine		1.67	1.43
	Composite Mean	**3.08**	**1.28**
Winnowing technologies			
Round/oval shape-weaved manual winnower		4.21	0.91
Oscillating sieves (mechanical winnower)		1.44	0.85
	Composite Mean	**2.83**	**0.88**
Parboiling technologies			
Remove all the chaffs on the paddy before soaking it		3.78	1.08
Steam paddy for about 30-40 minutes		3.41	1.35
Remove unfilled/empty grains		3.27	1.31
Use jute bags to cover the container during steaming		2.84	1.54
Wash the paddy twice with clean water		2.54	1.20
Soak the paddy for about 18 hours in warm water		2.49	1.18
Use of specialized parboiling container		1.61	0.79
Utilise rice separator/net to sieve broken grains		1.35	0.65

Table 5 continued

	Composite Mean	**2.66**	**1.14**
Drying technologies			
Using plastic sheet/ tarpaulin to dry the paddy		4.04	1.10
Using drying/concrete floor to dry paddy		3.63	1.45
Using a shed with a fire underneath to dry paddy		2.79	1.27
Using solar energy to dry paddy by occasionally stirring it		3.89	1.37
Using a moisture meter to test for moisture content		1.68	1.22
Using a mechanical dryer to dry paddy		1.62	1.30
	Composite Mean	**2.61**	**1.29**
Milling technologies			
Using a mechanical miller to mill rice		1.98	1.16
Using a de-stoning machine to remove stones/pebbles from rice		1.45	0.84
Using de-huskers or dehulling machines to paddy		1.43	0.83
Using a machine to remove unfilled grains		1.37	1.24
Using a rice separator to grade broken rice		1.35	0.65
	Composite Mean	**1.52**	**0.94**
Storage technologies			
Using sacks/jute bags to store rice		3.59	1.21
Using containers (wooden boxes, drums/kegs, etc.)		3.32	1.40
Using ice barns to store paddy		3.00	1.40
Stacking bags of rice 20cm above on wooden racks		2.95	1.29
Cleaning storehouse three weeks before the arrival of fresh harvest		2.75	1.27
Keeping moisture content of grains at or below 14.0%w.b		2.35	1.24
Checking the moisture content of the store by using a moisture meter		2.13	1.52
	Composite Mean	**2.87**	**1.33**
Packaging & marketing technologies			
Using a phone to facilitate marketing negotiations		2.45	1.10
Using groups to market rice.		2.22	1.18
Package processed rice at 8-13% moisture content		2.01	1.03
Weigh rice on a weighing scale		1.68	1.21
Weigh paddy on a weighing scale		1.58	1.22
Use of labels/tags for traceability/identification of rice types and quality		1.34	0.63
Using laminated and zipped bags to package rice		1.17	0.47
Composite Mean		**1.78**	**0.98**
Overall Mean		**2.60**	**1.16**

Source: Field Data, Kamanda (2021) n=400. Means were calculated on a scale of 1-5

Competence scale: 1=incapable, 2=less capable, 3=moderately capable, 4=capable, 5=highly capable.

Where: 1= (≤1.45), **2**= (1.46-2.45), **3**= (2.46-3.45), **4**= (3.46-4.45), **5**= (≥4.46)

4. Conclusions and Recommendations

The smallholder farmers in the Southern Region of Sierra Leone have moderate competencies in undertaking the rice post-harvest value addition technologies. Their competencies are more in the traditional technologies, than the modern technologies. These modern technologies include; the use of a planting calendar, moisture metre, combine harvesters, packaging and marketing, and milling. Additionally, only four independent variables: the main source of labour, alternative livelihood, the key source of information, and the main source of farmers' income, proved to be the best predictors of the post-harvest value addition by smallholder farmers which predicte 12.5% of the variance in smallholder farmers' competencies in rice post-harvest value addition. This shows very little influence on farmers' competencies indicating that other independent variables which might have shown significant influence on farmers' competencies are not included in the OLS model. The study, therefore, suggests that smallholder farmers should improve their rice post-harvest value addition activities, position themselves well to attract credits and other forms of support from the agriculture ministry and other donors. Lastly, there is a need to investigate other variables such as production factors that might predict farmers' competence in rice post-harvest value addition practices.

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Disclosure and Conflicts of Interest

Philip Jimia Kamanda, Masa Veronicah Motaung, and Ernest Laryea Okorley have respectively declared no conflict of interest for this study.

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