Maize Farmers’ Perception of Effectiveness of Extension Service Delivery in Zabzugu and Tatale/Sanguli Districts in Northern Region of Ghana

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Failure of agricultural technology adoption is most often premised on lapses in the farmers’ socio-economic variables and governments’ failure to provide certain institutional resources. More so, when extension programme objectives fail, blame for this failure are often shifted on the farmers without looking at whether extension service delivery methods/tools meet the demands of farmers. This study assessed perception of maize farmers on effectiveness of extension delivery tools in Zabzugu Tatale in the Northern Region of Ghana. The study involved a cross-sectional survey with 240 randomly sampled household heads growing maize. Primary data was collected using structured questionnaire and analysed in means at three-points Likert scale using descriptive statistics with the help of Stata 14.0. Results showed that creation of awareness of agriculture extension agents was perceived very effective (M=2.71); visiting farmers and organizing field meetings with farmers were found to be effective with means (M=1.77) and (M=1.88) respectively. However, extension delivery was poor in the following areas: Field Days (M=1.35), Organization of Demonstrations (M=1.40), Research-Extension-Farmer linkage (M=1.26) and Farmer Training Programme (M=1.36). It was, therefore, recommended that government and development partners should provide funds and logistical support to agricultural extension agents to deliver extension services using the methods the farmers in Zabzugu Tatale considered effective. The government also needs to supervise and equip Research-Extension-Farmer Linkage Committee (REFLC) in the study area. Extension officers should also facilitate the formation and sustenance of farmer groups in their respective zones since agricultural technologies are diffused easier among farmer groups than among individually scattered farmers.

**Keywords:** Extension service delivery, farmers, effectiveness, training, & maize

INTRODUCTION

Agricultural sector is crucial to the country’s sustainable long-term growth and development in Ghana; although the rapid increase in the extractive sector (minerals, oil and gas) has reduced the comparative size of the agricultural sector in the overall economy, agriculture continues to be vital to employment, income generation and poverty reduction, employing 45 percent of the national labour force—far more than any other sector, and contributing more than one-fifth of Ghana’s GDP (Jansen, 2017). Promoting technology transfer is often the most cost-effective way to boost agricultural productivity. Agricultural extension has long been seen as a key element for enabling farmers to obtain information and technologies that can improve their livelihoods and is recognized as an important factor in promoting agricultural development through encouraging adoption of high yielding technologies (Taye, 2013). Thus, the goal of agricultural extension is to direct rural farmers through educational process to assist them adopt relevant innovations that would improve their farm output and standard of living (Grace et al., 2016).

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It is only when farmers adopt the introduced innovations that they are self-empowered economically to improve on their standard of living. Regrettably, Ghana has made little progress in encouraging the adoption of improved technologies (Jansen, 2017). Meanwhile, agricultural extension service functions from the backdrop belief that increase in productivity depends primarily on the acceptance of improved cultural and technological change at the rural farm level and that smallholder farmers can achieve higher farm yields only if they adopt recommended scientific farming techniques in place of their traditional practices (Aphunu & Otoikhian, 2008).

Jock and Gershon (2004) indicated that investments in extension services have the potential to improve agricultural productivity and increase farmers’ incomes. Yet the impact of extension on farm performance is diverse, reflecting disparities in how extension services are delivered and in the circumstances of service recipients, (Jansen, 2017). If an extension service is recommending agricultural technology it will be very useful to ascertain the number of farmers adopting the new practice; and for non-adopters, it will be very instrumental to find out whether they find disadvantages with the new practice or whether the extension methodology used is not being effective in diffusing the technology among the farmers (Agbarevo, 2013; Waddington et al., 2010; and CIMMYT Economics Program, 1993). As Asiedu-Darko (2013) noted, farmers’ failure to adopt agricultural technologies is as a result of unattractiveness of some of the technologies, citing the incomplete husk cover of quality protein maize known as Obatanpa, and the posture of some extension agents as a feature that makes the maize variety unattractive and a disincentive to effective dissemination of farming technology respectively. So the innovation itself, those diffusing the innovation, the channels (communication methods and tools) of diffusing the innovation, and then the recipients of the innovation (members of the social system) (Rogers, 2003) are all actors when evaluating extension programmes.

Evaluation of the achievement of extension delivery programmes, most often, focuses on the demand side of extension (farmers) such as farmers’ behavioural change in terms of adoption, increased use of production inputs, yield, income and impact assessment; and when the indices on these variables are low, farmers are blamed for not responding to extension delivery programmes, (Taye, 2013). This evaluation myopia will make it very difficult for a solution to be provided to a failure of agricultural extension programmes. A broader look at the demand and supply side of extension service will provide a level ground for programme evaluation. Therefore, the effectiveness and efficiency of the tools with which extension personnel deliver extension services, cannot be overlooked since this may, in fact, be a greater reason for success or failure of extension programmes (Agbarevo, 2013).

