EFFECTIVENESS OF EXTENSION COMMUNICATION CHANNEL IN THE ADOPTION PROCESS OF HERMETIC BAG STORAGE TECHNOLOGY IN NAKURU, KENYA.

ABSTRACT

This study sought to examine effectiveness of extension communication channel on adoption process of hermetic bag storage technology. This was prompted by the various maize post-harvest losses experienced by farmers despite maize being staple food in Kenya. Correlational study design was employed while proportional simple random samplingtechnique was used to obtain a sample size of 120 farmers in the Njoro, Molo and Rongai sub-counties of Nakuru County. Content and face validity was assessed by subjecting the instrument to critique by experts in Egerton University. Cronbach alpha was used to estimate the reliability of the research instruments and was found to be 0.848. Descriptive statistics (means, percentages and standard deviation) and inferential statistics (Pearson correlation) were employed for data analysis. Pearson correlation coefficient analysis was used to test the hypotheses at significant level of α = 0.05.The results indicated that Pearson Correlation was highest at the decision-making stage 0.853 followed by the persuasion stage at 0.651, adoption stage at 0.624 then implementation stage came fourth at 0.466 and finally awareness stage at 0.363.Therefore the study established that extension communication channels are effective in persuasion, decision, implementation and adoption stages of hermetic bag adoption process. The study recommends that Government should come up with policies to support extension service to facilitate the adoption of hermetic bag storage technology and hence attain food security

Keywords: extension communication channel, Adoption process, Hermetic bag storage technology, small scale farmers, post-harvest losses, maize storage

1. INTRODUCTION

Maize is a vital food crop cultivated in most parts of the world, especially in low- and middle-income countries (LMICs) and globally the third most grown cereal [1]. In Kenya, maize and its products are the staple food to the majority of the population with an annual per capita consumption of approximately 77 kg [2]. Reducing postharvest losses therefore can go a long way in the achievement of food security, hence motivating the farmers' interest in postharvest losses mitigation [3]. This can

be achieved through dissemination of information using effective communication channels. Study by[4]revealed that, extension workers are key providers of agricultural information and advisory services to farmers in Sub-Sahara Africa (SSA). This means that, their role is particularly crucial when it comes to promoting improved agricultural technologies. In Kenya extension services play a key role in sharing agricultural knowledge, technologies, information and also linking the farmers to other sectors of the economy [5].

In the same way for rural people, extension agentsare charged with providing knowledge and information on particular innovations to farmers[6]. Agricultural extension in this information age has been recognized as an essential medium of disseminating information and advice to farmers[7]. Consequently, agricultural extension is important because the frequency of extension contacts influences the adoption behavior of farmers as well as influencing agricultural technology adoption for improving the production and productivity of smallholder farms[8-9].Therefore, extension service is a relevant and key measure to be employed in disseminating agricultural information to farmers since they often work towards quickening the decision-making process by employing strategies such as demonstration trials and provision of technical knowledge to the farmers. This is in line with results of study by [10]which underscored that agricultural extension service is considered as public support for technology adoption in the rural sector. Extension workers play a critical role in providing agricultural professional services, farmers training, advisory and technical support to farmers [11]. Agricultural extension process can be defined as a transfer of technologies integrating and interconnecting a series of sub-processes, which include: a transfer or delivery of the new technology from the source to the target area, a process of localization or harmonization of technology, which is intended to make the technical fit with the environmental conditions in the target area and is compatible with the prevailing agricultural systems in the region through a test and confirmatory tests of the technique in the target and promotion of the region, persuading farmers to adopt new technology, enabling the targeted farmers to apply the technology in their farms and giving them the knowledge and skills necessary to do so and the provision of technical application requirements[12].

Agricultural extension is the basis of the transfer of agricultural technologies to farmers and persuasion of farmers to adopt those agricultural techniques. Likewise agricultural extension workers are playing a major role in the transfer of agricultural technologies to farmers.Therefore,the process of transfer of agricultural technologies and of persuading farmers to apply them on farms needs to be done by specialists in agricultural extension who have practical experience in the dissemination of agricultural technologies and know how to deal with farmers[13-14]. Findings by [15} confirms that farmers who participate in extension activities and farmer's field schools are more positively impacted in adoption of agricultural technologies compared to those who do not participate in these activities. Extension information sources thereforehave a positive impact on the adoption of IPM technologies as well as social participation of farmers in extension[16-18].Therefore,contact with extension workers and off-farm participation is positive in determining adoption for example in the case of chemical fertilizer adoption by farmers[19].

