



Research Article

Farmers' Satisfaction With Crop Extension Services Provided by Department of Agricultural Extension – A Case from Rural Bangladesh

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Abstract | Bangladesh is primarily an agriculture-based country, with the Department of Agricultural Extension (DAE) serving as the nation's largest crop extension service provider. As with other organizations, client satisfaction is crucial to DAE's effectiveness. The purpose of this study was to assess the satisfaction level of crop farmers. The study was conducted in three villages of Gauripur Upazila in the Mymensingh district. Data were collected from 100 farmers in the selected villages between September 15 and October 14, 2019, using a pre-tested, structured interview schedule. A Farmers' Satisfaction Index, developed using 25 Likert-type scale statements, was employed as the dependent variable. Data were analyzed using SPSS software, and linear regression analysis was conducted to determine the influence of selected farmer characteristics on their satisfaction levels. The results indicated that overall farmer satisfaction with extension services ranged from low to medium. Linear regression analysis revealed that the most influential factors affecting satisfaction levels were age, education, perceived economic return, attitude toward extension services, participation in extension programs, knowledge of agricultural extension services and access to need-based training. Based on these findings, there are clear opportunities for DAE to better address the needs of crop farmers and improve service effectiveness.

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Introduction

Bangladesh is an agrarian country with a population of 161.4 million (World Bank, 2020). For the majority of its population, agriculture is not only a source of food security but also a primary means of

livelihood and poverty alleviation. According to the World Bank (2016), agriculture accounted for 90% of the poverty reduction between 2005 and 2010 and played a key role in supporting long-term economic growth. Although the sector's contribution to the economy has declined over the past forty years,

agriculture still contributed more than 12.68% of the national GDP in the 2019–2020 fiscal year (World Bank, 2020). This is a significant decrease from 46.7% in 1980–81 and 24.1% in 2000–2001 (BBS, 2016). Nevertheless, agriculture remains a crucial driver of economic development in Bangladesh (Bangladesh Economic Review, 2017). Approximately 40.06% of the labor force is engaged in agriculture (BBS, 2019). Given Bangladesh's status as the largest delta in Asia and the most densely populated delta in the world, agriculture represents a strategically vital sector for the country (BBS, 2018). Agricultural extension, therefore, plays a pivotal role in supporting this sector and improving the livelihoods of a significant portion of the population.

Among various extension service providers, the Department of Agricultural Extension (DAE) is the largest in Bangladesh. DAE aims to deliver need-based extension services to all categories of farmers, enabling them to optimize their use of resources (Rashid and Gao, 2016). Since its establishment in 1982, DAE has been providing crop extension services to farmers across the country. The public perception of DAE and its communication strategies are critical to the effectiveness of technology transfer. According to IFPRI (2012), DAE's initiatives to promote High Yielding Varieties (HYVs) of rice increased the share of HYV-cultivated rice land from about 20% in the early 1980s to over 70% by 2005–06. Bangladesh is currently the third-largest rice producer and the second-largest jute producer globally (Hossain and Abdulla, 2015), which underscores DAE's role in advancing agricultural production through extension services.

DAE's extension services include method and result demonstrations to disseminate new technologies and knowledge among farmers. Extension workers provide services via mobile phones, conduct regular field visits to assess conditions, and offer need-based training on crop production. Additionally, DAE encourages the formation of farmer groups and promotes the adoption of new technologies within these groups (DAE Manual, 2018; Ahmed *et al.*, 2018). When government subsidies are available, DAE is also responsible for distributing them to farmers.