Despite agricultural extension efforts to increase maize yield in Zabzugu Tatale, low adoption of improved agricultural technologies continues to hamper the extension goal. Ansah et al (2018) investigated the effects of postharvest management practices on welfare of farmers and traders in Zabzugu. Ansah and Tetteh (2016) also investigated the determinants of yam postharvest management in the Zabzugu District. None of these studies looked at which agricultural extension delivery tools were suitable for sending messages to farmers. Tatale District is even out of touch with any of these studies. Besides, no known study so far has investigated into the effectiveness of agricultural extension delivery in Zabzugu Tatale area. Previous study by Hassan et al. (2019), carried out in 2017, looked at the socio-economic factors influencing adoption of improved maize varieties in Zabzugu Tatale where farmers’ access to extension service was found significant. This study was, therefore, a follow-up to fill the research gap by studying maize farmers’ perception of the effectiveness of the tools with which extension services are delivered in Zabzugu Tatale. Measuring the effectiveness in the view-point of farmers makes it a demand-driven and bottom-up approach that will serve the conditions and needs of the farmers. This study first looked at the respondents’ socio-economic characteristics such as access to extension, marital status, age, years of experience in maize farming, household size, years of education, membership of FBO, and farm size; and then assessed the maize farmers’ perception of effectiveness of extension service delivery tools such as Awareness of the existence of agriculture extension agents, Visiting Farmers, Organizing Field Meetings with farmers, Field Days, Organization of Demonstrations, Research-Extension-Farmer Linkage and Farmer Training Programmes.

LITERATURE REVIEW

Effectiveness of any tool answers two questions: Is the tool achieving its purpose? At what rate is it achieving its purpose? Thus, effectiveness of any extension approach answers these questions. Complexities exist in evaluating agricultural extension approach, and this lack of simplicity arises from the fact that agricultural extension approach is not operating in isolation but as part of a social system that has a complex environment. Research institutions, extension, and farmers are in this system that is affected by government policies in allocation of resources. The process of making research findings accessible to farmers is the function of extension, (Directorate of Agricultural Extension Service, 2011). Farmers expect accurate and timely information about agricultural technology to create their awareness of research findings and stimulate their interest in adopting a technology. The role of research and extension services is to give adequate, specific and unbiased technical and management information and advice in direct response to the needs of their clients (farmers) (Directorate of Agricultural Extension Service, 2011). Extension agents monitor changes in farming practices, assess the adoption of new technology and provide feedback to research; they, therefore, perform...
fiduciary and intermediary role between technology developers (researchers) and users of that technology (farmers) and farmers at this end expect easy access to and smooth flow of extension services to them—a service that will serve their needs (Mwangi and Kariuki 2015). Thus, extension is acting as a safety valve through which research findings and developed technologies are transported to farmers. A study conducted by Asiedu-Darko (2013) recommended that there was the need for active involvement of farmers in the extension delivery and building the competence of extension agents to enable them deliver on their given roles. In Ghana, this could only be done efficiently by strengthening the activities of Research Extension Farmers Linkage Committees (RELCs) at the national and regional levels to identify and prioritize farmers' problems for solution through research and extension as well as policy dialogue, (CSIR and MoFA, 2013); and it is believed that research, extension and farmers are the three main pillars of agriculture system and their effectiveness largely depends on the strong linkages among them (Sewnet et al., 2016). Research and Extension Linkage Committee (RELC) and Research–Extension–Farmer–Input-Suppliers Linkage committees (REFILS) are some of the participatory approaches for improving linkages between research and extension, and to ensure that farmers' problems reflect in research planning and activities. They are formal structures that institutionalize interactions between public research and extension institutions to generate demand-driven and participatory research programmes and extension activities; the membership of regional RELC/REFILS is composed of 15 representatives/co-ordinators from farmers' groups, researchers, extension agents, subject matter specialists, local government and the private sector; while the activities are mainly at the regional level, they are supported by multi-stakeholders, coordinating committee for formulating policies and sourcing funds to support for RELC/REFILS's activities (Ragasa, 2013).

However, results from the study by Ragasa (2013) conducted into the perceptions of stakeholders about effectiveness and inclusiveness of research-extension-farmer linkage in Ghana and Nigeria showed that the scope and effectiveness of these linkage committees was limited as majority of researchers and extension agents in the sample were not involved in these committees, and most of the extension agents in Ghana reported they were unaware of RELCs. The inadequate functioning of RELCs is as a result of poor coordination due to lack of clarity as to which of the two implementing institutions (CSIR and MoFA) in separate ministries is responsible for providing leadership and harmonising the activities of the platform (SEND GHANA, 2016). Kumar et al. (2002) concluded that organizational factors (the size and goals of organization and organization climate), Psychological factors (the attitude, job satisfaction), external factors of the organization, lack of mechanism to stitch research, extension and farmers together, have been the causes of poor or weak linkage between research, extension and farmers.

