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Maize farmers' use, preference, and trustworthiness of information sources and communication channels in Dormaa, Ghana: A gender comparison.

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Maize farmers' use, preference, and trustworthiness of information sources and communication channels in Dormaa, Ghana: A gender comparison.

Abstract

The study aimed to identify maize farmers' use, preference, and trustworthiness of the various information sources and communication channels farmers in Dormaa, Ghana, used to receive information about their farming activities. A questionnaire was developed, and data was collected from 217 maize farmers. The result revealed more males are involved in maize production than females. Most males indicated they received training in using hermetic bags more than female farmers. Respondents ranked Extension agents highest as the source from which they receive their farming information. Based on the level of preference for the information sources, the results show a statistically significant difference between male and female farmers' preference for Extension agents, friends/neighbors, and church leaders, with male farmers preferring these information sources more than females. The result indicated a significant difference between male and female preferences for phone calls, with more males indicating they preferred telephone calls. The t-test results of farmers' trustworthiness for the information sources revealed a significant difference between male and female farmers' trustworthiness for fellow farmers, friends/neighbors, telephone calls, and posters/billboards for communication channels. Given that Extension professionals are the most preferred and trustworthy source of information, we recommend that the government and stakeholders organize extension training programs to strengthen local extension. We recommend greater women involvement and given strategic roles in the planning and organization of training programs.

Keywords

Gender, information sources, preference, trustworthiness, Ghana

Authors

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Introduction

Agriculture plays a vital role in the Ghana economy. It accounts for approximately 17% of Ghana's Gross Domestic Product (The World Bank, 2020), employs more than 50% of the labor force, and contributes significantly to households' livelihoods (The World Bank Group, 2018). In Ghana, maize tops the chart in food crop production in the area planted and accounts for significant grain production (Danso et al., 2017). Maize is also a major staple food in Ghana. However, most maize produce does not leave the farm to the plate. About 30-40% of maize harvested is lost during storage (Opit et al., 2014). Researchers attribute the loss to traditional storage methods farmers adopt to store maize (Darfour & Rosentrater, 2016; Manu et al., 2019), exposing the maize to insect pest damage at the postharvest stage.

Women play a significant role in the postharvest stage (Nordhagen, 2021; Sawadogo-Ouédraogo et al., 2017). They are involved in the harvest, drying, threshing/winnowing, storage, and primary transformation (Sawadogo-Ouédraogo et al., 2017). Although women are commonly involved in the postharvest management decisions including how much to store and how much to sell based on family consumption needs, storage facilities, and the need for urgent cash (Affognon et al., 2015), men make the final decision concerning resource allocation and use related to postharvest activities (Abdulsalam-Saghir et al., 2015). However, involving women in final resource allocation decisions will increase family and community welfare since about 60% of women employed work in the agricultural sector in Sub-Saharan Africa (Meinzen-Dick, 2019). And when women farmers in Africa thrive the family, communities, and economies benefit (Meinzen-Dick, 2019).

To ensure an increase in food availability, increase farmers' welfare, and enhance food security, reducing postharvest loss and increasing women's role in postharvest activities is paramount. The hermetic storage bag is an innovation proven to safeguard grain products from insect pests and rodent attacks during storage (Baributsa & Ma Cristine, 2020; Rierson, 2020). The hermetic storage bag protects maize from damage since the bag creates an atmosphere through a gas exchange that controls moisture and insects (De Groote et al., 2013). There is a need for farmers to adopt hermetic storage bags because of the potential to increase maize availability and reduce maize postharvest loss. When designing programs promoting the adoption and dissemination of hermetic storage bags, there is a need to consider women's participation, farmers' preference, and the trustworthiness of information sources and communication channels they receive agricultural information. For this study, we intended to focus more specifically on studies done in Africa since information sources and communication channels farmers prefer and trust to receive agricultural information are sometimes uniquely different from the Western context.

Access to information about an innovation is important to speed up the adoption and help farmers make informed decisions about a new agriculture technology. Information needs to be accessible to smallholder farmers through appropriate and reliable information sources and communication channels. According to Musa et al. (2015), communication increases the adoption rate of modern farm practices since the knowledge gained drives farmers to try innovations. Access to agricultural information sources and farmers' perceived value of the source influence adoption (Toma et al., 2018). Interpersonal communication such as friends, relatives, neighbors, Extension agents, and contact farmers are examples of dominant and used information sources, while radio and television are major mass-media communication channels

farmers receive information about their agricultural activity (Okwu & Daudu, 2011; Opara, 2008).

