

## **Demand for and Intensity of Use of Extension Services Among Cocoa Farmers in Ghana: The Heckpoisson Approach**

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### **Abstract**

*In response to the evolving landscape of agricultural extension services, a paradigm shift is imperative, moving away from the traditional supply-centric approach to one that recognizes farmers as active participants influenced by socio-economic factors. This transformation is especially pertinent for cocoa farmers, whose livelihoods hinge on this crop. To elucidate this shift, our study employs a multistage sampling technique to select 400 cocoa farmers in the Tafo District, Eastern Region, Ghana to ensure representativeness and diversity. The Heckpoisson model analysis reveals that farmers' demand for and intensity of use of extension services are intricately linked to a spectrum of socio-economic factors; farming experience, cooperative membership, farm size, sex, number of farms, religion, land tenure, marital status, household size, access to credit, distance to the farm, age, and years of formal education. Building upon our insights, we recommend that extension service providers tailor their services to align with the socio-economic characteristics of farmers.*

**Keywords : Demand, Farming Experience, Intensity, Extension services, Heckpoisson model**

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## **INTRODUCTION**

The majority of agricultural workers in developing nations like Ghana are rural farmers. Therefore, governments and other key players in developing nations should prioritise fostering sustainable rural growth alongside the implementation of efficient and effective agricultural systems (Kilelu et al., 2014). According to Abdallah and Awal (2016), extension access in difficult-to-reach locations will improve rural agricultural growth. Rural farmers, unable to access extension services, find themselves driven to seek employment in various urban centres as their primary source of income (Davis and Terblanche, 2016). If extension services are created in rural areas, rural farmers would have an opportunity to profit from global agricultural services (Chen et al., 2021). Sub-Saharan Africa faces major obstacles when it comes to production, maintaining food security, and eradicating poverty. These issues include the slow uptake of new agricultural technologies and a lack of extension services to facilitate that uptake (Ragasa et al., 2016). The implementation of agricultural extension services is a crucial aspect of agricultural development as it stimulates the growth of agricultural systems. It is not possible to achieve high levels of agricultural productivity without a competent agricultural extension service. Through the inclusion of farmers and other stakeholders in the value chain, extension service now serves an increased and more diverse group of stakeholders. Consequently, there is a growing need to enhance the effectiveness, relevance, customer responsiveness, and cost-efficiency of agricultural extension services (Ragasa et al., 2016).

Extension delivery in Ghana has undergone several modifications to enhance its effectiveness. The Unified Extension System (UES), which had a top-down methodology, took the place of the original General Agricultural Extension Approach in 1978. Within the UES, the Training and Visit (T&V) system is operated, involving extension agents visiting farmers on their farms to provide training and information on modern technologies. However, challenges arose

due to poor coordination between the Department of Agricultural Extension Services and research institutions located in different ministries. In response, the Decentralised Extension System was introduced in 1997 to address the shortcomings of the T&V system, particularly its top-down approach (Amezah and Hesse, 2002). The decentralisation resulted in the delegation of authority from the Ministry of Food and Agriculture (MoFA) to the district-level offices at the district assemblies, representing the lowest tier of government administration. The primary objective of this decentralisation was to establish a demand-driven extension system with the overarching aim of enhancing the productivity and income of farmers. Despite endeavours to advance decentralisation and local involvement in the development of extension programmes, the Ghanaian extension system has faced criticism for its failure to prioritise decision-making by farmers, who are pivotal stakeholders in the extension process, leading to widespread dissatisfaction with the extension system in the country (Amezah and Hesse, 2002). The extension delivery system in Ghana remains predominantly supply-driven, with extension agents assigned to specific operational (geographical) areas. Resource and logistical constraints, coupled with a high ratio of extension agents to farmers, often result in limited access to extension services based on the ease of reaching farmers.

The choice to engage in extension services by farm households is a behavioural reaction to the requirement to boost agricultural output to meet production goals. Roger's theory of diffusion of innovation explains the underlying incentives to use extension services if it is assumed that a farmer's decisions about the demand for extension services are also dependent on their socio-economic characteristics (Rogers, 2003). Farmers want better extension services to help plan activities and make the right choices for inputs. This means that extension services must correlate with agricultural transformation. To achieve food security, farmers must eventually gain access to high-quality extension services. However, this may not be the case for rural farmers. Various restrictions have compelled them to persist with outdated farming practices, leading to low yields (Churi et al., 2012). For countries aiming to enhance their agriculture, providing effective extension services is crucial. However, when these services are inadequately disseminated, progress is significantly impeded. The demand for agricultural information varies over time due to changes in the environment and advancements in agricultural technology. Due to evolving agricultural technologies and the advent of agricultural interventions and policies, farmers' information demands fluctuate throughout time. This calls for a demand-driven extension approach. Just as it is defined in economics, demand for agricultural extension services refers to farmers' active seeking behaviour towards agricultural extension officers at a specific price. In this case, they do not wait for extension officers to approach them with information but rather seek the information themselves because they know the relevance of such information (Kilelu et al., 2014). Agricultural transformation is possible if technologies are developed with a demand-driven strategy (Birner et al., 2009).