The effectiveness of the extension approach in enhancing capacity building, technological adoption and ultimately improved agricultural output depends on key factors associated with the extension method used, the governance, capacity and management structures of the extension approach, as well as underlying contextual factors such as the policy environment, market access, characteristics of beneficiary communities and weather conditions (Directorate of Agricultural Extension Services, 2011). A careful choice of extension method serves the needs of the clientele. In planning learning situations and organizing teaching activities, the extension worker draws upon a variety of teaching approaches. Wilson and Gallup (1964) argued that the judgment exercised in selecting the most appropriate method for the particular teaching situation and the skill with which the working tool is used have a direct bearing upon the amount and quality of the learning resulting from the teaching effort.

In a study into farmers perception of extension methods used by extension personnel for dissemination of new agricultural technologies in Pakistan, Khan and Akram (2012) found that farm/home visit was perceived as very good and best method having rank ‘1’, followed by field days at ‘2’ and demonstration plots at ‘3’ on the basis of their weighted score. It was concluded that respondents below 40 years were more responsive and alert. Majority of the sample respondents termed extension services as ineffective and the extension delivery methods (Farm/Home visit, Office calls, Demonstration plots, Field days, Farmers Trainings, Local Agriculture Fair, Workshop/Discussion) used for dissemination were also not effective.

Also, when Al-Rimawi et al. (2016) assessed vegetable growers' perception of effective extension methods and Information Communication Technologies for training vegetable growers in Jordan, using four point Likert-type scales to analyze data collected from a random sample of 98 vegetable growers, the methods of extension delivery that were found to be effective were farm visit, meeting groups of farmers, result demonstrations and farm tours. Field days, mass media/TV and radio, Mobile communication/SMS, printed materials, electronic materials, farm schools, and internet-provided extension were, however, perceived by the respondents as being ineffective method of extension delivery in the study area. According to Akpalu (2013), extension service in the broader system of agricultural and rural development performs intermediary roles: (1) providing information for the government (research institutions) about the productive performance and farmers’ potential and the appropriate ways research will respond to farmer requirements; (2) providing assistance to smaller-scale farmers to appropriately form FBOs to gain access to finance and other production requirements, and to market their produce through group action; and (3) providing assistance to rural communities seeking to better manage local agricultural and natural resources through new forms.
of organization, such as livestock associations, water-user associations and land-care groups. The primary responsibilities of agricultural extension services are mainly to create awareness among farming communities and to facilitate the improvement of the living standards of rural people through educational procedures (Khan and Akram, 2012).

If an extension service is recommending agricultural technology, according CIMMYT Economics Program (1993), it will be very useful to ascertain the number of farmers adopting the new practice; and for non-adoptors, it will be very instrumental to find out whether they find disadvantages with the new practice or whether the extension methodology used is not being effective in diffusing the technology among the farmers. Therefore, this study looked at farmers’ perception of effectiveness of the tools with which extension services are delivered to farmers in the study area since Agbarevo (2013) argued that a major factor in the adoption process is how healthy extension activities are organized and delivered, and if adequate delivery activities are conducted with effective tools of delivery and personnel, then there will be a greater likelihood of high adoption and the vice versa. Similarly, Waddington et al., (2010) argued that the effectiveness of the extension system in fostering capacity building, technological adoption and ultimately improved agricultural outcomes depends on the major factors relating to the advisory methods used, the governance, capacity and management structures of the extension system, as well as underlying contextual factors such as the policy environment, market access, characteristics of beneficiary communities and weather conditions.

In a study into Farmers’ Perception of Effectiveness of Agricultural Extension Delivery Programmed (ADP) in Cross-River State, Nigeria, Agbarevo (2013) found that there exists a high (94.82 percent) level of awareness among farmers about the existence of extension agents; holding fixed meetings with farmers was (87.93 percent); effectiveness indicators were as follows: method demonstrations conducted (82.75%); result demonstrations conducted (79.31%); method/result demonstrations conducted (77.58%); while effectiveness in conducting of field days was (72.41%). Extension effectiveness in visiting farmers was 65.55%, while supervisory visits by extension officers from headquarters and zonal offices was 60.12%. However, research-extension-farmer linkage through On-Farm Adaptive Research (46.55%) and farmer training programmes that were executed (39.65%) were perceived poor. The strongest links in the delivery process areas were found to be farmer visits, meetings between farmers and extension personnel, demonstration, while the weakest links were organization of Research-Extension-Farmer-Linkages, farmer training programmes and distribution of training materials. The study concluded that any evaluation of extension programme should be done in terms of rate of adoption, programme effect and impact relative to the effectiveness and efficient of extension delivery process.