Studies have identified a wide range of available agricultural sources and channels farmers receive information about their agricultural activities in Africa (Malekani & Mubofu, 2020; Opara, 2008). These information sources and channels include radio, newspapers, brochures, exhibitions, fliers, and seminars, village leaders, church leaders, friends, and relatives. Friends/neighbors/relations were the most regularly available/accessible interpersonal sources of information. Extension workers, contact farmers, and opinion leaders were other sources from which farmers received information. Radio is a widely used and preferred mass medium by farmers in Nigeria to obtain agricultural information (Okwu & Daudu, 2011), with farmers indicating that it is a regularly available and accessible mass medium they obtained agricultural information in the area. A study by Omari and Frempong (2019) revealed that radio was a source farmers used and preferred to receive food safety information in Ghana. There is a high chance that audience preference and trustworthiness for an information source or channel influence farmers' use frequency.

Providing users with information will help them make well-informed decisions and is essential for planning. Access to information about agricultural technology is important as it reduces uncertainty when farmers decide to either adopt or reject new technology (Adolwa et al., 2012). Moreover, information is considered usable when it is well communicated to the user. According to Agwu and Adeniran (2009), the goal of communication is to bring about a change of attitude and skills and create awareness and aspiration of the receiver. Research studies have recognized that information and knowledge are essential in creating awareness and are among the strategies used to achieve change in agricultural practices (Mchombu, 2003). In addition, information needs to be disseminated through appropriate channels and sources to enhance the adoption of hermetic storage bags. Communication channels are key in information dissemination (Muriuki et al., 2016).

Literature Review

A myriad of studies has been carried out to identify the different information sources and channels in providing valuable information to farmers in Africa (Mariuki et al., 2016), and farmers preference and trust for these sources and channels (e.g., Msoffe and Ngulube, 2017; Okwu & Daudu, 2011; Omari & Frempong, 2019; Opara, 2008). Studies show that in African countries, farmers' high preference for Extension agents is face-to-face interaction, which farmers believe is more reliable and more feasible to receive specific information and training (Mariuki et al., 2016; Msoffe & Ngulube, 2017; Opera, 2008). Extension agents were also found to be the most preferred source of information for farmers in Nigeria (Okwu & Daudu, 2011; Opara, 2008). Family, friends, and neighbors were other information sources identified with high farmers' preferences (Msoffe & Ngulube, 2017; Omari & Frempong, 2019). Msoffe and Ngulube (2017) posit that a high preference for these sources was based on the oral tradition that prevailed in rural areas in Tanzania.

According to Mariuki et al. (2016), public and private extension organizations, agricultural extension, and advisory services are major players in providing farmers with valuable information, technologies, and education to boost farm productivity and enhance food security and farm income for smallholder farmers. Taku-Forchu et al. (2023) posit that to enhance the adoption of an agricultural storage technology, Extension agents should provide

farmers with information on hermetic storage bags during training, targeting communities with the least number of adopters in Dormaa, Ghana. Moussa et al. (2009) elucidate that farmers who participated in village-level demonstrations during extension programs in Burkina Faso and Niger were more likely to adopt hermetic storage technologies. To make informed decisions to adopt hermetic bags, extension agents can provide farmers with relevant and credible information and hands-on experience on postharvest maize storage, an important issue in Sub-Saharan African countries to reduce food loss during storage to make more food available.

Researchers have assessed the sources of information for women farmers in Africa (Isaya et al., 2016; Okwu & Umoro, 2009). Women play a major role in agricultural activities associated with post-harvest (Sawadogo-Ouédraogo et al., 2017). In a study to investigate women farmers' agricultural needs and accessibility in Nigeria, the researchers found that fellow women and mass media were the primary sources of agricultural information for women farmers, and accessibility of information from these sources was relatively high (Okwu & Umoro, 2009). A study by Isaya et al. (2016) in Tanzania examines agricultural information sources by women farmers. Participants indicated radio and agricultural extension workers are the primary source of agricultural information used by women farmers.

Other studies identified mass media communication channels as the most preferred channels where farmers obtain agricultural information (Boellstorff et al., 2013; Rimi et al., 2015; Tucker & Napier, 2002). For instance, farm magazines (Tucker & Napier, 2002), radio, and newspapers were identified as the most preferred channel (Omari & Frempong, 2019). Some studies indicated a high preference for receiving information through reading print sheets, watching television, reading newspaper articles, and visiting internet websites (Boellstorff et al., 2013). Although sometimes farmers strongly prefer some information sources or channels, farmers must trust these sources for the information received to be effective.

How frequently a source is used is contingent on the receivers' perception of its credibility. When information is received from people and well-known and trusted sources, the information will influence the receiver (Telg et al., 2012). Omari and Frempong (2019) found that respondents received food safety information in Ghana from channels such as radio, the internet, social media, newspapers, and information sources such as family and friends. Regarding trustworthiness, scientists/researchers, family and friends, and radio and newspapers were reported to be the trusted sources and channels respondents received information. As revealed by farmers, extension, local farmers, and crop advisors were other trusted information sources (Borelli et al., 2018).