Concerned stakeholders have intensified their calls for a reassessment of the conventional top-down extension approach (Kingiri, 2021). Badu et al. (2011) justified this by asserting that achieving improved yields through extension and other agricultural programmes requires a more nuanced understanding of farmers' specific needs and agricultural goals. Extensionists can adjust to farmers' changing demands thanks to demand-driven extension services (Bitzer et al., 2019). Also, it was discovered that the demand-delivery model increases access to extension services (Williams and Taron, 2020). The implication is that the traditional view of extension access, which looked at extension contacts or the "access or no access" dichotomy, is not helpful when measuring extension as a demand-driven function (Kilelu et al., 2014). The traditional extension system operates as a top-down model. In contrast, the demand-driven extension system adopts a bottom-up approach tailored to address the specific needs of farmers in the field. This demand-driven approach embraces pluralism, encouraging the involvement of diverse extension

providers such as NGOs, farmer organisations, and the private sector in delivering extension services. In this system, farmers have the autonomy to choose the type of extension services they prefer, a significant aspect given their operation within a liberalised marketing system where they decide on production systems based on market demands. The transition from the conventional to the demand-driven extension system is pivotal because it enables a more adaptive and flexible approach to the delivery of extension services. By incorporating multiple stakeholders and empowering farmers to select their preferred services, the demand-driven system is better equipped to address the varied needs of farmers and foster sustainable agricultural growth and development (Masangano et al., 2016). Gido et al. (2015), Anang et al. (2015), and Abdallah et al. (2016) employed various statistical models to look into farmers' desire to use extension services and determine factors. These studies looked at extension service delivery as a supply function, where farmers were seen as passive actors within the extended value chain. A paradigm shift is needed away from this convention. This study takes a different look by measuring extension service delivery as a demand function. In this study, the Heckpoisson (Probit and Poisson) regression model is used to evaluate both the demand for and the intensity of the use of extension services. Understanding this topic will help raise the standard of extension service delivery for rural farmers' productivity.

## RESEARCH METHODS

The study's population constituted all the cocoa farmers within the Tafo cocoa district. Having a total population of 12,822 farmers, the sample size was determined using the Yamane formula. The formula is expressed as  $n = \frac{N}{1+N(e)^2}$ . Where: n = sample size required, N = sampling frame (12,822), e = margin of error (5%), Substituting 12,822 and 0.05 into the formula, we have;  $n = \frac{12822}{1+12822(0.05)^2}$ , n=388. Even though the calculated sample size was 388, it was revised to 400 to account for unresponsive participants. The researchers adopted a multistage sampling technique. A simple random sample procedure was used to select the study area. In the second stage, all four operational areas were chosen through the census method, thus, Bunso, Kukurantumi, Old Tafo and Osiem. Out of the four (4) operational areas, 100 respondents were selected from each of them using a simple random sample procedure in the last stage. The researchers gathered primary data from the participants through in-person interviews, employing structured questionnaires with closed-ended questions. Data were gathered using Open Data Kit (ODK) and were analyzed using STATA version 17.

The analysis of household demand for extension services and the intensity of their use involves a two-stage decision-making process. In the initial stage, farmers decide whether to seek extension services or not. Four different variables were used to measure demand, thus, 1) whether a farmer makes calls to an extension agent, 2) whether a farmer attends extension training programmes outside the community, 3) whether a farmer visits the extension office and, 4) whether a farmer patronizes agricultural media by extension agents. Each dependent variable was treated separately. In the subsequent stage, those who choose to seek services decide on the extent of their use (intensity of use), which is contingent on the choice made in the first stage. The choice of these variables were informed by various studies conducted by Gido et al. (2015), Sumo et al. (2022), Anang et al. (2015), and Abdallah et al. (2016).

For farmers opting not to seek extension services, the optimal decision is observed as zero, rather than treating it as unobserved. However, utilizing Heckman's (1979) two-step sample selection model, which treats the number of contacts as continuous rather than a count variable, is not feasible. In the present study, the dependent variable for the first stage is whether the

respondent seeks extension services or not, and for the second stage, it is the number of extension contacts (a count variable). The Heckpoisson model, a combination of Probit and Poisson regression models, was employed to evaluate the effect of socioeconomic characteristics on the demand for extension services and the intensity of their use among cocoa farmers. This model, estimated in two stages (selection and count), is preferred for its ability to simultaneously estimate parameters for binary and count data and correct for sample selection biases (Cameron and Kolstoe, 2020). Following the approach outlined by Waruingi et al. (2021), the model for the selection part is specified as follows:

$$Z_i^* = \beta_i W_i + \mu_i$$

$$Z_i = \begin{cases} 1 & \text{if } Z_i^* > 0 \\ 0 & \text{if } Z_i^* \leq 0 \end{cases}$$

Where;  $Z_i^*$ =binary indicator,  $W_i$ = vector of explanatory variables,  $\beta$  =the parameters to be assessed, and  $\mu_i$ = disturbance term presumed to be normally spread. The frequency of a farmer's use of extension services (Intensity) is only tracked when the farmer requests them. We defined the count equation (intensity) as follows:

$$Y_i = \alpha_i X_i + \omega_i$$

where  $Y_i$ = intensity of use,  $X_i$ =vector of explanatory variables,  $\omega$ = disturbance term assumed to have a bivariate normal distribution with zero mean and a covariance matrix.