In another research into farmers’ perception of the effectiveness of extension agents of Delta State Agricultural Development Programme (DADP) in Nigeria, Aphunu and Otokhian (2008) found that respondents perceived extension agents to be vast in knowledge of subject matter and integrated theories with practicals. Respondents, however, were not impressed with extension agents’ teaching and communication skills. Their findings also showed a significant relationship between the effectiveness of extension agents and the adoption of technologies.

Also, in a study into farmers’ perception of effectiveness of Agricultural Extension delivery towards aquaculture development in Ebonyi State of Nigeria, Egbe and Eze (2014) found that in the area of farmers training programmes, ineffectiveness was perceived in the Training and visits of farmers, Organization of field meetings, Organization of methods, techniques and result demonstrations, and Organization of research linkage workshops. Only Training on efficiency of production, processing and storage was effective in farmers’ training programmes. In the dissemination of information, awareness creation through electronic media and use of interpersonal contacts to pass technical information were effective tools of extension delivery except use of printed media to circulate information which farmers perceived as being ineffective. Egbe and Eze (2014) argued that the inability of extension officers to deliver effectively on training program might be due to high ratio of an extension worker to farmers.

Also, in Moaba’s (2016) study into farmers’ perception of agricultural extension service delivery in Germiston Region, Gauteng Province of South Africa, collecting data on a purposive and simple random sample of 78 respondents. A 4 and 3 point Likert-type scale method score was used to determine farmers’ perception of effectiveness of extension methods. Results showed that farmers’ perceptions of farmer training and demonstrations were highly effective in the study area. Study groups, farmers days, individual farm visits and on-farm trials and research were perceived to be effective. The study further revealed that the following extension methods were perceived to be slightly effective by farmers, workshops, print materials and office calls; and telephone calls, however, was perceived to be ineffective by farmers in the study area. Moaba (2016) argued that it was imperative to ensure that methods regarded to be effective were mainly used to deliver extension messages and that extension officers should be encouraged to do away or minimize the application of extension methods perceived to be slightly or not effective. Continuation with such methods may results in non-participation of farmers to extension activities since it has been considered to be non-effective. In achieving objectives of extension programme, the teacher-learner situation frequently involves the associated use of two or more kinds of extension teaching methods since the learners (farmers) have different
demographic and socio-economic characteristics. For example, using e-extension approach to disseminate information about improved maize variety may have a greater limitation of reaching rural farmers who lack access to television signal unless this signal is provided and a village TV show centre is established to serve other rural farmers who do not have televisions. This was emphasized by Phichitchaisopa and Naenna, (2013) in their study into the factors influencing adoption of healthcare Information Technology (IT) services in Thailand, when they found facilitating conditions to have a positive influence on adoption of healthcare information technology. They argued that infrastructure supports, such as computer systems or knowledge are necessary for adoption. In addition, no matter how equipped are extension agents, they cannot influence adoption of agricultural technology that is too costly for poor farmers to access. This is to say that the effectiveness of any extension approach depends largely on its suitability to the farmers' geographical, demographic and socio-economic characteristics, the policy environment and the entire social system in which the approach is used. Extension agent-farmer ratio also greatly influences the effectiveness of extension delivery.

From the review of effectiveness of the tools of extension delivery, it was observed that very little of empirical studies had been done, as the above had been thoroughly gleaned and insufficient to produce a macroscopic outlook of the problem situation across the global agricultural literature, and for that matter, the local setting.

This paper therefore, aimed at assessing maize farmers' perception of level of effectiveness of the tools with which extension services are delivered in Zabzugu Tatale in the Northern Region of Ghana.

METHODOLOGY

The Study Area

The study was carried out in two districts: Zabzugu District and Tatale/Sanguli, District. The population of the study area is 123,854 (60,039 for Tatale/Sanguli + 63,815 for Zabzugu District) according 2010 Population and Housing Census, (Ghana Statistical Service, 2014). According to Zabzugu Tatale District Assembly Composite Budget (2012), the Zabzugu Tatale District Assembly was carved out of the former Eastern Dagomba District (Yendi) in 1988, and established by the Legislative Instrument 1449. It is one of the eastern corridor districts in the Northern Region of Ghana. The district is located in the eastern flank of the Northern Region and covers an area of 2,332sq kilometres. It shares boundaries with the Republic of Togo to the East, Yendi District to the West, Nanumba North and South, and Nkwanta Districts to the South, and Saboba and Chereponi Districts to the North.

The district has undulating land with hills found in the Sheini/Kandin areas along the Ghana-Togo border. River Oti and streams in the district serve as drainage systems. The district experiences two main seasons during the year – the dry and the wet seasons. The dry season starts from late October to early May. Farming activities noted for this period are: harvesting of rice, cassava, yam, drying of food stuffs, preparation of farmlands and making of yam mounds. This season is also noted for hunting and burning of bushes for game. Most fire disasters occur during this period. The second season, the wet season, span from late May to early October. The annual average rainfall is 1,200mm. The onset of the rains is characterized by strong storms which sometimes result in removal of roofs and rendering many people homeless. The heavy rains especially from July to September render most roads in the district deplorable, constraining the transport of fresh farm produce.