Theoretical Framework

This study uses source credibility theory and uses and gratifications theory as a framework. The source credibility theory depicts that users of information consider a source credible when they trust the information from the source and the audience select sources they trust to gratify their needs. Users of information will expose themselves to information sources or channels they prefer and trust.

Source Credibility Theory

Hovland et al. (1953) developed the source credibility theory asserting that people are more likely to be persuaded when the source of information is perceived as credible.

Trustworthiness is an essential component of credibility (Hovland et al., 1953; Sternthal et al., 1978). Users of information consider a source credible when they can trust the information they receive. Wilkins et al. (2018) consider trust a proxy for the credibility of information. Source credibility is an important component researchers use to assess the uptake of agricultural innovations (Lamm et al., 2016). Researchers postulate that the credibility of information sources or channels affects how farmers adopt an agricultural innovation (Wilkins et al., 2018). Also, credible sources and channels play a significant role in disseminating agricultural information (Choudhary & Khan, 2017; Dhayal & Bochalya, 2015).

Furthermore, in maximizing the potential value of information, the focus should be on what information is communicated and, also, ensuring the right source delivers the information (Hovland et al., 1953). Therefore, as perceived by recipients, highly credible sources are more persuasive (Barr et al., 2011; Sternthal et al., 1978). Sources perceived as highly trustworthy produce a more positive attitude than less trustworthy sources (Pornpitakpan, 2004).

When a person considers a source or channel credible, they will select that medium or listen to the communicator to satisfy their needs. Audience use of a communication channel or source to gratify their desire is based on the communicator's expertise or the perceived trustworthiness of the information source or channel. This indicates an organic relationship between source credibility and communication channels based on the uses and gratifications frame.

Uses and Gratification Theory

Katz et al. (1973) pioneered the uses and gratification theory. The theory explains audiences' choices in selecting media channels that fulfill audience desires (Lin, 1999). The audience often seeks communication to satisfy their needs. The audience behavior is goal-directed, aware of their needs, and selecting media to gratify those needs (Katz et al., 1973). Scholars have used the uses and gratification theory to justify audience's media use and the selection to gratify needs (Okwu & Daudu, 2011). Research postulates recipients selectively choose, attend, and retain media messages based on their needs (Okwu & Daudu, 2011).

Audience selection and media use for information and knowledge depend on how they qualify which media source best fulfills their needs. According to Katz et al. (1973), media selection behaviors are based on audience needs and audience desire to satisfy those needs. Recipients' trust in media is determined if the service meets their needs and they feel gratified after consuming information from trusted media.

Trust in Information Sources and Preferences in Communication Channels

Wilkins et al. (2018) posit that information sources refer to the person or organization distributing the information. The authors describe that the trustworthiness of the information sources is associated with the believability of the source, while communication channels refer to where people obtain information or the mode used to deliver information. O'Keefe et al. (1999), elucidate a distinction between sources and channels, where a source is a person or institution that originates or designs a message while a channel is the means through which a message gets to the receiver. Communication channels, compared to sources, have no specific entity, agenda, or purpose, such as television, radio, and magazine. While a source is an entity or organization with a mission or has specific people or groups behind it.

Due to the reasons stated above, the researchers of this study chose not to assess the trustworthiness of communication channels because channels, such as TV, Radio, and newspapers, are neutral. They are only tools to transmit the message to the audience, while information sources can represent a group of people, certain ideologies, and values, which impact how likely someone will accept the information presented (Wilkins et al., 2018).

When the audience is exposed to an information source they trust using the communication channel they prefer, they derive gratification after consuming it (Lin, 1999). Trust and communication preference have a positive relationship (Johnson & Kaye, 1998; Tsfati & Cappella, 2003). How credible the audience views a medium is strongly related to the frequency of its use, and users judge their preferred medium as the most credible (Johnson & Kaye, 1998). Therefore, people often expose themselves to information sources they trust and channels they prefer.

Literature about Sources and Channels Used by Farmers

Research studies that examined the communication channels and information sources used by farmers to access agricultural information and farmers' preference and trustworthiness for these sources and channels did not separate information sources from communication channels and made this separation based on gender. With no prior information and resources about gender differences regarding the information sources and communication channels farmers receive agricultural information in the study area and the involvement of women in the post-harvest stage, there is a need to target women's involvement in the adoption of post-harvest loss storage technology to close the gender gap. Previous studies focused on examining (1) information sources and (2) communication channels that determine the adoption of hermetic storage technology among farmers (Mariuki et al., 2017) and strategies used to share agricultural knowledge and sources of agricultural information used by farmers (Kavi et al., 2018; Malekani & Mubofu, 2020; Rimi et al., 2015) in some African countries occurred independently without separating the information sources and communication channels based on gender. This author was able to find a trend study with findings about information sources and channels together to compare information needs and channels used by rural women in Africa and other developing countries (Rodriguez et al., 2015).