We empirically specified selection model equations of the probit model as:

$$Z = \beta_0 + \beta_1 Age + \beta_2 Sex + \beta_3 Edu + \beta_4 Marit_{status} + \beta_5 FarmExp + \beta_6 FarmSz + \beta_7 NumF + \beta_8 HHS + \beta_9 Reli + \beta_{10} Landten + \beta_{11} AccCred + \beta_{12} DistFarm + \beta_{13} Coop + \mu_i$$

Variables definition, measurements and expected sign employed in the model are presented in Table 1.

**Table 1:** Variables used in the models and their measurement and expected sign

Dependent variables	Measurement	Expected sign	Source
<b>Demand for extension services</b>			
Calls to extension officer	1 if a farmer makes calls to an extension agent and 0 for otherwise		Gido et al. (2015), Sumo et al. (2022), Anang et al. (2015), Abdallah et al. (2016)
Attendance to training programmes outside the community	1 if a farmer attends extension training programmes outside the community and 0 for otherwise		
Visit to extension service office	1 if a farmer visits the extension office and 0 otherwise		
Patronage of Agric media programmes	1 if a farmer patronizes agricultural media by extension agents and 0 for otherwise		
<b>Intensity of use of extension services</b>			
Calls intensity	Number of calls made per year		Gido et al. (2015), Sumo et al. (2022), Anang et al. (2015), Abdallah et al. (2016)
Training intensity	Number of training attended outside the community in a year		
Number of visits to extension office	Number of visits to the extension office in a year		
Number of agricultural media programmes patronized	Number of agricultural media programmes patronized in a year		
<b>Explanatory variables</b>			
Age	Farmers age in years	+/-	

Sex	1= male and 0= otherwise.	+/-	Abdallah and
Education	Years of education	+	Awal (2016);
Marital status	1 = married and 0 =otherwise	+/-	Gido et al.,
Farming Experience	Years of farming	+	(2015); Ragasa et
Farm Size	Acres	+/-	al., (2013);
Number of farms	Number of farms	+	Wossen et al.,
Household size	Household size in number	+	(2017); Anang et
Religion	1 = Christian and 0 =otherwise	+/-	al., (2015);
Land tenure	1 =own land and 0 otherwise.	+	Mutambara et al.,
Access to credit	1 = yes and 0 =otherwise	+	(2013); Nambiro
Distance to farm	Distance from the farmer's homestead to the nearest farm in kilometres.	-	et al., (2006)
Cooperative	1 =member of cooperative and 0= otherwise.	+	

## RESULT AND DISCUSSION

### Sample Characteristics

The demographic details of the interviewed cocoa producers are provided in Table 2. It was discovered that cocoa producers are, on average, 45 years old. The age of 45 may signify a stage where these farmers have accumulated valuable insights into cocoa cultivation practices. It also prompts considerations for succession planning within the industry, as younger individuals may need to be encouraged to enter cocoa farming to ensure the continuity and sustainability of the sector. The average farming experience and years of schooling among cocoa farmers were 12 and 9, respectively. A farming experience of 12 years suggests that these farmers likely possess a substantial amount of practical knowledge and skills related to cocoa cultivation. This experience can influence decision-making, crop management, and the adoption of new agricultural practices. On the other hand, an average of 9 years of formal schooling indicates a moderate level of education among cocoa farmers, which can play a role in their ability to understand and implement modern agricultural techniques as well as engage with extension services and educational programmes. The farmers, on average, owned approximately five (5) acres of land. This average suggests a small-sized landholding among the farmers (Ankuyi et al., 2023), which can have implications for their overall productivity, crop diversity, and economic well-being. The average number of farms used by cocoa farmers was 2. The average of two farms suggests a level of diversification in agricultural activities, allowing farmers to spread their risks and potentially enhance overall resilience. Cocoa farmers had an average household size of 8. A household size of 8 suggests a relatively large family unit (Denkyira et al., 2017), and this has implications for resource allocation, labour availability, and overall socio-economic dynamics within the farming community. Cocoa farmers, on average, travel a distance of 6 kilometres to reach their farms. This information indicates the extent of mobility and the geographical spread of farms within the community. This average distance travelled may influence farmers' time management, energy expenditure, and overall efficiency in farming activities. Of the cocoa farmer population, 74% were male and 26% were female, highlighting a notable gender imbalance among the cocoa farmers in the study area. This information sheds light on potential gender-specific dynamics in cocoa cultivation, influencing aspects such as labour distribution, decision-making, and access to resources. Only 7.50% of the interviewed cocoa farmers owned their farm plots. This low percentage suggests that a considerable majority of cocoa farmers may be operating on leased or communal land, impacting their long-term security and control over the cultivation areas. Land ownership is a critical factor in influencing farmers' decision-making,

investment strategies, and overall commitment to sustainable farming practices. Additionally, 68% had access to credit facilities, 15% had access to their labour, and a significant portion, 75.75%, were members of cooperative societies. The limited access to personal labour suggests potential challenges in terms of workforce availability. The high percentage of farmers being members of cooperative societies is promising, as it indicates a collective approach to farming that can enhance resource sharing, knowledge transfer, and bargaining power.