Soils in the district are generally sandy loam with alluvial deposits in the lowlands. It is a very rich soil which results in the growth of yam, cassava, maize, groundnuts, millet, sorghum, rice and other crops. The vegetation of the District is guinea savannah, though some areas in the southern aspect fall within the transitional zone. Economic trees such as dawadawa, teak, kapok and mango can be found. There are also tall grasses, shrubs, and thorny species.

The major ethnic groups in the district are Dagombas constituting 25.1%; Kokombas, 42.6%; Basare, 28.3% while the minor ones are Kabre, 1.8%; Bemoba, 0.4%; Akan 0.4%. Other Ghanaian tribes such as Kotokole, Hausa, Zabarima, Fulani, and Ewes, all constitute 1.3% of the population in the area. The Ewes are mainly settler fishers along the major River Oti, while the Fulanis are herdsmen for the indigenous people, Kotokoli, Hausa and Zabarima are traders. The Dagomba celebrate Damba, Fire (Bugum) and Eid festivals celebrated while the Bassare and Konkomba celebrate the Yam and Christmas festivals (Ghana Statistical Service, 2014).

The area is about 98% agrarian people engaged in crop production and animal rearing. The main crops cultivated by farmers in the district are yam, maize, millet, sorghum, cassava, groundnuts, cowpea and soya beans. Cattle, goats and sheep and poultry are the main livestock reared in the district. The small ruminants are often sold during the lean season (May to July) to meet the food needs of households.

The Study Population

The population for the research included all households producing maize in Zabzugu and Tatale/Sanguli Districts. The population of maize farmers was obtained from the districts’ offices of Ministry of Food and Agriculture and it included 17,463 registered maize farmers in 2014/2015 farming season.
Data Collection Methods

Primary data were sourced from maize farmers in the study area through structured questionnaire. Enumerators who could understand the farmers’ language were recruited to support in the questionnaires administration. All responses from the questionnaires were then coded into Microsoft excel and transported into Stata14.0 for analysis. Literate farmers answered the questionnaires themselves and handed them over to the enumerators. The questionnaire also elicited data on farmers’ perception of the effectiveness of extension delivery using Extension Effectiveness Indicators (Awareness, Visit, Field meeting, Regularity, Field Days, Demonstrations, Supervision, Research-Extension-Farmer Linkage Workshop, and Farmer Training) proposed by Misra (1997).

Sample Size Determination

In determining the sample size, this study followed Cochran (1963) formula: 

\[ n = \frac{p(1-p)z^2}{\epsilon^2} \]

where \( n \) represents the sample size, \( p \) is the population proportion or sample proportion, \( z \) is the z-score obtained from the standard normal distribution table at a given level of confidence and \( \epsilon \) is the margin of error. The research allowed a level of precision of 4.4% at 95% level of confidence. Zabzugu and Tatale-Sanguli District has a total population of 123854 people (63,815 and 60,039 respectively), according to the 2010 Population and Housing Census, (Ghana Statistical Service (2014). The population proportion was arrived at 14.1% by dividing the population of maize farmers by the total population of the study area. From the standard normal distribution table, the confidence level has a z-score of 1.96. The sample size was therefore computed as:

\[ n = \frac{0.141(1-0.141)1.96^2}{0.044^2} = 240.3361 \]

The research, from the computation, used 240 respondents, (i.e. 240 maize farmers).
Sampling Procedure

A three-stage, randomized sampling procedure was used. The three stages involved selection of (1) zones, (2) communities, and (3) maize farmers. These farmers were selected as follows: Stage 1: Study area was stratified into ten (10) Agricultural Zones (AZs), and five zones were selected through simple random sampling (lottery) method; stage 2: four (4) communities were randomly selected from each of the 5 AZs to make up twenty (20) communities. Stage 3: Then a total of 240 respondents (sample size) were selected from these communities based on equal allocation. Twelve (12) respondents were selected in each of the communities from the list of farmers (sample frame) obtained from the respective zonal extension officers. This made up the sample size of 240 maize producing households in the study area. The communities selected for the study included the following; Zabzugu, Laaagbani, Gumpila, Kworli, Woribogu, Sabare, Nakpali, Kuntumbiyili, Mantili, Tatale, Nachamba No. 1, Kuyoli, Nakpali-borle, Bidiribombe, Bekunjib, Bilando, Bachadoo, Sanguli, Nagbindo and Nanbone.