This research study analyzed information sources and communication channels as two independent concepts among maize farmers in Dormaa, Ghana, and specifically investigated their information-seeking of agricultural activities, their trustworthiness of information sources and preferences of communication channels based on gender.

Purpose and objectives

The purpose of this study is to identify the information sources and communication channels maize farmers use to receive information about their agricultural activity and farmers' preference and trustworthiness of the different sources based on gender, as well as to determine the effects of the sources and channels on farmers' adoption decisions. Specifically, the study sought to:

1. Identify the information sources and communication channels maize farmers receive agricultural information.

2. Ascertain differences based on male and female maize farmers' preferences for information sources and communication channels.
3. Identify male and female maize farmers' differences regarding perception of trustworthiness for the information sources.
4. Determine the effects of information sources and communication channels on maize farmers' adoption of hermetic storage bags.

Methodology

Research Design and Instrumentation

To fulfill the purpose and objectives, we used a researcher-administered survey for this study. We applied descriptive, inferential statistics, and probit regression models. The t-test was used to determine whether there is a significant difference between the means for male and female farmers' preferences and the trustworthiness of the information sources and channels. The probit model was used to identify the effect of the information sources and channels on farmers' adoption of hermetic storage bag technology in Dormaa, Ghana. A survey instrument was designed based on literature that outlines sources and channels farmers received agricultural information (Okwu & Daudu, 2011; Opara, 2008), inputs from agricultural education professionals, and Extension agents in the study area. We incorporated suggestions to make final changes to the instrument. The questionnaire for this section has three parts. The first part focused on identifying the different sources and channels farmers receive agricultural information. The second part was to ascertain farmers' preference for the different sources and channels, using a 5-point scale (1 = *Not at all preferred* to 5 = *Most preferred*). The third part asked farmers to indicate their perceived trustworthiness for the different sources. It was also a 5-point scale question (1 = *Not at all trustworthy* to 5 = *Very trustworthy*).

The panel of instrument reviewers was made up of six faculty experts specializing in rural development, innovation adoption in agricultural education and agricultural communication reviewed, edited, and ensured that different sources and communication channels were on the list. From the edits, we made revisions and added more sources and channels. The experts approved the questionnaire for face validity before we started administering the questionnaire.

Data Collection Procedure and Methods

A researcher-administered survey was conducted face-to-face with respondents to collect data from smallholder maize farmers in Dormaa, Ghana. The researchers developed an online survey questionnaire using Qualtrics as the data collection platform. However, due to no internet in the target communities, we used the offline Qualtrics data collection system on an electronic device to capture responses, and the responses were automatically recorded once the device was connected to the internet. Participants selected for the study were farmers in Dormaa, Ghana, who have been producing maize for the last two years. Dormaa was selected because the area was identified as a high maize production zone (Opit et al., 2014).

The study's participants were selected using a multistage sampling technique. Dormaa was selected in the Middle Belt in Ghana in the first stage. In consultation with some Extension professionals working with the Ministry of Food and Agriculture (MoFA) in the Dormaa Municipality, we selected four communities (Amasu, Duasidan, Koradaso, and Suromani) with

maize production as the main economic activity. In the third stage, a systematic sampling technique was used to survey farmers in the four communities. Beginning at the first house at the entrance into the community and surveyed one adult in every third house who was involved in maize production in the last two years. If no adult in the household was involved in maize production, we skipped the house and moved to the third house to maintain consistency. We were able to collect data from 217 maize farmers in the study area.

Data Analysis

Descriptive statistics, inferential and probit regression were adopted to analyze and present results. The probit estimation technique was used to analyze the effects of information sources and communication channels on farmers' adoption of hermetic storage bags, predicting the probability or likelihood of adopting the hermetic storage bags. The selection of the probit estimation techniques was based on the fact that the dependent variable for the adoption model is a dummy. A farmer was considered an adopter if he/or she stored maize using hermetic bags (Taku-Forchu, 2022). In analyzing the adoption of hermetic bags, the paper estimated the probability of adopting the technology given the expression:

$$Y_i = \{1\ if\ farmer\ adopts\ hermetic\ bags\ 0\ if\ otherwise\}$$

The probit model was used to determine the probability that $Y_i = 1$. The probit model is a standard normal distribution and was derived by introducing a random variable y* that is a function of a vector of variables. The model was constructed as follows:

$$Y^* = X_i\beta_i + \varepsilon_i$$

where

$$Y = \begin{Bmatrix} 1\ if \quad Y^* > 0 \\ 0\ otherwise \end{Bmatrix} = \begin{Bmatrix} 1\ if \quad X_i B_i > 0 \\ 0\ otherwise \end{Bmatrix}$$

Where Y* (the latent variable) is observed for values greater than 1 and 0 otherwise, which represents an index for the adoption of hermetic storage bags. X_i is the vector of explanatory variables, β_i is a vector of unknown parameters, and ε_i is the error term, $\varepsilon \sim N(0, 1)$.