Extension services/agents play an important role in providing credible information and advice especially on agricultural technology[20]. A pilot study conducted on PICS in Burkina Faso and Niger revealed that the core extension program focused on PICS technology awareness building through village level activities involving multiple visits by trained field technicians [21].Despite the pertinent role of extension, the objective of Agricultural extension in developing countries including Kenya to improve the productivity and livelihoods of rural farmer and their families has been underscored in the Strategy to Revitalize Agriculture (SRA) in Kenya[22]. However, the above literature supports the role of extension in dissemination of agricultural information. Therefore, extension communication channel stands to benefit farmers in the adoption of hermetic bags storage technology although literature does not advice at what stage of the adoption process the extension channel would be most effective and hence the justification of this study to provide the answers.

2. METHODOLOGY

Correlational study design was adopted as ideal for the study due to its ability to measure the degree of association between variables. Rongai, Molo and Njoro were

selected as the sub-counties of study due to their high potential in maize production in the county with a sample size of 120 small scale maize farmers selected from an accessible population of 10,660 farmers.

SS= Z2* (p)* (1-p)/ C2 Whereby: SS= sample size = Z value (in this case 1.96 for 95% confidence level) p = estimated proportion of an attribute that is present in a population. The variability of a population that was to adopt Hermetic bag storage technology was not known thus assumed maximum variability i.e., p=0.5 c = confidence interval (or the desired level of precision), expressed as decimal, in this case 0.0895. SS= (1.96)2 (0.5) (0.5)/ (0.0895)2 = 120.

This study examined content validity of the instrument by subjecting it to critique by experts in the University to ensure it was clear and logical while reliability was achieved by pretesting the instruments to ensure consistence in precision and the Cronbach alpha reliability coefficient for the small-scale maize farmers was0.848. The data was analyzed through the use of descriptive statistics (frequencies, mean, percentages and standard deviation) and inferential statistics (Pearson correlation coefficient. The descriptive statistics were used to summarize the data and inferential statistics were used to test hypotheses. Pearson correlation coefficient analysis was used to test the hypotheses at significant level of $\alpha = 0.05$ to show the relationship between the independent and the dependent variable (extension communication channel and adoption process).

3. RESULTS AND DISCUSSIONS

3.1: Effectiveness of extension communication channel on the adoption process of hermetic bags storage

The objective of the study was to establish the influence of extension service as a communication channel on the adoption process of hermetic bags storage technology by small scale maize farmers in Nakuru County. The objective sought information on how effective extension communication channel was in the five stages of the adoption process (awareness, persuasion, decision, implementation and adoption stages) of the hermetic bag storage technology.

3.1.1: Effectiveness of extension channel in the awareness stage of the adoption process of hermetic bags storage technology

From Table 1, 94% of the respondents stated that extension channel is ineffective in providing knowledge on the existence of hermetic bag storage technology while 6% of the respondents stated that extension channel is effective in provision of knowledge on the existence of hermetic bag storage technology with a mean of 2.604and std. dev of 0.970. In addition, 90% of the respondents stated extension channel are ineffective in giving information quickly while 10% of the respondents stated that extension channel is effective in giving information quickly with a mean of 2.28 and std. dev = 0.934. Furthermore 80%of the respondents stated that extension channels are ineffective in giving accurate information while 20% of the respondents stated that extension channels are effective in giving accurate information with of a mean of 2.62and std. dev = 0.923. The study findings indicate that extension communication channel is not the most effective communication channel in dissemination of information on hermetic bag storage technology to the small-scale maize farmers. It further explains that government extension agencies are often bureaucratic and the services they provide may not have the capacity to reach all smallholder farmers nor provide up-to-date and tailored information to meet the needs of the farmers. This is also supported by findings of[23] that broadcast media play influential roles in providing extension services, especially in view of the public extension agencies' ineffectiveness in providing the much-needed agricultural extension services to farmers.