Method of Data Analysis

This study adopted the variables proposed by Misra (1997) as tools of extension service delivery to evaluate the effectiveness of the tools of extension delivery in the study area. The variables were Awareness (Number of farmers), Visit with farmers (Number of visits by village extension worker, say per month), Field meeting (Number of meetings held with village extension workers), Regularity (Number of meetings held by village extension worker with farmers on fixed days), Field days (Number of field days organized by village extension worker (monthly, quarterly, and annually), Demonstrations (Number of (a) method demonstrations and Result demonstrations organized by village extension worker monthly, quarterly and annually), Supervision (Number of supervisory visits from Agricultural Extension Officers to village extension worker in the field per month), Research-Extension-Farmer Linkage (Number of research-extension-farmer linkage workshops organized yearly), and Farmer Training (number of farmers trained in farmer training centres/farmer training workshops organized).

To ascertain maize farmers’ perception of the effectiveness of the tools of extension delivery in terms of the effectiveness indicators, a three-point Likert-type scale ranging from ‘ineffective’ (1), ‘effective’ (2) to “very effective” (3) were used. Responses were categorized in terms of their mean scores. A mean score that was less than 1.5 was considered ineffective; a mean score of 1.5 to 2.0 was considered effective, and then 2.1 to 3 were considered very effective. Data was analyzed with descriptive statistics using stata 14.0 and presented in means and standard deviations.

RESULTS AND DISCUSSION

This section presents and discusses results of the study. First, the socio-economic characteristics of respondents are presented (Table 1) and discussed and then second, the perception of farmers of the effectiveness of the tools of extension delivery are also presented (Table 2) and discussed. The study solicited responses from 240 respondents as the sample size for the survey. As indicated in Table 1, the mean value for sex is 0.92, indicating higher (92 percent) male respondents over females who constituted only 8 percent of the sample. There was no intent for gender comparison, and for that matter the respondents were selected at random irrespective of sex, but it was observed that majority of maize producing households in the study area were headed by males.

Table 1 also shows that respondents who were married had a mean value of 0.854, representing 85.4 percent of the sample size, and the remaining 14.6 percent were single. Married couples are usually more responsible in terms of provision of food and shelter for the household which makes married household heads tend to dominate the respondents.

The minimum and maximum ages of respondents were 18 and 72 years respectively, with an average of 31.97 years. This shows that the majority of respondents were in their active years; which implies a positive relationship between age and risk aversion as argued by Ouma et al. (2014). The minimum and maximum number of years of experience in maize farming among respondents was 3 and 36 years respectively and the average number of years of experience is 10 years. More so, the respondents’ average household size was about 13 persons, with the least household size being 2 persons and maximum being 35 persons.

With years of formal education, the minimum and maximum values were 0 and 21 years respectively, with the mean of 2.1 years, indicating that the majority of the respondents had lower number of years of education. Similarly, Fadare et al., (2014), and Salifu et al. (2015) found low education among maize farmers in Nigeria and Ghana respectively. However, this was contrary to the higher literacy (65%) among the sampled maize producing households found in the studies of Teferi et al. (2015) and Akinbode & Bamire (2015).

Also, there was low membership of FBOs among the sampled maize producing households in Zabzugu and Tatale/Sanguli Districts. The mean value for FBO membership as indicated in Table 4.1 was 25.4 percent while the remaining farmers with non-FBO membership were 74.6 percent. However, Teferi et al., (2015) found a relatively higher (about 56%) of maize producing
households belonging to farmer-based organizations. Yet farmers with FBO membership have greater access to credit than non-FBO members. In his study into the determinants of access to credit and its impact on household food security in Karaga District in the Northern Region of Ghana, Abdul-Jalil (2015) re-emphasized the need for farmers’ participation in FBO membership, indicating that being a member of farmer-based organization could increase the amount of credit accessed by farmers by 0.0583 at 1% level compared to farmers who did not belong to FBOs.

This, therefore, means that a farmer, as Rafael (2011) also attested, without FBO membership will have a less likelihood of getting access to credit which will then, consequentially, mitigate against other fertile conditions of successful adoption of agricultural technologies. Farmers within an FBO learn from each other how to grow and market new crop varieties (Rogers, 2003). It is also assumed that extension agents find it relatively cheaper reaching FBOs with innovations and those innovations are diffused faster among members of an FBO than among farmers who are exterior to the FBO.

As further seen in Table 1, the mean value for farmers’ access to extension service is 0.492, meaning that 49.2 percent of maize producing households in the sample of the study had access to extension service. It is however contradictory that but performed poorly in assisting farmers to form farmer groups and to have access to credit. Similarly, maize farmers’ membership had not been encouraged. These areas of poor performance must be improved to promote adoption.