The DAE has undergone several restructurings to enhance its effectiveness (Arifullah *et al.*, 2014). To fulfill its mission, it is essential to evaluate

farmers' satisfaction with DAE services to ensure that extension efforts are responsive and impactful. However, to date, no comprehensive study has been conducted to assess Bangladeshi farmers' perceptions of DAE's services. Globally, several studies have evaluated farmers' satisfaction with extension services. For instance, Ganpat *et al.* (2014) found only modest levels of satisfaction among farmers in the Eastern Caribbean. Elias *et al.* (2016) reported that 68% of farmers in Northwest Ethiopia were dissatisfied with agricultural extension programs. In contrast, most farmers in Amathole, South Africa, expressed satisfaction with the extension services provided (Agholor *et al.*, 2013). In Tripura State, North-East India, 38.33% of farmers were highly satisfied and 36.67% were moderately satisfied with their extension services (Debnath *et al.*, 2016). Similarly, Kassem *et al.* (2021) found that farmers in northern Egypt were moderately satisfied with available extension services.

The present study was conducted to address two key research questions:

1. Are crop farmers satisfied with the extension services they currently receive from the DAE?
2. What factors influence crop farmers' satisfaction or dissatisfaction?

The specific objectives of this study were to assess crop farmers' satisfaction with DAE extension services and to identify the factors associated with their levels of satisfaction or dissatisfaction.

Theoretical framework

Satisfaction with agricultural extension service

Customer satisfaction can be defined as the extent to which a company's goods and services meet or exceed client expectations (Farris *et al.*, 2010). In the context of agricultural extension, satisfaction is defined as meeting farmers' pre-existing expectations regarding the quality of extension services (Elias *et al.*, 2016). Farmers, considered consumers in the extension program delivery system, expect high-quality outcomes from these services (Agholor *et al.*, 2023). Satisfied farmers are more likely to continue engaging with extension services and to share positive feedback with others (Ganpat *et al.*, 2014).

Assessing farmers' satisfaction offers valuable insights into the effectiveness of extension services and the extent to which a lasting positive impression is

formed both of which play crucial roles in building trust between farmers and agricultural extension providers for future collaborations (Kassem *et al.*, 2021). Moreover, understanding farmers' perceptions of extension services is essential for extension leaders to accurately allocate resources, evaluate performance, determine staff compensation, and inform policymaking (Yazdanpanah and Feyzabad, 2017).

Quality of agricultural extension service

One of the key factors influencing satisfaction is the quality of the services provided (Ghiasi *et al.*, 2017; Kassem *et al.*, 2021; Adel and Nahed, 2016). A customer's perception of tangibility, responsiveness, assurance, empathy, and reliability are all important determinants of service quality (Wilson *et al.*, 2008). According to Parasuraman *et al.* (1985), customer satisfaction consistently increases when the perceived service quality is high.

In the context of extension services, Buadi *et al.* (2013) emphasized that while a single limiting factor can render a service ineffective, overall satisfaction relies on maintaining high-quality performance across all dimensions. An effective agricultural extension service is defined as one that meets farmers' needs in diverse agroecological settings through regular communication between farmers and extension personnel. Such services are also recognized for being supportive, well-organized, and responsive to farmers (Thuo *et al.*, 2014; Mur *et al.*, 2016; Ragasa *et al.*, 2013). Developing accountability mechanisms through participatory monitoring and evaluation is essential for meeting farmers' expectations and enhancing service quality (Kassem *et al.*, 2021).

Researchers have explored various dimensions of service quality evaluation. Sylla *et al.* (2019) identified four key service components to assess how farmers perceived the quality of services from both public and private sectors: (i) assistance with technical matters or training; (ii) input provision; (iii) loan facilitation; and (iv) market facilitation. Additionally, Birner *et al.* (2009) and Mur *et al.* (2016) proposed three primary standards for evaluating extension service quality: services should be (1) concise and easy to understand; (2) relevant meaning timely, cost-effective, appropriate, and tailored to farmers' agricultural and socioeconomic conditions; and (3) reliable being consistent, accurate, transparent, and locally validated.

Methodology

Method of data collection and analysis

The farm household heads, who were involved with crop cultivation in the study area for their livelihood, constitute the study population. A 20 percent sample size (100 farmers) was selected for data collection using simple random sampling techniques from a total of 500 farmers (Israel, 1992) of the Upazila that were engaged in crop production as reported by the Upazila Agriculture Office.