The vector of explanatory variables for communication channels and information sources was measured on a 5-point scale (1-5), in terms of preferences and trustworthiness of the communication channels and information sources.

The t-test results were obtained by analyzing male and female farmers' differences in preferences and trustworthiness of the different information sources they use to receive information about their farming activities. The data analysis was done using STATA version 16 software.

Results

Demographic/Farm Characteristics

The demographic results identified more male farmers (n = 125, 58.41%) than female farmers (n = 89, 41.59%) in the study area. The mean age of respondents was 44.05 years. The results also show that more male farmers (n = 80, 64%) are adopters of hermetic bags than female farmers (n = 45, 36%). Also, more males were served by Extension agents (n = 109, 59.89%,) than females (n = 73, 40.11%) and majority male farmers (n = 83, 61.48%) indicated

they received training in the use of hermetic bags than female farmers (n = 52, 38.52%). Furthermore, male farmers (n = 74, 72.55%) were members in farmers' associations at a higher rate than female farmers (n = 28, 27.45%).

Sources and channels used by farmers to access information about their farming activities

Objective one was to identify the different sources and channels farmers in Dormaa, Ghana, used by farmers to receive information about their farming activities. Table 1 presents the different channels and information sources used by farmers to receive their agricultural information. The responses were based on participants to indicate all that apply.

Table 1
Communication Channels/Information Sources Used by Farmers in Dormaa, Ghana

	Yes		***No***	
Sources/channels of Information	***f***	**%**	***f***	**%**
Communication Channels				
Radio	145	70.73	60	29.27
Television	48	23.41	156	76.59
Newspapers	8	3.96	194	96.04
Telephone calls	41	20.10	163	79.90
Posters/billboards	20	9.85	183	90.15
Information Sources				
Fellow farmers	145	71.08	57	28.92
Friends and neighbors	96	46.60	109	53.40
Cooperative society	33	16.02	173	83.80
Extension professionals	166	80.98	35	19.02
Church leaders	22	10.95	178	89.05
Local meeting leaders	46	22.77	155	77.23
Agro-dealers	47	23.04	155	76.96

Most respondents (80.98%) indicated they received agricultural information from Extension professionals. It was followed by fellow farmers (71.08%) and radio (70.73%). Newspapers (3.96%) and posters/billboards (9.85%) were communication channels respondents used the least to receive agricultural information.

Farmers' preferences and trustworthiness for communication channels and information sources.

Reviewing the data on communication channels for both preference and trustworthiness, we found radio was rated as preferred by 82.94% of respondents. This percentage was calculated by combining the number of farmers who rated the channel as either preferred or most preferred on a likert-type scale. Similarly, most of the maize farmers (73.21%) found radio as a trustworthy communication channel to receive agricultural information about their farming activities. Extension professionals were also highly rated as both a preferred (90.82%) and trustworthy (94.21%) source to receive agricultural information in the study area.

The results in Table 2 show the mean difference for male and female farmers based on their preference for the communication channels farmers receive information about their farming activities. The results reveal that there are no significant differences between male and female farmers' preference for the communication channels of radio, television, newspaper, and poster/billboards. However, the results show a significant difference between male and female preferences for phone calls ($t = 4.55$, $p < .0001$), indicating that male farmers in the study area preferred telephone calls more than female farmers for information.

Table 2

Preference of Communication Channels among Farmers in Dormaa, Ghana by Gender

	Female		Male		Total		
Variable	M	SD	M	SD	M	SD	*t*
Radio	3.88	0.89	3.89	0.93	3.89	0.91	0.14
Television	2.34	1.12	2.59	1.24	2.49	1.19	1.47
Newspaper	1.43	0.80	1.41	0.81	1.43	0.81	0.11
Telephone Calls	1.53	0.98	2.27	1.24	1.96	1.19	4.55***
Posters/Billboards	2.08	1.16	2.36	1.24	2.24	1.21	1.58

Note: Responses were based on a 5-point scale, 1 = *Not at all preferred* to 5 = *Most preferred;* *** = p<0.01, ** = p<0.05, * = p<0.1

From Table 3, most respondents indicated a preference (most preferred) for Extension professionals (73.43%). It was followed by fellow farmers (49.52%) and friends/neighbors (35.41%), and participants indicated they preferred to receive information from these sources. Respondents indicated that agro-dealers (31.88%) were a moderately preferred source of information.

The mean difference for male and female farmers based on their level of preference for the different sources is presented in Table 3. There was a statistically significant difference between male and female farmers' preference for Extension professionals ($t = 2.88$, $P = 0.0044$), friends/neighbors ($t = 2.17$, $P = 0.0311$) and church leaders in the community ($t = 1.97$, $P = 0.0506$). It is also evident that male farmers prefer these information sources more than females prefer this information source.