### Table 1: Socio-economic Characteristics of respondents

<table>
<thead>
<tr>
<th>Variables name</th>
<th>Variable description</th>
<th>Measure</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access to extension service</td>
<td>Received at least one extension visit by a farmer on maize production</td>
<td>1 = access, 0 = no access</td>
<td>0.492</td>
<td>0.501</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Sex</td>
<td>Sex of the farmer</td>
<td>1 = male, 0 = female</td>
<td>0.92</td>
<td>0.277</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Marital status</td>
<td>Marital status</td>
<td>1 = married, 0 = single</td>
<td>0.854</td>
<td>0.354</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Age</td>
<td>Number of years lived</td>
<td>Years</td>
<td>31.97</td>
<td>14.33</td>
<td>18</td>
<td>72</td>
</tr>
<tr>
<td>Experience</td>
<td>No. of years in maize farming</td>
<td>Years</td>
<td>10.047</td>
<td>6.599</td>
<td>3</td>
<td>36</td>
</tr>
<tr>
<td>Household size</td>
<td>No. of persons in a household</td>
<td>Number of people</td>
<td>12.446</td>
<td>6.598</td>
<td>2</td>
<td>35</td>
</tr>
<tr>
<td>Years of education</td>
<td>Number of formal schooling years completed</td>
<td>Years</td>
<td>2.142</td>
<td>4.936</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>Membership of FBO</td>
<td>Belonged to a farmer-based organization or not</td>
<td>1 = member of FBO, 0 = not a member of FBO</td>
<td>0.254</td>
<td>0.436</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Farm size</td>
<td>Hectares of farm plots cultivated</td>
<td>Hectares</td>
<td>11.038</td>
<td>8.406</td>
<td>1</td>
<td>55</td>
</tr>
<tr>
<td>Farmer training programme</td>
<td></td>
<td></td>
<td>1.3625</td>
<td>1.61817</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

### Table 2: Rating of perception of effectiveness of the tools of extension delivery

<table>
<thead>
<tr>
<th>Variable</th>
<th>Obs</th>
<th>Measure</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awareness of extension agents</td>
<td>240</td>
<td>A mean score &lt; 1.5 = ineffective, from 1.5 to 2.0 = effective, and from 2.1 to 3 = very effective</td>
<td>2.7125</td>
<td>0.4975358</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Visiting farmers</td>
<td>240</td>
<td></td>
<td>1.770833</td>
<td>0.7214462</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Organizing field meeting regularity</td>
<td>240</td>
<td></td>
<td>1.875</td>
<td>0.5866364</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Organizing Field days</td>
<td>240</td>
<td></td>
<td>1.345833</td>
<td>0.6281268</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Organization of Demonstrations</td>
<td>240</td>
<td></td>
<td>1.395833</td>
<td>0.611589</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Embarking on Supervisions by extension agents in the field</td>
<td>240</td>
<td></td>
<td>1.633333</td>
<td>0.5989298</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Organization of Research-extension-farmer linkage workshops</td>
<td>240</td>
<td></td>
<td>1.2625</td>
<td>0.4594999</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

**Source: Field Survey, 2016**

As presented in Table 2, the results show that there exists a very high level of awareness among farmers about the existence of agriculture extension agents as maize farmers perceived awareness creation about existence of extension agents to be very effective (M=2.71). This shows that extension agents played their primary role of awareness creation about the need for farmers to seek extension advisory services, a finding consistent with that of Agbarevo’s (2013) and Egbe and Eze (2014) in which awareness creation about existence of extension agents was perceived very effective in Cross-River State and Ebonyi State respectively in Nigeria. However, even though farmers are aware of the existence of extension agents in the study area, table 1 shows that only about 49% (M = 0.492) of the maize farmers interviewed had access to extension service. This gives an indication that awareness does not necessarily guarantee access to extension service, and there is a likelihood that other factors still militate against the maize farmers’ access to agricultural extension service in the study area.
Visiting farmers was found to be effective with the mean value of 1.77. Similar findings were made by Agbarevo's (2013), Al-Rimawi et al. (2016) and Moaba's (2016) in their research into farmers' perception of agricultural extension delivery in Cross River State of Nigeria, Jordan, and South Africa respectively where farm visit by extension agents were found to be effective methods of extension delivery. On the contrary, Ibrahim et al. (2014) in Nigeria; Khan & Akram (2012) in Pakistan; and Egbe & Eze (2014) in Nigeria found that visiting farmers was ineffective tools extension delivery.

However, extension delivery was poor in the following areas: Field Days (M=1.35), Organization of Demonstrations (M=1.40), Research-Extension-Farmer Linkage (M=1.26) and farmer training programme (M=1.36). The poorest performance in extension delivery was field days which was consistent with the findings of Khan & Akram, (2012) in Pakistan; Egbe & Eze, (2014) in Nigeria; and Al-Rimawi et al., (2016) in which field days was found to be poor method of extension service delivery. On the contrary, performance in field days was found to be effective tool of extension delivery in Agbarevo's (2013) study into Farmers' Perception of Effectiveness of Agricultural Extension Delivery (AEDP) in Cross-River State, Nigeria.