Researchers interviewed 20 farmers using the draft interview protocol. The structured interview protocol was improved based on feedback from these 20 initial interviews. Finally, in-person interviews (paper and pencil questionnaire) were conducted in October and November 2019. To measure farmers' contentment with extension services, the interview primarily used a Likert-type scale of 25 single-sentence items (Ganpat *et al.*, 2014). The respondents were asked to mark the statements they agreed with or disagreed with. Strongly disagree (1), disagree (2), agree (3), and strongly agree (4) were the possible responses for each item (4). The following index was developed to measure farmers' satisfaction:

$$\text{Farmers' Satisfaction Index (FSI)}: \frac{\sum Ri}{R_{max}} = 100$$

Study area

Three villages Chorail, Chandersatia, and Salihor in the Gauripur sub-district (hereafter Upazila) of Bangladesh's Mymensingh district were selected as research sites (Figure 1). Mymensingh generates 11% of all rice produced in the country. Additionally, the majority (66.9%) of Gauripur Upazila's population is engaged in agriculture. Besides rice, the area also produces numerous crops, including jute, wheat, mustard, potato, brinjal, tomato, country bean, and okra, among others. As most people in this area are involved in crop production, there is a high likelihood that they have received some form of service from the Department of Agricultural Extension (DAE).

Where, R_i represents the individual's answer to each sentence and R_{max} represents the highest possible score (The maximum possible score for 25 things is 100). Higher scores signify a higher level of contentment with the extension services.



Figure 1: Map of the mymensingh district's gauripur sub-district (Kabir, 2011)

Table 1: Selection of variables with their source

Variable	Source
Age	Ganpat <i>et al.</i> , (2014), Kassem <i>et al.</i> , (2021)
Level of education	Ganpat <i>et al.</i> , (2014), Kassem <i>et al.</i> , (2021)
Household size	Elias <i>et al.</i> , (2016), Altalb (2017)
Farm size	Ganpat <i>et al.</i> , (2014), Altalb (2017)
Annual family income	Elias <i>et al.</i> , (2016), Kassem <i>et al.</i> , (2021)
Social mobility	Somanje <i>et al.</i> , (2021)
Credit received	Elias <i>et al.</i> , (2016), Kassem <i>et al.</i> , (2021),
Extension media contact	Elias <i>et al.</i> , (2016)
Perceived economic return	Elias <i>et al.</i> , (2016), Yazdanpanah & Feyzabad, (2017)
Participation in extension program	Kassem <i>et al.</i> , (2021),
Experience of farming activity	Elias <i>et al.</i> , (2016)
Knowledge on extension service	Altalb (2017)
Attitude towards extension service providers	Pandey <i>et al.</i> , (2020)
Need based training	Elias <i>et al.</i> , (2016)

A similar scale and index were used by Ganpat *et al.*, (2014) and Awatade *et al.*, (2019). Cronbach's Alpha

was calculated at 0.86 for the scale, and this was deemed a highly reliable scale using guidance from Leontitis and Pagge (2007), DeVellis, (2005) and Ganpat *et al.* (2014). The independent variables were chosen based on the existing literature review (Table 1).

Regression analysis was used to measure the third study goal, which was to find parameters linked to farmers' satisfaction levels. Data was cleaned, processed, and analyzed for the study using SPSS version 20 of the statistical program for social science. A multitude of graphs and charts were generated with the Microsoft Excel 2013 application.