Table 1: Effectiveness of extension channel in the awareness stage of the adoption process of hermetic bags storage technology

Extension channels in the awareness stage	VE	E	I	VI	Mean	Std. dev
Knowing the existence of hermetic bag storage technology	3%	3%	32%	62%	2.604	0.970
Giving information quickly	2%	8%	38%	52%	2.28	0.934
Giving accurate information	6%	14%	31%	49%	2.62	0.923

Scale: VE=Very Effective -5, E=Effective -4, DK=Don't Know -3, I=Ineffective-2, VE=Very Ineffective -1

3.1.2: Effectiveness of extension communication channel in the persuasion stage of the adoption process of hermetic bags storage technology

From Table 2, 95% of the respondents stated that extension channel is effective in convincing farmers on importance of hermetic bags while 5% of the respondents stated that extension channel is ineffective in convincing farmers on importance of hermetic bags with a mean of 2.40and std.dev. of 0.964. In addition, 80% of the respondents stated that extension channels are effective in building confidence on the hermetic bag storage technology while 20% of the respondents stated that extension channel are ineffective in building confidenceon the hermetic technology with a mean of 2.42 and std. dev of 0.945. Furthermore 80% of the respondents stated that extension channels are effective in presenting information on hermetic bags in an appealing way while 20% of the respondents stated that extension channel are ineffective in presenting information on hermetic bags in an appealing way with a mean of 2.04 and std. dev of 0.953.

This is consistent with findings by [4] that, extension workers are the key providers of agricultural information and advisory services to farmers in Sub-Sahara Africa (SSA). This means that, their role is particularly crucial when it comes to promoting improved agricultural technologies. In the same way [13] indicated that Agricultural extension is the basis of the promotion of agricultural technologies to farmers and to persuade farmers to adopt those agricultural techniques. They also revealed that, agricultural extension workers are playing a major role in the transfer of agricultural technologies to farmers. This means that extension agents persuade farmers as they not only inform them on their landutilizationand other agricultural practices but also motivate them to adopt modern agricultural technologies in their daily interactions with the farmers.

Table 2: Effectiveness of extension channel in the persuasion stage of the adoption process of hermetic bags storage technology

Extension channels in the persuasion stage	VE	E	DK	I	VI	Mean	Std. dev
Convincing on importance of	44%	51%	0%	1%	4%	2.40	0.964

hermetic bags							
Building confidence on the hermetic technology	**32%**	**48%**	**0%**	**7%**	**13%**	**2.42**	**0.945**
Presenting information on hermetic bags in an appealing way	**37%**	**43%**	**0**	**7%**	**13%**	**2.04**	**0.953**

Scale: VE=Very Effective -5, E=Effective -4, DK=Don't Know -3, I=Ineffective-2, VE=Very Ineffective -1

3.1.3: Effectiveness of extension communication channel in the decision stage of the adoption process of hermetic bags storage technology

From Table 3, 77% of the respondents stated that extension channels are effective in giving opportunity to ask questions on hermetic bag technology while 10% of the respondents stated that extension channel are ineffective in giving opportunity to ask questions on hermetic bag technology with a mean of 4.04and std. dev of 0.231. In addition, 82% of the respondents stated that extension channels are effective in answering all the questions that triggered use of hermetic bag storage technology while 9% of the respondents stated that extension channel are ineffective in answering all the questions that triggered use of hermetic bag storage technology with a mean of 3.873and std. dev of 1.037.

Furthermore 82%of the respondents stated that extension channels are effective in helping to understand the benefits of using hermetic bags which led to the decision to use the bag while 10%of the respondents stated that extension channel are ineffective in helping to understand the benefits of using hermetic bags with a mean of 4.177 and std. dev of 0.912. The findings are in line with [24] that agricultural extension is a system that focuses on empowering and equipping the farmers with the abilities to help them make sound decisions, solve their problems themselves and manage their farming business.Effectiveness of extension communication channel in decision making therefore could be attributed to the role they play as intermediaries between research and farmers. This builds a lot of trust to farmers as they rely on extension agents for research findings. Therefore, extension agents operate as facilitators and communicators, helping farmers in their decision-making and ensuring that appropriate knowledge is implemented to obtain the best results with regard to sustainable productionand general rural development.

Table 3: Effectiveness of extension channel in the decision stage of the adoption process of hermetic bags storage technology

Extension channels in the decision stage	VE	E	DK	I	VI	Mean	Std. dev
Giving opportunity to ask questions on hermetic bag technology	67%	10%	13%	0%	10%	4.04	0.231
Answering all the questions that triggered use of hermetic bag storage technology	40%	42%	9%	3%	6%	3.873	1.037
Helping to understand the benefits of using hermetic bags which led you decide to use the bag	58%	24%	8%	4%	6%	4.177	0.912

Scale: VE=Very Effective -5, E=Effective -4, DK=Don't Know -3, I=Ineffective-2, VE=Very Ineffective -1

3.1.4: Effectiveness of extension channel in the implementation stage of the adoption process of hermetic bags storage technology

