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Influence of Institutional factors on Adoption of Improved Cassava Processing Technologies among Small Scale Farmers in Migori County, Kenya

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Abstract
Cassava is a key food crop, a cheaper raw material for animal feed and has various industrial uses. However, cassava utilization is faced with some challenges in that; once harvested, it is perishable if not processed, it is also bulky and has high cyanide concentration. Processing can increase its utilization. In Kenya, improved cassava processing technologies have been developed but their adoption continue to be low especially among small scale farmers. This paper therefore establishes the influence of institutional factors on adoption of improved cassava processing technologies in Kuria-West and Suna-west Sub-Counties. Eight wards were purposively selected based on the magnitude of cassava production, 120 cassava small scale farmers were proportionately and randomly selected. An interview schedule was used to collect data that was analyzed. Data analysis was done using descriptive statistics and binary logistic regression to test the hypotheses at a level of significance of $p \leq 0.05$. *Institutional factors of this study explained 20.8% variation in adoption. The Chi-Square value was significant at .000. Therefore, null hypothesis which stated that, selected institutional factors [access to extension services, credit access and group membership] have no statistically significant influence on the adoption of improved cassava processing technologies by small scale farmers in the study area was rejected.The findings of the study can be a basis for interventions to help farmers adopt technologies and guide the government and policy makers in formulating strategies to address the challenges faced in processing and utilization of cassava.*
Keyword: *Adoption, Institutional factors, influence, small scale farmers, Technologies*

1. Introduction

Cassava (*Manihot Esculenta Crantz*), is a starchy tropical root crop that develops underground and is originally from Latin America. It is one of the few food crops that can be produced efficiently without need of mechanization and in areas with unpredictable weather patterns. Globally, it provides food to an estimated 800 million people and is mostly grown by low-income, small-scale farmers Food and Agricultural Organisation [FAO], 2013). The world's annual cassava production has been increasing yearly due high demand in the world especially in Asia, Africa, Latin America and Caribbean (Reinhardt , 2017). In Africa, cassava grows well in tropical and subtropical regions especially in Sub-Saharan Africa (Allem, 2002; Olsen & Schaal, 2001). It is a major food security crop in Africa due to its characteristic of drought and disease resistance to, tolerance to low-quality soils and flexible harvest cycle in that it can be harvested anytime of the year once mature. It is also used as a raw material for various industries including food, animal feed and starch (Balagopalan, 2002). There is an expanding market for cassava food products and there is prospective for further production increase to reach the optimal 80 tonnes for each hectare as compared to the present world average yield of 12.8 tonnes (FAO,2013).

Cassava production in Kenya remains low in comparison to some other African countries like, Ghana, Nigeria, Democratic Republic of Congo, Angola, Uganda among others who not only produce cassava as a staple food but also for commercialization (FAO, 2013). Its production in Kenya is 1,112, 000 tonnes from an area of 90,394 hectares (FAO, 2017). It is one of the major root crop in Western, Coastal and Eastern Kenya where it accounts for 63%, 30% and 7% respectively. Migori County is one of the main cassava growing counties in Kenya hence it is chosen for this study on the basis of magnitude; other producing counties in Kenya include Busia, Homa Bay, Kisumu, Kilifi and Machakos (Ministry of Agriculture, Livestock, Fisheries and Irrigation [MoALF&I], 2007). In Kenya, it is mainly grown for subsistence use and the additional sold in the local market as whole fresh roots, sun-dried raw crisps, fried or roasted. Being drought tolerant and low input requirements, it can do well in ASALs

(Arid and Semi-Arid Lands) of Kenya where other crops like maize and beans fail and therefore it's an alternative food security crop (Achieng, Dannenberg, & Willkomm, 2017).

The Kenyan National Policy on Cassava Industry of 2007 indicated that, the cassava processing industry is being promoted by purchase and installation of modern processing plants attained through the reduction of importation duty on cassava processing machineries. The government recognizes that a robust cassava processing industry is essential in encouraging local production of cassava and bring cassava and cassava-based products to into maximum use (Ministry of Agriculture, Livestock, Fisheries and Irrigation (MoALF & I, 2007).The Cassava Development Board of Kenya (CDBK), was established in the year 2007 as a sub-coordinating device for the cassava sector with the aim of moving Kenya towards self-reliance in the cassava industry. This board has put effort to enhance competitiveness of cassava-based product to a great extent. Cassava processing technologies have also been promoted in order to increase utilization of cassava-based products, although the adoption continues to be low especially among smallholder farmers (Achieng, Dannenberg, & Willkomm, 2017).