The factors influencing crop farmers satisfaction levels were identified using regression analysis (both enter and stepwise methods). Multiple regression analysis was conducted to understand the correlations among the multiple variables being investigated (Tabachnick *et al.*, 2013). Following the elimination of unimportant variables from the model, stepwise regression analysis aids in quantifying the individual contributions of component variables (Quddus and Kropp, 2020). The multiple regression analysis equation is as follows (Eq. 3):

$$y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{12} X_{12} + \beta_{13} X_{13} + \beta_{14} X_{14} + \epsilon_i \dots \dots (3)$$

Table 2: *Characteristics profile of the respondents (n= 100)*

Characteristics(measuring units)	Range		Respondents (n=100)		Mean	SD*
	Possible	Observed	Category	(%)		
Age (years)	-	22-70	Young (18-35)	17	45.64	11.69
			Middle aged (36-50)	53		
			Old (above 50)	30		
Level of education (years of schooling)	-	0-17	Illiterate (0)	15	5.23	5.10
			Can sign only (0.5)	27		
			Primary (1-5)	16		
			Secondary (6-10)	28		
			Above Secondary (>10)	14		
Household Size (No. of family members)	-	2-8	Small size (up to 4)	41	4.86	1.23
			Medium size (5-6)	49		
			Large size (above 6)	10		
Farm Size(Hectares)	-	0.09-1.94	Landless (<0.02 ha)	0	0.39	0.35
			Marginal (0.02-0.2ha)	39		
			Small (0.21-1.0 ha)	56		
			Medium (1.01-3.0 ha)	5		
			Large (>3.0 ha)	0		
Annual family income ('000'Tk.)	-	20-500	Low (up to 200)	83	1.48	108.3
			Medium (201-400)	13		
			High (above 400)	4		
Social mobility (scale score)	0-18	7-15	Low (up to 6)	0	10.5	1.91
			Medium (7-12)	85		
			High (above 12)	15		
Credit received ('000'Tk)	-	0-100	No credit (0)	39	16.16	22.65
			Low (1-33)	45		
			Medium (34-67)	11		
			High (above 67)	5		
Extension media contact (scale score)	0-57	10-26	Low (up to 19)	50	19.28	5.02
			Medium (20-38)	50		
			High (above 38)	0		
Perceived economic return (scale score)	0-10	0-4	Low (up to 3)	95	1.60	0.91
			Medium (4-6)	5		
			High (above 6)	0		
Participation in extension program (scale score)	10-40	12-24	Low (up to 20)	84	17.66	2.95
			Medium (21-30)	16		
			High (above 30)	0		
Experience of farming activity (years)	-	4-43	Low (up to 14)	31	18.18	9.16
			Medium (15-29)	54		
			High (above 29)	15		
Knowledge on extension service (scale score)	0-29	7-19	Low (up to 10)	25	12.18	2.54
			Medium (11-20)	75		
			High (above 21)	0		
Attitude towards extension service providers (scale score)	8-32	10-21	Low (up to 16)	71	15.30	2.34
			Medium (16-24)	29		

			High (above 24)	0		
Need-based training (days)	-	0-3	No training (0)	74	0.50	0.91
			Short (up to 7)	26		
			Medium (8-30)	0		
			High (above 30)	0		

Where, y_i = farmers' satisfaction, β_0 = constant, X_1 = age, X_2 = level of education, X_3 = household size, X_4 = farm size, X_5 = annual family income, X_6 = social mobility, X_7 = receiving credit, X_8 = extension media contact, X_9 = perceived economic return, X_{10} = participation in extension program, X_{11} = experience of farming activity, X_{12} = knowledge on extension service, X_{13} = attitude towards extension service providers, X_{14} = need based training, ϵ_i = Error term