**Table 2:** Sample characteristics

Continuous Variables	Mean	Std. Dev.
Farming Experience	11.70	5.20
Years of Education	9.03	2.21
Farm size of Farmers	5.08	4.01
Age of Farmers	44.92	14.52
Number of farms	1.60	0.93
Household Size of Farmers	8.10	3.98
Distance to farms	5.75	4.75
Categorical/Dummy Variables		
Sex	Frequency	Percent (%)
Female	106	26.50
Male	294	73.50
Marital Status	Frequency	Percent (%)
Married	208	52.0
Others	192	48.0
Religion	Frequency	Percent (%)
Others	30	7.50
Christianity	370	92.50
Land tenure system	Frequency	Percent (%)
Owner	30	7.50
Others	370	92.50
Access to Credit Facilities	Frequency	Percent (%)
No	128	32.0
Yes	272	68.0
Access to labour		
Others (hired, communal etc.)	340	85.0
Own	60	15.0
Membership in a Cooperative Society	Frequency	Percent (%)
No	97	24.25
Yes	303	75.75

Source: Field Data, 2022.

### Extension Needs of Cocoa Farmers

Table 3 provides a comprehensive overview of extension needs in agricultural activities based on both frequency and percentage. Cultural practices emerge as a critical focal point, with an overwhelming 99.25% of respondents expressing a need in this area, highlighting the recognition of their pivotal role in effective crop management. Abugu et al. (2013) similarly found that it is common for farmers in Nigeria to seek information about cultural practices. Post-harvest activities follow with a substantial 95.25%, highlighting the significance attributed to activities such as storage, processing, and marketing after the harvest. The high demand for post-harvest extension could be due to the importance that smallholder farmers place on ensuring food security all year round (Bawa, 2019). Pre-planning activities and planting activities also register high percentages at 84.25% and 76.25%, respectively, indicating a strong demand for guidance in activities preceding the cultivation phase. Harvesting activities, with a comparatively lower

percentage of 60.75%, suggest that, while recognized as important, there may be room for increased awareness and support in optimizing harvesting techniques. Overall, these findings emphasize the diverse spectrum of extension needs in agriculture, providing valuable insights for tailoring extension services to address specific challenges at different stages of the agricultural cycle.

**Table 3:** Cocoa farmers' extension needs.

Needs	Frequency	Percent (%)
Pre-planning activities	337	84.25
Planting activities	305	76.25
Cultural practices	397	99.25
Harvesting activities	243	60.75
Post-harvest activities	381	95.25

Source: Field Data, 2022.

### **Demand For and Intensity of Use of Extension Services**

Table 4 sheds light on the demand for and intensity of the use of extension services by cocoa farmers. The mean values provide insights into the average intensity of use for each variable, while standard deviations indicate the degree of dispersion in the data. The data indicates that a significant majority (75.75%) of respondents have made calls to extension officers, with a mean of 15.89 calls per year and a standard deviation of 12.55, suggesting a considerable variation in the frequency of interactions. Attendance at extension programmes is reported by 68% of respondents, with a mean of 1.16 and a standard deviation of 1.00, showcasing a relatively lower average frequency but with less variability. Notably, visits to extension offices are recorded by 52% of respondents, with a higher mean of 4.29 and a standard deviation of 2.00, indicating a more diverse pattern of usage. Moreover, agricultural media programmes see significant patronage, with 85% of respondents engaging and a mean of 1.36 with a standard deviation of 1.10. These findings suggest a substantial demand for extension services, particularly through calls and media programmes, highlighting the varied ways in which farmers seek and utilize agricultural information. Overall, the findings emphasize the importance of extension services, with variations in the extent of utilization across different aspects reflecting the diverse needs and preferences of cocoa farmers. Extension contact is key to enhancing the uptake of innovations by farmers. Farmers in the study area could be considered high users of extension services; when combining their contact with extension providers via phone and face-to-face, the average number of contacts is 6 (six). This exceeds the discovery by Sumo et al. (2022), who found that farmers in Liberia typically have an average of three (3) contacts with extension service providers per year.

**Table 4:** Demand for/intensity of use of extension services.

Variables	Frequency	Percent (%)	Mean	Std. Dev.
Calls to extension officer				
No	97	24.25		
Yes	303	75.75	15.89	12.55
Attendance to extension programmes				
No	128	32.0		
Yes	272	68.0	1.16	1.00
Visits to the extension office				
No	192	48.0		
Yes	208	52.0	4.29	2.00
Patronage of agricultural media programmes				
No	60	15.0		

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Yes	340	85.0	1.36	1.10
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Source: Field Data, 2022.