From Table 4, 88% of the respondents stated that extension channels are ineffective in demonstrating proper use of the hermetic bag storage technology while 12% of the respondents stated that extension channel are effective in demonstrating proper use of the hermetic bag storage technology with a mean of 2.984and std dev of 1.132. In addition, 84% of the respondents stated that extension channels are ineffective in giving understanding on the proper use of hermetic bag storage technology while 9% of the respondents stated that extension channel are effective in giving understanding on the proper use of hermetic bag storage technology with a mean of 2.145and std. dev of 1.121. This means that extension communication channel is not effective in influencing implementation of hermetic bag storage technology. This could be attributed to the fact that agricultural advisory systems have changed over the past decades, especially in regard to public extension since farmers receive information from a wide range of sources and in the last two decades, public and private actors operating in rural contexts in developing countries have widened their array of methods for disseminating knowledge through radio programmes, videos and other ICT-based methods [25]. Similarly, whereas it is recommended that specialists in agricultural extension are

best in influencing decision on adoption,it becomes difficult as the process requiresa lotof resources[26]. The work of government extensionspecialistsrequiresa lot of resources which are not be easy to mobilize especially for the government extension [27].

Table 4: Effectiveness of extension communication channel in the implementation stage of the adoption process of hermetic bags storage technology

Extension channels in the implementation stage	VE	E	DK	I	VI	Mean	Std
Demonstrating proper use of the hermetic bag storage technology	**0%**	**8%**	**4%**	**48%**	**40%**	**2.984**	**1.232**
Giving understanding on the proper use of hermetic bag storage technology	**4%**	**4%**	**8%**	**34%**	**50%**	**2.145**	**1.121**

Scale: VE=Very Effective -5, E=Effective -4, DK=Don't Know -3, I=Ineffective-2, VE=Very Ineffective -1

3.1.5: Effectiveness of extension communication channel in the adoption stage of adoption process of hermetic bags storage technology

From Table 5, 70% of the respondents stated that extension channels are effective in providing continuous follow up to avoid discontinuation while 20% of the respondents stated that extension channel are ineffective in providing continuous follow up to avoid discontinuation with a mean of 2.563 and std. dev of 0.908. In addition, 60% of the respondents stated that extension channels are effective in promoting continuous use of hermetic bag storage technology while 30% of the respondents stated that extension channel are ineffective in promoting continuous use of hermetic bag storage technology with a mean of 2.181and std. dev of 0.913. Furthermore 60% of the respondents stated that extension channels are effective in providing advice in the course of utilization of the hermetic bag while 25% of the respondents stated that extension channel are ineffective in providing advice in the course of utilization of the hermetic bag with a mean of 2.604 and std. dev of 0.970. This is consistent with [9] that, agricultural extension service significantly influenced agricultural technology adoption for improving the production and productivity of

smallholder farms. Therefore, extension service is a relevant and key measure to be employed in disseminating agricultural information to farmers since they often work towards quickening the decision-making process by employing strategies such as demonstration trials and provision of technical knowledge to the farmers. The findings also agree with [10} that agricultural extension service is considered as public support for technology adoption in the rural sector.

Table 5: Effectiveness of extension channel in the adoption stage of the adoption process of hermetic bags storage technology

Extension channels in the adoption stage	VE	E	DK	I	VI	Mean	Std
Providing continuous follow up to avoid discontinuation	40	30	5	15	10	2.563	0.908
Promoting continuous use of hermetic bag storage technology	40	20	10	10	20	2.181	0.913
Providing advice in the course of utilization of the hermetic bag	20	2	5	20	2.604	0.970	

Scale: VE=Very Effective -5, E=Effective -4, DK=Don't Know -3, I=Ineffective-2, VE=Very Ineffective -1

3.2: Correlation between effectiveness of extension communication channel in the various stages of the adoption process of hermetic bags storage technology

From Table 6, Pearson correlation value on the effectiveness of extension services communication channels at the awareness stage was 0.363 while the significant value was 0.000 which was less than 0.05 significant levelwhich is the reference p value in the analysis.This implies that there is a weak positive correlation between the effectiveness of extension services and creating awareness about hermetic bags storage technology among small scale maize farmers in Nakuru County, Kenya. In addition, the Pearson correlation value on the effectiveness of extension services communication channels at the persuasion stage is 0.651 while the sig value was 0.000 which was less than 0.05 significant level this implies that there is a strong positive correlation between the effectiveness of extension services and

persuading small scale maize farmers in Nakuru County about hermetic bags storage technology among.