Results and Discussion

Features of the respondents' socioeconomic status

Table 2 provides an overview of the farmers' demographics. Most farmers in the study ranged in age from middle-aged to elderly. This is likely a result of the younger generation's involvement in non-agricultural pursuits, particularly in urban and educational settings. The outcome is comparable to that of Uddin *et al.* (2016) and Hasibuan *et al.* (2019). In this research, slightly more than 4 in 10 (42%) farmers reported completing six years of education on average, 20% claimed to be illiterate, and 22% claimed to be able to sign their name only. The literacy rate for study participants was considered relatively lower than the national 72.3 percent literacy rate (Bangladesh Statistics, 2018). The average family size among respondents was 4.86, which was higher than the 4.06 national average (HIES, 2016). The respondents had an average farm size of 0.39 hectares. Compared to the 0.6 hectares of the typical farm in the country, this was smaller (Uddin *et al.*, 2017). In comparison to the national average of 0.142056 million Bangladeshi taka (\$1,675.00 USD), the average annual income of the farmers in the research region was 0.2102 million Bangladeshi taka (\$2,478.49 USD) (BBS, 2018). Regarding social mobility, 85% of respondents reported medium social mobility, whereas just 15% were considered highly mobile. Furthermore, a substantial proportion (39 %) had no access to credit. All the farmers (100%) belonged to low to medium extension media interaction, and 95% of respondents had a low perceived economic return. The vast majority (84%) of respondents reported

low Extension participation, and all respondents mentioned poor input distribution by DAE. Slightly more than five in ten respondents (54%) had medium experience in farming. The majority of respondents had little to medium knowledge about agricultural extension services. Furthermore, the majority of respondents (71%) expressed a poor impression toward agricultural extension services. The highest proportion of the farmers had no short period of training. Farmers struggle to grasp DAE's operating procedures due to a lack of training.

Farmers' satisfaction level

The percentage responses to each statement in Table 3 are intended to measure farmers' satisfaction with agricultural extension services. All statements were expressed positively. A certain degree of contentment would be shown by agreement with such assertions, and vice versa. Mean frequencies indicated that, altogether, 29% of farmers reported some degree of satisfaction (9% strongly agreed with the assertions and 20% agreed), whereas 71% showed dissatisfaction (35% disagreed with the statements and 36% strongly disagreed).

The statement with the highest degree of agreement was "If feasible, I would want to engage with the extension service" (28% of farmers were in agreement and 35% were in strong agreement). Also high in the agreement was, "I do believe that extension service is based on well-stated principles" (with 30% of farmers agreeing and 33% strongly agreeing). On the other hand, the item "I believe Extension handles all farmers fairly and equitably" was strongly rejected as 69% of farmers disagreed, and 30% disagreed very strongly. Similarly, farmers disagreed with the statement, "Extension service is of high quality" (with 35% of the farmers expressing disagreement and 65% strongly disapproving) In addition, 97% of people who responded to the survey disagreed with the statement that they are content with the agricultural extension service and want to use it going forward. There were mixed levels of agreement with statements such as, "I

Table 3: *Individual statement frequency*

Statements				Respondents percentage				Mean
				SD	D	A	SA	
If possible, I like to collaborate with the extension service				15	22	28	35	2.83
I think extension service is based on fluent principles				15	22	30	33	2.81
Extension service, in my opinion, benefits me without asking me anything in return.				16	24	29	31	2.75
Extension workers try their level best to provide service				17	26	29	28	2.68
My experience tells me that if the extension service decides to try anything new, I will be invited to participate				17	29	30	24	2.61
I believe that the suggestions from the extension service is always true				18	30	33	19	2.53
I believe the extension service values my contributions				19	32	33	16	2.46
The extension service cares for my well-being as well as that of my family				21	34	34	11	2.35
Extension officers value my opinion				21	37	36	6	2.27
Extension service providers are easy to reach				22	40	35	3	2.19
I enjoy dealing with the extension service				25	42	30	3	2.11
Extension service providers always keep their promises				28	43	26	3	2.04
Extension programs are need-based				31	44	23	2	1.96
Extension officers and I have a productive working relationship				35	42	20	3	1.91
The extension service is consistently willing to work with me				40	38	20	2	1.84
Extension workers understand farmers' situation and give advice accordingly				43	38	17	2	1.78
The extension officer conducts all operations with the utmost professionalism				46	38	15	1	1.71
The extension service provided is extremely necessary for my farming activity				50	36	12	2	1.66
I am happy with the activities of upazila agriculture office				53	37	8	2	1.59
For getting farming information, extension service is my most preferred source				54	38	6	2	1.56
I would gladly suggest the extension service to other farmers				57	36	5	2	1.52
When I am in need, extension service is prepared to assist me				60	36	4	0	1.44
I will continue to rely on the extension service since I am pleased with it				64	33	3	0	1.39
Extension service is of high quality				65	35	0	0	1.35
I believe extension personnel handle all farmers equally and equitably				69	30	1	0	1.32
Mean score of satisfaction				36	35	20	9	
Cronbach alpha				0.86				
Variable	n	Mean (SD)	Min.	Max	Skewness		Kurtosis	
Farmers' satisfaction	100	51(10.92)	30	80	0.524		0.375	