Nevertheless, cassava has some challenges, the main one being its perishability, once unearthed, it has a short shelf life when not treated, other challenges faced by cassava farmers are its bulkiness, making transportation difficult as well as the high cyanide content (FAO, 2013). Cassava processing is therefore very important because it increases the shelf life, facilitates transportation and marketing, reduces the cyanide content and improves its palatability. The nutrition content can also be improved by fortification with other foods. It can also reduce the food losses and stabilizes seasonal fluctuations in the supply of the crop (Ehinmowo & Fatuase 2016). There are various cassava processing technologies used to make different products depending on availability of the resources, customs and preferences (Hillocks , Thresh, & Bellotti, 2001) .The traditional processing methods utilized in Kenya include pounding, grinding, boiling, brewing, fermentation and open sun drying (Karuri, Mbugua, Karugia, Wanda, & Jagwe, 2001). Improved cassava technologies use up-to-date equipment to enhance acceptability, reduction of the cyanide concentration, reduce on labor and diversify cassava products. These equipment include; flour mill, grinder, grater, dryer, fryer, sifter, oven and peeler (Dada. 2012). Cassava flour consists of mainly starch which is a raw material for food and non-food industries.

There are several factors that influence farmers in the process of adopting technologies. These factors include; the socio-economic, biological, technological, institutional, socio-psychological, cultural, among others (Salehin, Kabir, Morshed, & Farid, 2009). According to Beshir, (2014), institutional factors are important factors in the process of adoption, they are all characteristics involving organizations and interactions that regulate access to and use of resources and services by farmers. They include access to access to credit facilities, membership in farmer groups and extension services (Rousan, 2007). Though there are studies carried out across the world on factors influencing adoption, there is little literature on the institutional factors that influence adoption of improved cassava technologies especially among small scale farmers in Kuria-west and Suna-west sub-counties in Migori County. This paper is aimed at examining the institutional factors influencing adoption of improved cassava processing technologies among small-scale farmers in the two sub-counties which are relatively high cassava production due to its warm climatic conditions that favor production of cassava (Climate-Data.Org, 2018). The area is at risk of climate change and has high poverty levels (County Government of Migori, 2015). The findings of the study may also form a basis for interventions to help farmers adopt cassava technologies. They may also guide the government, academic institutions, policy makers and farmers in formulating effective policies and strategies that will help address constraints encountered by small scale farmers in the process of adoption of cassava processing technologies. Finally, it will also add to the existing body of knowledge on adoption of technologies.

2. Research Methods

The target population was small scale cassava farmers in Suna-West and Kuria-West sub-counties in Migori County. According to the Overall Cassava Coordinator in Migori County, there are about 1500 small scale cassava farmers in Kuria-West sub-county and 500 in Suna-West. Therefore, the target population for this study is 2000 small scale cassava farmers. The accessible population is 120 and 400 small scale farmers in Suna west and Kuria west respectively who are registered with the County and are evenly distributed. Random sampling method was used to select a sample of 120 cassava small-scale farmers who were proportionately selected from the wards. All the wards in Suna-West Sub-County were selected and five wards in Kuria-West.

The study on which this paper is based employed a cross-sectional survey research design. In this design, data from the respondents was collected at a single point in time without repetition from the representative population. This design helped in describing, explaining and determining the relationship between variables (Babbie and Mouton, 2005). A purposive sampling procedure was followed in which Suna-west and Kuria -west sub-counties were purposively selected on the basis of magnitude of cassava production. All the wards in Suna-West Sub-County were selected since the farmers are evenly distributed all over the sub-county. In Kuria –West, the accessible small-scale cassava farmers were distributed uniformly in five wards. Proportionate random sampling method was used to determine the number of farmers to be interviewed in each sector. The list of small-scale farmers was obtained from the county cassava coordinator and the respondents was drawn through simple random sampling using bucket method. In this method, all names of the members were written on pieces of paper and put in a bucket, then the required number of pieces of paper was pulled out randomly. This gave every member an equal chance of being selected.

A researcher-administered semi-structured questionnaire was used to gather data in regard to the objectives of the study. The tool was chosen on the basis that the data was to be collected by engaging the farmers on one on one. The research tool was pilot-tested on 20 % of the sample size from West Kamagambo and North Sakwa wards in Rongo Sub-county in Migori County. These areas have similar characteristics to the main study. The questionnaire was subjected to a reliability test. This assessment was done to determine the degree of internal consistency of the instrument in producing results or data after repeated trials (Mugenda & Mugenda, 2003). was used to test reliability whereby a minimum value of (α) coefficient of 0.7 was be accepted, as recommended for education and social science research (McMillan and Schumacher, 2014). In this study the cronbach alpha coefficient obtained was 0.74.