### **Socioeconomic Factors Influencing Demand and Intensity of Calls to Extension Officers**

Table 5 reveals that farm size, number of farms, and cooperative membership influenced the demand for calls to extension officers. In terms of the intensity of calling extension officers, age, sex, and distance influenced cocoa farmers. However, years of formal education influenced both the demand and intensity of calls to extension officers. Thus, as cocoa farmers receive more years of education, they tend to show an increased likelihood of seeking and engaging in phone communication with extension officers. In line with the finding, Gido et al. (2015) assert that a level of formal education is needed for a farmer to be proactive in seeking information. They further argued that educated farmers showed a higher intensity of adoption of cocoa research innovations. This is conceivable since more education tends to enhance the farmer's capacity for innovation and information processing, both of which are crucial for the adoption of enhanced agricultural productivity. Furthermore, a better education enables farmers to recognize when they require new information and where to find it. Cocoa farmers with extensive land holdings request phone consultations with extension officers. Managing a large cocoa farm involves various tasks, and farmers may find it more time-efficient to engage in phone consultations rather than allocating time for on-site meetings. This allows for flexible communication that can be integrated into their busy schedules. Gido et al. (2015) support the idea that the size of a farm influences how quickly new cocoa research breakthroughs are adopted. As cocoa farmers expand the number of cocoa farms under cultivation, their likelihood of reaching out to extension officers for assistance through phone calls increases. Managing a larger number of cocoa farms could lead to increased economic stakes. Farmers may perceive the cost-effectiveness of phone consultations over on-site visits, considering factors such as travel expenses and time constraints. Cocoa farmers belonging to cooperative societies express a higher demand for phone consultations with extension officers compared to their counterparts who are not part of cooperatives. Cooperative societies often involve resource pooling for shared benefits. Farmers within cooperatives might find phone consultations a cost-effective way to leverage shared knowledge and expertise, contributing to improved agricultural practices and yields.

As cocoa farmers get older, their tendency to make phone calls to extension officers also increases. Older farmers may face physical limitations that make travelling to seek assistance more challenging. Utilising phone calls allows them to access extension services without the need for extensive travel, promoting convenience and accessibility. Gido et al. (2015) observed that the age of the farmer influences how much cocoa technology is adopted. In contrast, gender demonstrates a negative correlation with the intensity of phone call usage, suggesting that females generally use these services less intensively. Differences in occupational and domestic roles might influence the intensity of phone call usage. If females are disproportionately engaged in caregiving responsibilities or other activities that limit their availability for extended phone conversations, it could contribute to lower usage intensity. The frequency of phone call usage rises with an increase in the distance to the farm. As the distance to the farm increases, farmers may find it more practical to use phone calls as a means of communication instead of travelling to the farm or meeting in person. Phone calls offer a convenient way to stay connected and address farm-related matters without the constraints of physical distance. Longer distances may entail more time and effort for farmers to reach their farms. Using phone calls allows for quick communication, enabling farmers to efficiently address issues, make decisions, or seek advice without the need for time-consuming travel.

**Table 5:** Estimation of factors influencing demand and intensity of calls to extension officers.

Variables	Demand for calls (1/0)		Intensity of use	
	Coefficients	Marginal effect	Coefficients	Marginal effect
Age	-0.01(0.00)	-0.09(0.00)	0.03***(0.00)	0.43(0.04)
Sex	0.70(0.54)	0.13(0.13)	-0.37***(0.13)	-0.63(0.21)
Years of formal education	0.06***(0.02)	0.02(0.06)	0.18*(0.11)	0.03(0.20)
Marital status	-0.11(0.14)	-0.01(0.04)	0.07(0.10)	(0.02)
Farming experience	0.01(0.01)	0.00(0.00)	-0.00(0.01)	-0.03(0.14)
Farm size	0.02**(0.01)	0.01(0.01)	0.02(0.01)	0.28(0.23)
Number of farms	0.13*(0.08)	0.028(0.02)	-0.06(0.06)	-1.10(0.99)
Household size	0.00(0.02)	0.00(0.01)	0.01(0.01)	0.11(0.22)
Religion	0.12(0.75)	0.02(0.36)	-0.11(0.17)	-0.20(0.29)
Land tenure	-0.02(0.76)	-0.11(0.36)	0.23(0.18)	0.39(0.32)
Access to credit	-0.05(0.14)	-0.03(0.04)	-0.08(0.09)	-0.14(0.15)
Distance to farm	0.01(0.01)	0.01(0.00)	0.02**(0.01)	0.03(0.01)
Cooperative membership	0.33***(0.10)	0.16(0.04)	0.07(0.10)	0.13(0.19)
Athrho			0.23(0.17)	
Lnsigma			-0.54***(0.12)	
Constant	-0.43***(0.06)		1.46***(0.28)	
Observations	400		400	
Wald test	238.42***	Log pseudolikelihood		-1171.85

Source: Authors' Construct, 2022. NB: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