believe that the suggestions from the extension service are always true” and “I feel that I am important to the extension service”. Again, based on the satisfaction score, the farmers were categorized into 3 categories (Figure 2).

Factors linked to crop farmers' degree of satisfaction with crop extension services

According to the results of the regression analysis (Table 4), all of the parameters substantially impacted the calculated satisfaction index ($F(14, 85) = 8.62, p 0.01$), and they accounted for 59% of the variation

in farmers' satisfaction ($R^2=0.587$). Multicollinearity among independent variables was not a major issue in the model, as shown by the Variance Inflating Factors (VIF) being less than 10. Age, level of education, perceived economic return, program participation, knowledge on agricultural extension services, attitude towards extension service providers, and need-based training were all shown to significantly affect farmers' satisfaction, as determined by individual t-tests.

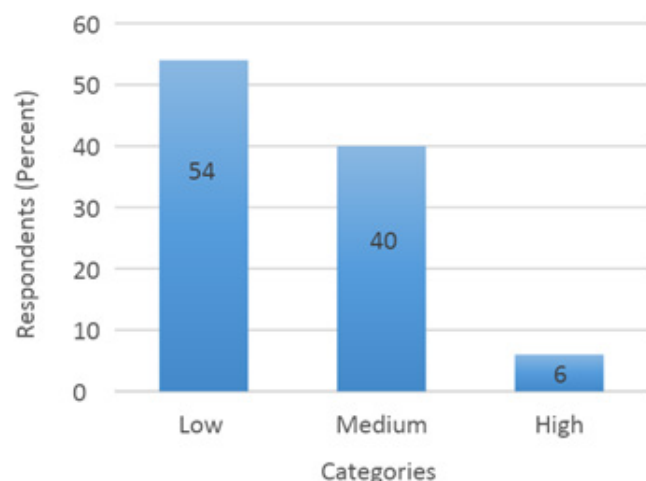


Figure 2: Farmers' satisfaction level regarding crop extension service provided by DAE ($n = 100$)

Younger farmers were happier with agricultural extension services than older farmers ($\beta = -0.088$, $t = -2.064$, $p < 0.05$). Regarding education level, farmers with higher education levels (secondary/tertiary) expressed greater satisfaction with agricultural extension services than farmers with lower education levels ($\beta = 0.144$, $t = 1.874$, $p < 0.05$). On the other hand, a rise in perceived economic return ($\beta = 0.910$, $t = 2.096$, $p < 0.05$) and participation in extension programs ($\beta = 0.391$, $t = 2.82$, $p < 0.01$) increases the level of satisfaction. Concerning knowledge level, farmers who were more knowledgeable about the crop extension services were more satisfied with

extension than those with less knowledge regarding DAE crop extension service ($\beta = 0.587$, $t = 3.055$, $p < 0.01$). Farmers having higher attitudes towards extension service showed a higher level of satisfaction ($\beta = 0.521$, $t = 2.543$, $p < 0.05$). Lastly, farmers with higher training exposure showed higher satisfaction ($\beta = 0.665$, $t = 2.136$, $p < 0.05$).