3. Result Analysis

3.1 Access to Extension services

Table 2 below shows the small-scale farmers responses on access to extension services from any of the providers for the last one year. The results showed that majority of small-scale farmers have not accessed extension services for the last year. About 53.3% of the respondents have not received extension services while 46.7% of the respondents agreed to have accessed extension services before.

Table I: *Access to extension services*

Access to Extension	Frequency	Percent
Yes	56	46.7
No	64	53.3
Total	**120**	**100.0**

The study also established the main providers of extension services to small scale farmers and the majority of the extension services were from fellow farmers 53.6% followed by farmer groups, 28.6%. Other extension providers include private companies, the county government and NGOs. Also, on the frequency of extension services, the results indicated that 32.1% of small-scale farmers received services once per year, while 37.5% received the services twice per year.

3.2 Access to credit facilities

In order to determine the influence of access to credit on the adoption of improved cassava technologies by small scale farmers, the data collected and analyzed is presented in table III below.

Table II: *Access to credit facilities*

	Frequency	Percent
No	64	53.3
Yes	56	46.7
Total	**120**	**100.0**

From the 120 respondents, 53.3% have not accessed any form of credit from whichever source for the last one year while 46.7accessed credit. The main source of credit for farmers is farmer groups, 46.4% is followed by table banking and then county government with a percentage of 14.3% each. The average amount of credit accessed by the respondents per year is 13887.50 Kenya shillings. 66.1 % of the farmers who accessed credit only received it inform of farm inputs while the rest got it in form of cash which they utilized to purchase tools and equipment (12.5%) while labour and household (10.7%) each. Generally, there is low currency as compared the amount required to invest in technologies and the respondents seem to have other priorities to take care of rather than investment in technologies. Low access to credit limits the financial resources available for the required technologies and therefore this has adversely impacted on the adoption process.

3.3 Membership in farmer organizations

Table 4 below presents the responses by small scale farmers on membership to farmer groups

Table III: *Membership in farmer organizations*

	Frequency	Percent
No	33	27.5
Yes	87	72.5

Total	120	100.0

The results showed that majority of small-scale farmers belong to farmer groups, 72.5% and of all the groups, 82.6% of them were registered. However, even though these groups considered themselves farmer groups, only 37.2% of the groups engaged in farming activities. The rest, 62.8% mainly engaged in table banking, saving and acquiring loans.

3.4 Level of Adoption Improved cassava Processing Technologies

Data collected on the access to improved cassava processing technologies by scale farmers was analyzed and is presented in the figure 1below:

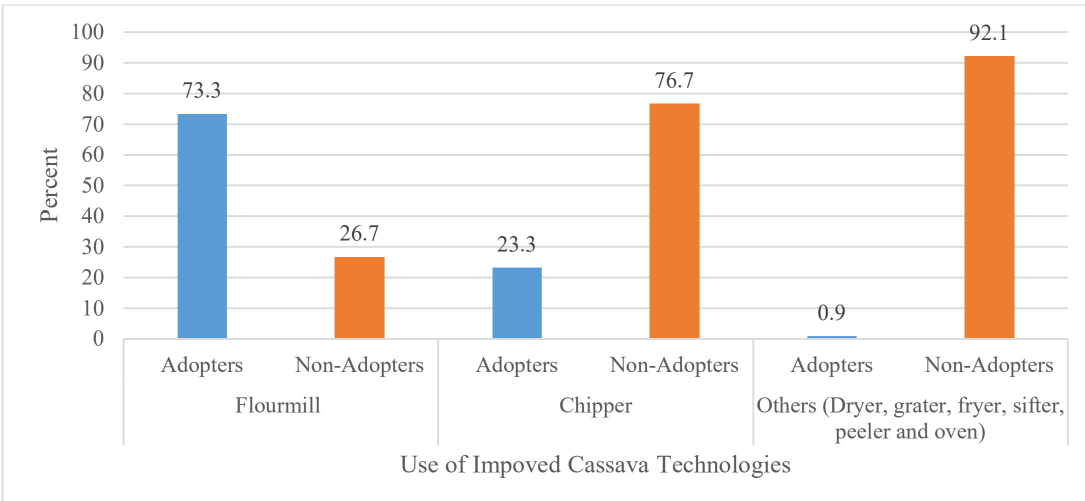

Figure 1. Access to improved cassava processing technologies

The results show the responses on the use of improved cassava processing technologies in the last on year. Use of flourmill is the only improved technology that is highly adopted in the two sub-counties with 73.3% of the farmers used this technology frequently in the last one year. The chipper is only adopted by 23.3% while the rest of the improved technologies, only an insignificant 0.9% have adopted them.