### Socioeconomic Factors Influencing Demand and Intensity of Attendance to Extension Training Programmes

Table 6 shows that age, the number of farms, and distance to the farm are factors influencing the demand for participating in agricultural extension programmes. Regarding the intensity of participating in agricultural extension programmes, religion and land tenure impact cocoa farmers. However, both demand for and intensity of attendance at agricultural extension programmes are influenced by farming experience and cooperative membership. The results indicate that younger farmers are more inclined to participate in agricultural extension training programmes compared to their older counterparts. Agricultural practices are evolving, with new methodologies and technologies continually emerging. Younger farmers, being generally more adaptable to change, may view training programmes as opportunities to enhance their skills, embrace innovations, and stay competitive in the evolving agricultural landscape. The result opposes that of Gido et al. (2015), who demonstrated a positive correlation between age and farmers' participation in agricultural extension programmes. Also, as distance to farms increases, the likelihood of farmers attending extension training programmes decreases. Longer travel distances can result in physical fatigue, especially in agricultural settings where farmers are actively engaged in labour-intensive work. This fatigue may discourage farmers from making the additional effort to attend training programmes after a long day's work. The finding is supported by Gido et al. (2015), who showed that farmers who live far from their farms are less likely to use extension services. The type of land tenure used by the cocoa farmer also influences their intensity of attendance at extension training programmes. Thus, farmers who possess land are more inclined to participate in extension training programmes in comparison to those who do not own any land. Farmers who own land may perceive participation in extension training as an investment in their agricultural enterprises. Land ownership often signifies a long-term commitment to farming, and farmers with such investments may be more motivated to enhance their skills and knowledge through training programs. Farmers who lack land control are less likely to invest in cutting-edge technologies for intense agricultural output, which lowers the

requirement for extension services (Mutambara et al., 2013). Consistent with the results, Gido et al. (2015) uncovered that farmers who own land had a greater number of extension contacts.

The demand for and intensity of participation in extension training programmes rises with an increase in cocoa farming experience. Farmers with increased cocoa farming experience are likely to encounter diverse challenges over time. The demand for extension training programmes may stem from a problem-solving orientation, where experienced farmers seek solutions to specific issues or challenges, they face in their farming practices. As cocoa farmers gain more experience, they often recognize the importance of continuous learning and skill development. Increased experience may lead to a deeper understanding of the complexities of cocoa farming, prompting a higher demand for extension training to enhance knowledge and expertise. Membership in farmers' cooperatives positively influences the demand for and intensity of participation in agricultural extension programs. Therefore, farmers who are cooperative members actively request and regularly participate in extension training programmes. Cooperative structures often facilitate better access to information and resources. Being part of a cooperative may provide farmers with enhanced opportunities to learn about extension programmes, leading to an increased demand for such services. Additionally, cooperatives may pool resources to support regular participation in training initiatives. Cooperative members benefit from shared learning experiences. Regular participation in extension training programmes could be driven by the desire to collectively acquire new knowledge and skills. The networking opportunities within cooperatives may also contribute to ongoing engagement in these programmes. Membership in a farmer group is associated with an increased demand for extension services, as indicated by Gido et al. (2015). The main reason the majority of farmers join farmer associations is to access information, loan opportunities, and extension services. This is attributed to the scarcity of extension agents relative to the demand for their services, necessitating group collaboration to reach more farms simultaneously (Ofuoku and Agbam, 2012).

**Table 6:** Estimation of factors influencing demand and intensity of attendance to extension training programmes.

Variables	Demand for training (1/0)		Intensity of use	
	Coefficients	Marginal effect	Coefficient	Marginal effect
Age	-0.06*(0.04)	-0.00(0.00)	0.02(0.03)	0.00(0.03)
Sex	0.70(0.54)	0.13(0.16)	0.17(0.12)	0.21(0.16)
Years of formal education	-0.06(0.15)	-0.03(0.04)	-0.06(0.08)	-0.08(0.11)
Marital status	-0.11(0.14)	-0.06(0.04)	0.01(0.09)	0.01(0.12)
Farming experience	0.10*** (0.01)	0.03(0.01)	0.18*** (0.07)	0.03(0.01)
Farm size	-0.02(0.10)	0.02(0.03)	0.07(0.07)	0.09(0.09)
Number of farms	0.14*(0.08)	0.01(0.00)	-0.03(0.04)	-0.04(0.05)
Household size	-0.01(0.12)	-0.05(0.03)	-0.12(0.09)	-0.15(0.13)
Religion	0.09(0.77)	0.00(0.36)	0.17*** (0.03)	0.02(0.00)
Land tenure	-0.05(0.78)	-0.15(0.36)	0.16*** (0.03)	0.02(0.01)
Access to credit	-0.06(0.14)	-0.03(0.04)	-0.17(0.12)	-0.22(0.16)
Distance to farm	-0.09**** (0.02)	-0.01(0.00)	-0.00(0.00)	-0.00(0.01)
Cooperative membership	0.03*** (0.02)	0.01(0.00)	0.08** (0.03)	0.10(0.04)
Athrho			-0.14*** (0.02)	
Lnsigma			-0.63*** (0.12)	
Constant	-0.47(0.69)		0.27(0.23)	
Observations	400		400	
Wald test	244.34***	Log pseudolikelihood		-566.97