Organization of Demonstrations was also another ineffective method of extension delivery which was found similar to the findings of Khan & Akram, (2012) and Egbe & Eze (2014) in which organization of demonstration was perceived ineffective method of extension service delivery in Pakistan and Nigeria respectively. However, Agbarevo’s (2013), Al-Rimawi et al. (2016), and Moaba’s (2016) found that organization of demonstrations was effective tool of agricultural extension service delivery in their research into farmers’ perception of agricultural extension delivery in Cross River State of Nigeria, Jordan, and South Africa respectively.

Ineffectiveness of Research-Extension-Farmer Linkage workshops was also found to be in line with the results of Agbarevo (2013) in Nigeria, Khan & Akram (2012) in Pakistan, Egbe & Eze (2014) in Nigeria and Moaba (2016) in South Africa who also found that Research-Extension-Farmer Linkage was perceived by farmers as ineffective tool of extension delivery in their study areas. The ineffective farmer training found from farmers’ perception is also found to be in line with Khan & Akram (2012) and Agbarevo (2013), but contradicts with Moaba (2016) in whose research findings farmer training programmes were perceived very effective tool of extension service delivery in South Africa. These areas of ineffective extension delivery are a source of serious concern as these indicators constitute the strong pillars of extension delivery, as Sewnet et al. (2016) also emphasized that research, extension and farmers are the three main pillars of agriculture system and their effectiveness largely depends on the strong linkages among them. Cerdan-

Infantes et al. (2009) also argued that improving productivity and quality requires a functioning system of technology generation and transfer and a means to implement these technologies; and that extension services can provide the proper institutional system to deliver these trainings to farmers. In Ghana, Research-Extension-Farmer Linkage Committee (REFLC) is responsible for ensuring this. Policy attention needs to be drawn to Research-Extension-Farmer Linkage Committee (REFLC) since majority of the farmers may not even be aware of the existence of the linkage committees as already indicated in literature by Ragasa (2013) in Ghana.

Literature has contradictory perception about effectiveness of the extension delivery tools postulated in this study, and this situation reflects the geographical, institutional and socio-economic contexts in which the extension services are delivered. Agricultural extension service, therefore, requires regular examination of farmers’ geographical, institutional and socio-economic characteristics to determine the appropriate and effective tools with which extension service could be disseminated at the right time and space. This will facilitate farmers understanding and maximize their benefits of extension advisory services, leading to assist farmers achieve high income and improve living standard through agricultural production in the study area and the country as a whole.

CONCLUSIONS AND RECOMMENDATIONS

The purpose of this study was to study maize farmers’ perception of effectiveness of the tools of extension delivery in Zabzugu and Tatale/Sanguli districts of Northern Region of Ghana. Data collected from random sample of 240 maize farmers was on their socio-economic characteristics and perception of effectiveness of the tools used by agricultural extension officers to deliver extension service. Perception was measured on a three-point Likert scale as Not Effective, Effective, and Very Effective; and responses were analysed with means using descriptive statistics. Of all the variables determined therein, only the Creation of Awareness about the existence of agriculture extension agents was found to be very effective tool of extension delivery. Visiting Farmers, Organizing Field Meetings with farmers, and Embarking on Supervision by extension agents in the field were perceived by maize farmers as being effective. However, Organizing Field Days and Demonstrations, Organization of Research-Extension-Farmer Linkage Workshops and Farmer Training Programmes were perceived ineffective. Farmers access to extension service was also reported to be low.

Regular farm visit is crucial for dissemination of extension messages; however, irregular funding of extension services will render it ineffective method of extension delivery. The ineffective Research-Extension-Farmer Linkage in the Zabzugu and Tatale/Sanguli districts is a source of worry as, of all the reviewed literature in this study, no findings contradict it.
This study, therefore, recommends that the government and the development partners should provide funds and logistical support to agricultural extension agents to deliver extension services using the methods the farmers in Zabzugu Tatale considered effective. The government also needs to supervise and equip Research-Extension-Farmer Linkage Committee (REFLC) in the study area since Research-Extension-Farmer linkage is of greater importance to the success of extension programme. Technology transfer cannot be effected without adequate linkages among these stakeholders since it is the platform, where mutual understanding is built among them about the problems and solutions in the agricultural sector.

Extension officers should also facilitate the formation and sustenance of farmer groups in their respective zones since agricultural technologies are diffused easier among farmer groups than among scattered individual farmers.

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Ansah I. G. K; Antwi, Justice and Donkoh S. A. (2018). Determinants of Farmer Linkage Committee importance to the success of extension programme. Farmer Linkage Committee also needs to supervise and equip extension services using the methods the farmers in and the development partners should provide funds and technological support to agricultural extension agents to deliver extension services using the methods the farmers in Zabzugu Tatale considered effective. The government also needs to supervise and equip Research-Extension-Farmer Linkage Committee (REFLC) in the study area since Research-Extension-Farmer linkage is of greater importance to the success of extension programme. Technology transfer cannot be effected without adequate linkages among these stakeholders since it is the platform, where mutual understanding is built among them about the problems and solutions in the agricultural sector.

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