3.5 Logistic Regression Analysis of Institutional Factors Influencing Adoption of Improved Cassava Processing Technologies

A logistic regression was done to establish the influence of institutional factors of access to extension services, access to credit and membership to farmer groups) on adoption of improved cassava processing technologies. The results are presented in the Table IV below.

Table IV: *Binary Logistic Regression Results on Influence of Institutional Factors on Adoption of improved cassava processing Technologies*

Variables	B	S.E.	Wald	df	Sig.	Exp(B)
Group Membership	.650	.489	1.765	1	.184	1.915
Access to Credit	1.492	.514	8.424	1	.004	4.448
Access to Extension	-1.345	.480	7.834	1	.005	.261
Constant	.672	.430	2.446	1	.118	1.959
Likelihood test χ^2= 18.457, df=3, p=.000						
Pseudo R^2 = .20.8						
Hosmer and Lemeshow Test = .990						
N=120						

The results indicate that access to extension services (p=0.005) has a significant influence on adoption of improved cassava technologies since the p-value is less than 0.05. Nevertheless, the Exp(B) value is below 1.0 which signifies that availability extension variable decreases the probability of adoption occurring. Access to credit (p=0.004) has a significant influence on adoption of improved cassava processing technologies since their p-value is less than 0.05. The Exp(B) value is above 1.0 which signifies that access to credit increases the probability of adoption of cassava processing technologies. Group membership (p=0.184) contributed positively but insignificantly to the model as its probability value is greater than 0.05. The Exp(B) value is above 1.0 which signifies that being a member of a group increases the probability of farmers adopting cassava processing technologies. The Pseudo R^2 statistics value was 20.8% and therefore, implies that the model fits the data practically well. The Hosmer and Lemeshow Test has a non-significant chi-square test of .990, this also indicates that the data fits the model well has and has significantly increased the ability of the factors to predict adoption of cassava processing technologies.

4. Discussion

The results show that farmers have a low education level, these findings correspond with Ogola *et al* 2010, whose findings indicated that small-scale farmers in Nyanza, Coast and Rift valley provinces of Kenya have lower education with 51.9 % secondary school level and below and 28.7% are illiterate. The results also indicate that there is low adoption of improved technologies among small scale farmers in Kuria-west and Suna-west sub-counties. This is in agreement with a study carried out in Ethiopia which indicated that adoption agricultural of technologies has not been optimum despite development programs introducing new technologies over the past two decades (Melesse, 2018). Formal extension is low among the respondents, 82.2% of the extension providers were fellow farmers and farmer groups. The results concur with the findings by Wambugu (2001) who indicated that, low percentage of farmers received formal extension services. According to Ngongo (2016), frequent accessibility of extension services can influence the adoption rate of improved technologies in agriculture. Provision of extension services on improved agricultural technologies can only be effective if there is more regular contact between the extension agents and the farmers to facilitate the process.

From the binary logistic regression analysis, the Exp (B) value is below 1.0 which signifies that availability extension variable decreases the probability of adoption occurring. This differs from the results by Beshir (2014), that indicated that access to extension services empowers farmers to identify and analyze their agriculture-related challenges as well as help them utilize available opportunities to maximize their profits. This could be attributed to the fact even though 53.3% of farmers received extension services, the majority of it was from sources which are not most times are not reliable; 53.6% from fellow farmers and 28.6% from farmer groups. According to Ali & Rahut (2013) among other researchers, based their research about extension offered by from extension agents deployed by the government to reach out to farmers. They indicated that extension agents provide farmers with valuable information regarding various agricultural technologies and plays an important role in the adoption of technologies. Extension plays an important role in generating consciousness about characteristics of particular technologies and enable farmers make informed adoption decisions. Therefore, farmers with a greater contact with extension agents are more likely to adopt technologies. These results therefore, confirms that government extension agents are useful in promoting cassava processing technologies.