Source: Authors' Construct, 2022. NB: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

### Socioeconomic Factors Influencing Demand Intensity of Visits to Extension Office

Table 7 shows that sex, farm size, number of farms, and household size distance to the farm are factors influencing why farmers visit agricultural extension offices for information. Regarding the intensity of visits, marital status, religion, and land tenure influenced them. However, both demand for and intensity of visiting extension offices are influenced by farming experience, distance to farms, and cooperative membership. The findings indicate that male cocoa producers are more inclined to visit extension offices compared to their female counterparts. In some farming communities, decision-making dynamics may influence who takes the lead in seeking agricultural support. If men traditionally play a more central role in decision-making related to farming activities, they may be more proactive in visiting extension offices. An increase in the number of farms per farmer is associated with a higher likelihood of visiting extension offices. Farmers managing a larger number of farms may operate on a larger scale, leading to increased complexity in their agricultural activities. This complexity could drive the need for additional information, guidance, and support, prompting these farmers to visit extension offices. Farmers with multiple farms may engage in diversified agricultural activities involving different crops or livestock. Managing diverse operations may necessitate seeking specialised knowledge and advice, contributing to a higher likelihood of visiting extension offices for tailored information. Farmers with larger household sizes have a higher likelihood of visiting extension offices. Larger households may rely more heavily on agriculture as a primary source of income and sustenance. In such cases, farmers may visit extension offices to gain insights into improving productivity, optimising resource use, and ensuring the economic viability of their agricultural endeavours.

Marital status influences farmers' visits to agricultural extension offices. Thus, unmarried cocoa farmers frequently visit agricultural extension offices compared to their married counterparts. Unmarried cocoa farmers may have more autonomy in decision-making and resource allocation compared to their married counterparts. This autonomy could lead to a heightened interest in seeking information and support from extension services. Unmarried farmers may have more flexibility in terms of time availability. Without family responsibilities, they may find it easier to allocate time for visits to extension offices, attend training sessions, and actively engage in learning opportunities. The distance to the farm was found to be significant for both the demand and intensity of use. This suggests that as the distance to the farm increases, there is a decrease in the likelihood of farmers visiting extension offices, intensifying the frequency of their visits. Membership in cooperative societies was found to have a significant influence on both the demand for and the intensity of visits to agricultural extension offices. Cooperative societies often signify a collective strength within a farming community. The significant impact on demand and intensity of visits suggests that farmers within cooperatives may leverage their collective influence to seek more information and support from extension services. The results concur with those of Doss (2006), who discovered that cooperative participation was positively connected to the speed at which technology was adopted.

**Table 7:** Estimation of factors influencing demand intensity of visits to extension office.

Variables	Demand for visit (1/0)		Intensity of use	
	Coefficients	Marginal effect	Coefficient	Marginal effect
Age	-0.06(0.04)	-0.00(0.00)	0.00(0.00)	0.00(0.00)
Sex	0.68***(0.24)	0.04(0.01)	-0.34(0.35)	-0.06(0.06)
Years of formal education	-0.06(0.14)	-0.03(0.04)	-0.05(0.08)	-0.07(0.01)
Marital status	-0.10(0.13)	-0.05(0.04)	-0.22**(0.90)	-0.04(0.01)
Farming experience	0.09***(0.05)	-0.01(0.00)	0.14**(0.07)	0.02(0.01)
Farm size	0.03***(0.02)	0.02(0.01)	-0.08(0.05)	-0.01(0.09)
Number of farms	0.14*(0.08)	0.00(0.00)	-0.01(0.05)	-0.10(0.08)

Household size	0.03*(0.02)	0.01(0.00)	0.01(0.09)	0.00(0.02)
Religion	0.15(0.78)	0.01(0.04)	0.57***(0.10)	0.10(0.04)
Land tenure	-0.05(0.79)	-0.01(0.04)	0.38**(0.17)	0.06(0.03)
Access to credit	0.05(0.14)	0.00(0.00)	0.14(0.09)	0.02(0.01)
Distance to farm	-0.08***(0.02)	-0.01(0.00)	-0.02***(0.07)	-0.00(0.00)
Cooperative membership	0.04***(0.02)	0.02***(0.00)	0.20**(0.08)	0.03(0.01)
Athrho			0.11**(0.05)	
Lnsigma			-2.87(0.00)	
Constant	-0.53(0.66)		0.10***(0.04)	
Observations	400		400	
Wald test	445.09***	Log pseudolikelihood		-604.60

Source: Authors' Construct, 2022. NB: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

### Socioeconomic Factors Influencing Demand and Intensity of Patronage of Agricultural Media Programmes

The socioeconomic factors prompting demand and intensity of patronage of agricultural media programmes are presented in Table 8. In terms of demand and intensity of use of extension services (patronage of extension media programmes), the results show that it is influenced by age, sex, marital status, farming experience, religion, land tenure, access to credit, and cooperative membership. In terms of demand for extension services, age, farming experience, and access to credit were positively significant, while age and cooperation were positively significant, and marital status and religion were negatively significant for the intensity of use. Age and farming experience were significant for both demand and intensity of use. This means that as the age and farming experience of a cocoa farmer increase, their demand for and intensity of use (patronage of extension media programmes) increase, and vice versa. The positive correlation suggests that as cocoa farmers grow older and accumulate more farming experience, there is a concurrent increase in their demand for extension media programmes and the extent to which they engage with them. Thus, individuals with more experience in farming are likely to recognize the value of extension services and actively seek out information to enhance their agricultural practices. The reciprocal relationship implies that efforts to tailor extension media programmes to the needs and preferences of older and more experienced cocoa farmers could yield more effective outcomes, fostering a mutually beneficial relationship between age, experience, and the utilization of extension services in the cocoa farming context.