Table 3

Preference of Information Sources among Farmers in Dormaa, Ghana by Gender

	Female		Male		Total		
Variable	M	SD	M	SD	M	SD	*t*
Fellow Farmers	3.48	1.07	3.57	1.08	3.53	1.07	0.55
Friends/Neighbors	2.85	1.39	3.26	1.28	3.10	1.34	2.17*
Cooperative Society	2.23	1.18	2.23	1.16	2.23	1.17	0.03
Extension professionals	4.29	1.26	4.69	0.73	4.52	1.00	2.88**
Church leaders	2.21	1.35	2.58	1.29	2.42	1.33	1.97*
Local Meeting leaders	2.47	1.43	2.53	1.34	2.50	1.37	0.33
Agro-dealers	2.36	1.20	2.43	1.02	2.39	1.10	0.42

Note: Responses were based on a 5-point scale, 1 = *Not at all preferred* to 5 = *Most preferred;* *** = p<0.01, ** = p<0.05, * = p<0.1

Results in Table 4 reveal a significant difference between male and female farmers' trustworthiness for fellow farmers (t = 2.55, P = 0.0116) and friends/neighbors (t = 2.63, P = 0.0092), with more males indicating a high level of trust for their farming information from fellow farmers and friends/neighbors compared to female farmers. However, there is no significant difference between male and female farmers' regarding their level of trustworthiness for Extension professionals, cooperative society, church leaders, local meeting leaders, and agro-dealers. These results indicate that male and female farmers behave similarly in terms of trust in these five sources to obtain information about their agricultural activities in the study area.

Table 4

Trustworthiness of Information Sources among Farmers in Dormaa, Ghana by Gender

	Female		Male		Total		
Variable	M	SD	M	SD	M	SD	*t*
Fellow Farmers	3.38	1.15	3.75	0.94	3.60	1.05	2.55*
Friends/Neighbors	2.64	1.38	3.13	1.28	2.93	1.34	2.63**
Cooperative Society	2.01	1.17	2.18	1.14	2.11	1.15	1.01
Extension professionals	4.57	0.96	4.75	0.72	4.68	0.83	1.56
Church leaders	2.39	1.38	2.71	1.42	2.58	1.41	1.62
Local Meeting leaders	2.42	1.43	2.68	1.42	2.57	1.43	1.26
Agro-dealers	2.37	1.14	2.56	1.05	2.48	1.10	1.27

Note: Responses were based on a 5-point scale, 1 = *Not at all preferred* to 5 = *Most preferred;* *** = p<0.01, ** = p<0.05, * = p<0.1

The effect of information sources and channels on adoption of hermetic bags

The findings presented in Table 5 show that the communication channels that includes, television and newspaper positively influenced the adoption of hermetic bags. Also, information sources, including extension professionals, local meeting leaders, and agro-dealers positively influenced the adoption of hermetic bags.

The results further indicate an increase in the level of preference for the use of television increases the likelihood of using hermetic bags at a 10% level of significance, showing that an increase in the level of preference by one point increases the likelihood of using hermetic bags by 6.7%. Similarly, a one-unit increase in the level of preference for newspapers increases the likelihood of using hermetic bags by 9.9%.

Table 5

Probit Results for Level of Preference of Sources/Channels on Adoption of Hermetic Bags

Variables	**Coefficient**	**Marginal Effects[1]**
Radio	0.117	0.045
	(0.120)	(0.046)
Television	0.174*	0.067*
	(0.101)	(0.039)
Newspaper	0.258*	0.099*
	(0.147)	(0.056)
Fellow farmers	-0.013	-0.005
	(0.098)	(0.038)

Cooperative societies	-0.026	-0.010
	(0.099)	(0.038
Telephone calls	-0.134	-0.052
	(0.107)	(0.041
Extension professionals	0.218*	0.083*
	(0.117)	(0.045)
Local meeting leaders	0.318*	0.122*
	(0.169)	(0.064)
Church leaders	-0.493**	-0.188**
	(0.181)	(0.069)
Agro dealers	0.217*	0.083*
	(0.110)	(0.042)
Constant	-1.656*	
	(0.791)	

Note: Prob > chi2=0.0023; LR chi2=27.32; [1]marginal effects are changes in response for a change in covariate (predictor). The figures in parentheses are standard errors;
*** p<0.01, ** p<0.05, * p<0.1.

In terms of information sources, preference for Extension professionals increases farmers' likelihood to adopt hermetic bags by 8.3%. The result is statistically significant at the 10% level. Similarly, local meeting leaders and agro-dealers have a positive effect on the likelihood of adopting hermetic bags. Specifically, an increase in the preference for information from local meeting leaders increases the likelihood of adopting hermetic bags by 12.2%. Also, an increase in farmers' preference for information from agro-dealers by one point increases the likelihood of adopting hermetic bags by 8.3%.