The results also indicate that there is limited access to credit among the respondents. These findings correspond with Wanyama et al (2013) who concluded that there is limited access to credit among small scale farmers and this hinders investment in agricultural technologies and innovations. The binary logistic regression analysis indicated that access to credit ($p=0.004$) has a significant influence on adoption of improved cassava processing technologies since their p-value is less than 0.05. The Exp(B) value is above 1.0 which signifies that access to credit increases the probability of adoption of cassava processing technologies. The results on access to credit are in line with those of Mutuku, Nguluu, Akuja & Bernard, (2016) who established that access to credit is a significant factor influencing adoption of technologies. Limited access to credit limits the farmer's ability to acquire capital to start and expand their use of technologies.

The results on membership to farmer organization indicated that even though a high percentage of farmers were in in groups which they considered farmer groups, only 37.2% involved themselves in farming activities. According to Tey, (2013), farmer groups get involved in collective marketing and therefore group decisions tend to influence members to make certain adoption decisions. More importantly collective marketing maximizes returns and increase financial capacity to invest in improved technologies. Also, farmers get inclined to certain technologies that are practiced by other members and replicate in their own fields. Also, farmer groups serve as entities within which extension services are easily delivered. From the binary logistic regression analysis, Group membership ($p=0.184$) contributed positively but insignificantly to the model as its probability value is greater than 0.05. The Exp(B) value is above 1.0 which signifies that being a member of a group increases the probability of farmers adopting cassava processing technologies. These results concur with Tey (2013) who established that membership to farmer groups such as cooperatives, associations and clubs tend to significantly influence its members to make certain adoption decisions about a wide variety of agricultural technologies. Farmers are inclined to appreciate benefits of certain technologies practiced by some members of their organizations and try out the innovations in their own fields. Further research to establish why membership to farmer groups does not influence adoption of cassava processing technologies would be necessary.

The value of Pseudo R^2 between 20% and 40% is considered a good fit (Ullah, Khan, Zheng and Ali, 2018). In this study, the Pseudo R^2 statistics value was 20.8% and therefore suggested that the model fits the data reasonably well. Peng, Lee and Ingersoll (2002) indicated that a non-significant value of chi-square of Hosmer and Lemeshow Test indicates that model fits well, from the results the value is insignificant and therefore the data fits the model well. This also has significantly increased the ability of the factors to predict adoption of cassava processing technologies. It was hypothesized that there is that the selected institutional factors [access to extension services, access to credit facilities and membership in farmer organizations] have no statistically significant influence on the adoption of cassava processing technologies by small scale farmers of Kuria-west and Suna-west sub-counties. The log likelihood test is statistically significant p=.000 which suggests that the independent variables jointly influence adoption of improved cassava processing technologies among small scale farmers. Therefore, contrary to the stated null hypothesis; the institutional factors significantly influenced adoption of improved cassava processing technologies. Hence, the null hypothesis was rejected.

5. Conclusion

The following conclusions were drawn grounded on the institutional factors of this study relative to adoption of improved cassava processing technologies among small-scale farmers. The study also established that most farmers have low access to formal extension services. The repercussion of low extension services access being insufficient knowledge transfer between extension agents and farmers consequently influencing adoption of improved cassava processing technologies adversely. There is also low access to formal sources of credit facilities and those who access it, it is inadequatethis contributes to limited access to resources required for investment in adoption of improved cassava processing technologies. Most farmers belong to farmer groups but these groups rarely practice farming activities, they are mainly involved in table banking and merry-go-round. Therefore, these groups are ineffective in promoting adoption of cassava processing technologies. It was very evident from the results that adoption of these technologies is very low among small scale farmers and the institutional factors have a significant influence on adoption of improved cassava processing technologies.

6. Recommendations

The government should reduce the costs of improved technologies and provide farmers with credit facilities to make the improved cassava processing technologies more accessible. The institutions that provide credit facilities should also be more considerate in giving loans to the small-scale farmers with at lower interest rate, this will support them because they limited resources. Hiring services of the improved technologies could also be established by the County governments to allow access by small-scale farmers at a lower cost. The extension agents should be more regionalized at Wards and villages so that contact between extension agents and the farmers is improved. Due to infrequent visitation by extension agents, other forms of communication that are appealing to the farmers should be used. For example, through text messages, radio, group meetings among others. Owing to the low levels of income among small scale farmers, the study recommends the farmers to come together and pool resources and purchase or hire the improved cassava processing machinery in groups and this will help them to adopt these technologies which as individual may be impossible to adopt.

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