Farmers who have access to credit are more likely to demand extension media programmes. The correlation between farmers having access to credit and an increased likelihood of demanding extension media programmes signifies a noteworthy connection between financial resources and the appetite for agricultural information. Farmers with access to credit often have the means to invest in their farming activities, and the desire for extension media programmes may stem from a strategic intent to optimize the returns on their investments. This positive association suggests that financial empowerment can be a driving force behind the demand for extension services, highlighting the importance of recognising and addressing financial constraints when designing and promoting such programs. According to Gido et al. (2015), the decision to embrace cocoa research innovations was positively and significantly influenced by financial access but not by the speed of adoption. Accordingly, farmers may be able to adapt advances from cocoa research if they have access to credit, but the level to which they do so won't depend on the availability of credit (Nambiro et al., 2006). Also, farmers who work their land are more inclined to make use of extension services. According to Tadesse (2017), holding a land title deed increases the expected demand for extension services.

**Table 8:** Estimation of factors influencing demand and intensity of patronage of agricultural media programmes.

Variables	Demand for Agric TV/radio (1/0)		Intensity of use	
	Coefficients	Marginal effect	Coefficients	Marginal effect
Age	0.29**(0.12)	0.06(0.03)	0.23**(0.11)	0.04(0.02)
Sex	0.70***(0.24)	0.13(0.04)	-0.31(0.37)	-0.06(0.06)
Years of formal education	-0.06(0.15)	-0.03(0.04)	0.00(0.08)	0.00(0.14)
Marital status	-0.11(0.13)	-0.06(0.04)	-0.36*** (0.09)	-0.06(0.01)
Farming experience	0.08*** (0.02)	0.00(0.00)	0.02** (0.01)	0.03(0.01)
Farm size	-0.03(0.10)	-0.00(0.00)	0.04(0.05)	0.01(0.01)
Number of farms	-0.06(0.79)	-0.01(0.04)	-0.05(0.05)	-0.09(0.08)
Household size	-0.05(0.14)	0.03(0.04)	0.00(0.10)	0.01(0.02)
Religion	0.15(0.78)	0.00(0.36)	-0.25* (0.13)	-0.04(0.02)
Land tenure	0.14* (0.08)	0.00(0.02)	0.03(0.16)	0.05(0.28)
Access to credit	0.03** (0.01)	0.01(0.00)	-0.09(0.09)	-0.01(0.01)
Distance to farm	0.01(0.01)	-0.00(0.00)	0.09(0.07)	0.00(0.01)
Cooperative membership	0.02(0.15)	0.00(0.00)	0.35*** (0.08)	-0.06(0.01)
Athrho			0.01(0.01)	
Lnsigma			-0.40(0.32)	
Constant	0.39(0.96)		0.14** (0.06)	
Observations	400		400	
Wald test	106.57***	Log pseudolikelihood		-610.10

Source: Authors' Construct, 2022. NB: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

## CONCLUSION

Understanding the influence of socioeconomic characteristics of smallholder cocoa farmers on the demand for and intensity of use of extension services is crucial for effective agricultural extension service delivery and their use by farmers to increase productivity, improve livelihoods, and reduce poverty. Age, sex, years of formal education, farm size, number of farms, distance to the farm, and cooperative membership influenced the demand and intensity of the use of extension services (calls to the extension officer). In terms of demand and intensity of use of extension services (attendance to extension training programme), the results show that it is influenced by age, farming experience, number of farms, distance to farm, religion, land tenure, and cooperative membership. Moreover, sex, marital status, farming experience, number of farms, household size, religion, land tenure, distance to the farm, and cooperative membership influence demand and intensity of use of extension services (visits to the extension office). Additionally, age, sex, marital status, farming experience, religion, land tenure, access to credit, and cooperative membership influence the demand and intensity of the use of extension services (patronage of extension media programme). The study shows that policy directives need to be extended to increase farmers' demand for and intensity of use of the various extension services available to them. Extension service providers generally need to modify their services following the socioeconomic characteristics of farmers, especially farming experience. To improve farmers' rate of calling extension officers via mobile phone, attending programmes outside their communities, visiting extension offices and patronizing media programmes, the following are recommended; venues for programmes must be centralized to allow easy mobility, farmers must be encouraged to join cooperative societies, non-formal educational outreaches could be organized for farmers, access to lands and credit should be facilitated by extension agents.

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