However, preference for information sources from church leaders has a negative and statistically significant effect on the likelihood to adopt hermetic bags. This result showed that an increase in preference for these leaders decreases the likelihood of adopting hermetic bags by 18.8%.

The overall regression results of farmers' preference of information sources and communication channels on the adoption of hermetic bags is significant. Therefore, this shows that all information sources and communication channel variables included in the model captured well the determinants of the adoption of hermetic storage bags.

Table 6 shows the results on the effect of the trustworthiness of the information sources on the adoption of hermetic bags. Most of the variables in the regression analysis were positive. The results for Extension professionals are positive and statistically significant while local meeting leaders were negative. Thus, Extension professionals have a key role in influencing farmers' trust in the study area.

Table 6

Probit Results for Level of Trustworthiness of Sources/Channels on Adoption of Hermetic Bags

Variables	Coefficient	**Marginal Effect[1]**
Fellow farmers	0.023	0.009
	(0.092)	(0.036)
Cooperative societies	0.059	0.023
	(0.100)	(0.039)
Extension professionals	0.214*	0.083*

	(0.129)	(0.050)
Church leaders	0.159	0.062
	(0.127)	(0.050)
Local meeting leaders	-0.303*	-0.118*
	(0.137)	(0.053)
Agro dealers	0.082	0.032
	(0.098)	(0.038)
Constant	-0.780	
	(0.819)	

Note: Prob > chi2=0.2162; LR chi2=0.2162; [1]marginal effects are changes in response for a change in covariate (predictor); Standard Errors in parentheses. The figures in parentheses are standard errors; *** p<0.01, ** p<0.05, * p<0.1.

From Table 6, the result shows that the level of trustworthiness of Extension agents has a positive and statistically significant effect on the likelihood of adopting hermetic bags indicating that an increase in the level of trust for Extension professionals by one point will increase the likelihood of adopting hermetic bags by 8.3%.

The effect of the trustworthiness of local meeting leaders on the likelihood of adopting hermetic bags is negative and statistically significant at a 10 % of significance, implying that an increase in the level of trustworthiness of local meeting leaders by one point rather decreases the likelihood of adopting hermetic bags by 11.8%.

Discussions, Conclusion, and Recommendation

Both mass media channels and interpersonal communication are used by maize farmers in Dormaa to receive agricultural information. However, interpersonal sources are preferred by the local communities since they interact with individuals and groups such as individual farmers and Extension agents in Dormaa, Ghana. Extension agents and other farmers are the most available sources of information to the farmers, and maize farmers in Dormaa are getting agricultural information and prefer to receive agricultural information from Extension agents. Interpersonal communication is viewed as reliable and provides specific information through face-to-face interaction (Msoffe & Ngulube, 2017). Other channels, such as billboards and newspapers, are available but not commonly used, with the exception of telephone calls. Farmers' preference for telephone calls may be due to the direct interaction involved in using this source of communication to receive agricultural information.

Extension professionals were the major source of agricultural information for farmers in the study area, with the Extension agents being the most preferred and most trusted source to receive agricultural information. The regression results also show Extension agents had a positive and statistically significant influence on farmers' likelihood to adopt hermetic bags in Dormaa, Ghana. Mariuki et al. (2016) posited that agricultural Extension and advisory services play a critical role in providing smallholder farmers with information, technology, and education. Opara (2008) found Extension agents were a dominant source farmers accessed agricultural information, and farmers showed a high preference for Extension agents as their preferred source of information. It is also in line with a study by Okwu and Daudu (2011), who found that Extension agents were the most preferred source of information by farmers in Benue State, Nigeria. The study's high preference for Extension agents could be attributed to face-to-face interaction and direct communication with farmers. Extension agents' direct contact with farmers

in rural communities plays a fundamental role in disseminating agricultural knowledge to farmers, raising farm productivity (Ikendi, 2019), and linking smallholder farmers to markets (Taku-Forchu, 2019).

However, the result reveals a significant difference, with more males indicating a greater preference to receive information from Extension agents than women. It was evident during fieldwork. For all four communities, all the local Extension agents were males. Based on the context and culture, women often do not feel comfortable interacting with male field workers, especially when married, for fear of societal criticism and spouses' disapproval. This might have influenced the difference.

Furthermore, the study reveals farmers' preference for their fellow farmers and friends/neighbors. A high preference for family, friends, and neighbors was visible in Msoffe and Ngulube's (2017) study. Farmers in some rural areas in Tanzania indicated these sources were the most preferred information sources. Opara (2008) also found that friends and relatives and fellow farmers were the preferred sources of information used by farmers. The high preference for these information sources is because farmers prefer listening and talking and the oral tradition in rural areas (Msoffe & Ngulube, 2017). Respondents indicated they trusted information they received from fellow farmers and friends/neighbors, with more males indicating their trust to receive information from these sources than female respondents. This confirms a study by Telg et al. (2012), where other farmers (other growers) are identified as the most trusted source farmers received information about citrus greening management.