Furthermore, the Pearson correlation value on the effectiveness of extension services communication channels at the decision-making stage is 0.853 while the sig value was 0.000 which was less than 0.05 significant level this implies that there is a strong positive correlation between the effectiveness of extension services in helping small scale maize farmers in Nakuru County make decision about hermetic bags storage technology among. The findings also indicates that the Pearson correlation value on the effectiveness of extension services communication channels at the implementation stage is 0.466 while the sig value was 0.000 which was less than 0.05 significant level this implies that there is a moderate positive correlation between the effectiveness of extension services and implementing hermetic bags storage technology among small scale maize farmers in Nakuru County, Kenya. Finally, the findings indicated that the Pearson correlation value on the effectiveness of extension services communication channels at the adoption stage is 0.624 while the sig value was 0.000 which was less than 0.05 significant level this implies that there is a strong positive correlation between the effectiveness of extension services and adoption of hermetic bags storage technology among small scale maize farmers in Nakuru County, Kenya.

Table 6: Correlation Pearson Result on the Effectiveness of Extension Services as a Communication Channels at Various Stages of Adoption Process

		Awareness	Persuasion	Decision Making	Implementation	Adoption
Extension Services	**Pearson Correlation**	**.363****	**.651****	**.853****	**.466****	**.624****
	Sig. (2-tailed)	**.000**	**.000**	**.000**	**.000**	**.000**
	N	**116**	**116**	**116**	**116**	**116**

In conclusion the value of Pearson Correlation was highest at the decision-making stage (0.853) followed by the persuasion stage at 0.651, adoption stage at 0.624 then implementation stage came fourth at 0.466 and finally awareness stage at 0.363. This shows that extension services as a communication channel is most effective at the decision stage of hermetic bags storage technology among small

scale maize farmers in Nakuru County, Kenya and the least effective at the awareness stage. The findings also concur with [28] who in their research on the crucial role of extension workers in agricultural technologies transfer and adoption ascertained that extension workers help a lot in determining the needs, constraints, priorities and opportunities for farmers. They also help in teaching farmers the value of improved agriculture, recommending suitable crops, encouraging adopting of appropriate technologies, and evaluating farmers' reaction and attitudes towarddevelopment projects. This further supports findings by [17] which found that social participation of farmers in extension with extension experts had significant correlation with the adoption of biological control by farmers.

3.3: Hypothesis Test Result on the Effectiveness of Extension Services on Adoption Process of Hermetic Bags Storage Technology

The finding indicated that the sig value was 0.000 which was less than 0.05 significant level. Therefore, based on the rule of significance, the study rejects the null hypothesis (Ho_1stating that there is no statistically significant effect of extension service as a communication channel on the adoption process of hermetic bags storage technology by small scale maize farmers in Nakuru County. The study concluded that extension service as a communication channel has a significant influence on the adoption process of hermetic bags storage technology by small scale farmers in Nakuru County. The findings agree with a study by [16] who found out that extension information sources had a positive impact on the adoption of Integrated Pest Management (IPM)technologies. In the same way, Noorhosseini [18] found participation of farmers in extension activities as an important factor of adoption of pest biological control. The findings are also in line with findings by [29] that extension service is a relevant and key measure to be employed in disseminating agricultural information to farmers since they often work towards quickening the decision-making process. This is by employing strategies such as demonstration trials and provision of technical knowledge to the farmers. Results of this study are also in line with findings by [30] that agricultural extension agencies have central role in facilitating the flow of a variety of information to offer the needed exposure of farmer to innovation for overall development.

Table 7: Hypothesis Test Result on the Effectiveness of Extension Services on Adoption Process of Hermetic Bags Storage Technology

		Extension channel
Adoption Process	**Pearson Correlation**	**.756****
	Sig. (2-tailed)	**.000**
	N	**116**

4. CONCLUSION

Extension service is an effective communication channel in the adoption process of hermetic bag storage technology. This is because it has positive influence in all stagesof the adoption process of hermetic bags storage technology by small scale maize farmers in Nakuru County. This implies that small scale maize farmers who have access to extension communication channel are more likely to be influenced to use and continued utilization of the hermetic bag storage technology. Therefore, extension as a communication channel should be given more emphasis in the persuasion, decision and adoption stages of the adoption process of hermetic bags storage technology. This therefore justifies the need to utilize extension communication channel for successful adoption process of hermetic bag storage technology.

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