For communication channels, participants in the study indicated radio as a preferred source of information. This study's finding is consistent with other studies findings, with radio indicated as a preferred source of information for farmers in rural communities (Msoffe & Ngulube, 2017; Okwu & Daudu, 2011). The regression results revealed that television and newspapers increase farmers' likelihood to adopt hermetic bags. This may be related to farmers' innovativeness and readiness to take risks. Rogers (2003) elucidates that individuals who first learn about an innovation through mass media then pass this information to others.

Based on trustworthiness, Extension professionals were found to be a trusted source of information by farmers. Fellow farmers and friends/neighbors are sources respondents indicated they trust. Studies have found other farmers as the most trusted source of information (Borelli et al., 2018). Family and friends are also trusted sources of information (Wilkins et al., 2018).

Although information sources (Extension, fellow farmers, friends, neighbors, etc.) were identified as preferred sources of information by farmers, mass media communication channels such as radio are indicated by respondents as a communication channel from which they receive information. Farmers also indicated their preference for radio. Tucker and Napier (2002) found radio the most preferred source used by farmers to receive information. Rodriguez et al. (2015) detected from their study that radio was the most frequently mentioned as the preferred communication channel used among rural women in Africa, Asia, and Latin America.

The results reveal Extension agents as the major source farmers receive information about their farming activities, with more males indicating they preferred Extension professionals for information than females. However, in terms of respondents' level of trustworthiness, male and female farmers similarly indicated the level of trustworthiness for Extension agents. The regression result reveals that the preference and trustworthiness of Extension agents had a positive and significant effect on farmers' likelihood to adopt hermetic bags.

Furthermore, the results reveal radio was the most used and preferred communication channel farmers received information about their agricultural activity. The results indicated no

significant difference between male and female preference for radio for both male and female respondents. This is an indication that access to radio and radio programs has no gender barrier since the availability of a radio set at home does not preclude any family member from listening to programs broadcasted over the radio.

The overall regression results of farmers' preference of information sources are more determining than farmers' trust of the information sources and communication channels on the adoption of hermetic bags. There is a likelihood that there are non-trustworthy variables that influence the adoption of hermetic bags.

From a practical viewpoint, it is recommended that farmers' preference for the sources and communication channels identified be leveraged when making decisions on disseminating information regarding hermetic bags. Given the relevance of Extension agents, efforts should be made to increase the number of Extension agents in the field, with female Extension agents assigned to work with farmers in the field.

Also, given that Extension professionals are the most preferred and trustworthy source of information, we recommend the government, policymakers, NGOs, especially Feed the Future Postharvest Loss Innovation Lab (PHLIL) organize Extension training programs to strengthen local Extension with human and material resources to ensure continuity when the PHLIL project in Dormaa comes to an end.

Given the relevance of radio as a preferred and trusted channel, we recommend that the Ministry of Food and Agriculture in Domaa, Ghana, in collaboration with the Extension office, organize radio programs at convenient times to educate farmers and provide them with information on the proper use of hermetic storage bags. These programs should be broadcasted in the local language (Twi) to reach the farming audience since Twi is the main mode of communication in Dormaa, Ghana.

Furthermore, training on hermetic storage technologies should also be organized, recorded, and provided to farmers who could not attend the training to watch at a convenient time. Based on culture in the studied area, one day per week is set aside when farmers are not allowed to go to the farm. Community leaders could be given these recordings to organize a time and location on these allocated days and send out an announcement indicating a replay of a training. We also recommend using visual aids during training since visual learners will find it easier to comprehend in conjunction with the physical demonstrations.

Also, to ensure women's participation in the training to enhance the adoption of hermetic bags in Dormaa, Ghana, we recommend a greater involvement of women and giving them strategic roles in the planning and organization of training. Extension agents should communicate information about this training to women groups to broaden the women audience. To ensure women benefit and increase learning for women during training, we recommend dividing participants into male and female groups when we get to practical parts and providing the same tools and bags for both groups. This prevents women from stepping back and letting men dominate in the practical part.

Additionally, all stakeholders involved in disseminating hermetic storage technology, including the PHLIL project and the Extension agents in Dormaa, MoFA should consider farmers' preferred and trustworthy sources and channels, increase women's participation in training programs to surge the adoption of hermetic storage bags in Dormaa. Specific strategies could include establishing video programs that could be used by extension and sharing innovative technology. Specific strategies that would motivate extension agents to intentionally

provide information on hermetic storage as well as seeking feedback about the adoption of hermetic storage bags could make a broad impact.

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