Stepwise multiple regression analysis

A stepwise multiple regression analysis was used to determine the individual contribution of the explanatory factors in predicting the variance in farmers' satisfaction level. The summary of stepwise multiple regression analysis is presented in Table 5. Multiple linear regression analysis revealed that the model included all seven explanatory variables - age, perceived economic return, education level, extension program participation, knowledge of agricultural extension services, attitude toward extension service providers, and need-based training.

Conclusions and Recommendations

The overwhelming majority of respondents (94%) reported a low to medium level of satisfaction, with only 6% indicating a high level of satisfaction. This finding aligns with Elias *et al.* (2016), where 38% of farmers were dissatisfied and 58% were moderately satisfied.

Table 4: A summary of multiple linear regression explaining the focus variable ($n = 100$)

Independent variable	VIF	B	SE	t	P-value
(Constant)		22.885	6.188	3.698	0.001
Age	1.483	-0.088	0.043	-2.064	0.042**
Level of education	1.284	0.144	0.077	1.874	0.045**
Household size	1.204	0.048	0.296	0.161	0.872
Farm size	1.472	0.617	1.276	0.484	0.630
Annual family income	1.751	0.003	0.005	0.502	0.617
Social mobility	1.247	-0.318	0.210	-1.514	0.134
Receiving credit	1.423	-0.018	0.022	-0.845	0.400
Extension media contact	1.201	0.138	0.108	1.279	0.205
Perceived economic return	1.205	0.910	0.434	2.096	0.039**
Participation in extension program	1.255	0.391	0.138	2.823	0.006***
Experience	1.422	0.050	0.047	1.075	0.286
Knowledge on agricultural extension services	1.515	0.587	0.192	3.055	0.003***
Attitude towards extension service providers	1.307	0.521	0.205	2.543	0.013**
Need based training	1.405	0.665	0.311	2.136	0.036**
$F(14,85) 8.62^{***}$					
$R^2 = 0.587$, Adjusted $R^2 = 0.519$					

Note. *** = $p < 0.01$; ** = $p < 0.05$; * = $p < 0.10$

Table 5: Stepwise multiple regression analysis summary

Model	Variables entered	Multiple R	Multiple R ²	Variation explained (percent)	Significance level
Constant+ X ₁₂	Knowledge (X ₁₂)	0.505	0.255	25.5	0.001
Constant +X ₁₂ +X ₁₀	Participation in extension program (X ₁₀)	0.594	0.353	9.2	0.001
Constant +X ₁₂ +X ₁₀ +X ₁₄	Need-based training (X ₁₄)	0.659	0.434	7.8	0.001
Constant + X ₁₂ +X ₁₀ +X ₁₄ +X ₆	Social mobility (X ₆)	0.692	0.479	4.5	0.001
Constant+ X ₁₂ +X ₁₀ + X ₁₄ +X ₆ +X ₁₃	Attitude (X ₁₃)	0.709	0.502	4.0	0.001
Constant+X ₁₂ +X ₁₀ +X ₁₄ +X ₆ + X ₁₃ +X ₉	Perceived economic return (X ₉)	0.724	0.524	1.7	0.001
Constant+X ₁₂ +X ₁₀ +X ₁₄ +X ₆ +X ₉ +X ₁ +X ₂	Education (X ₂)	0.740	0.548	2.1	0.001

Several factors were identified as significantly influencing farmers' satisfaction levels. Among these, farmers' knowledge of crop extension services emerged as the most influential. Farmers' operational and production decisions are primarily informed by experiential knowledge gained through practice, observation, and trial over time (Sumane *et al.*, 2018). One of the major challenges in developing countries remains farmers' limited access to extension and agricultural knowledge. In this study, all respondents fell into the low to medium category in terms of their knowledge of crop extension services (Table 1), a result consistent with findings by Altalib *et al.* (2017) and Umeh *et al.* (2018). Farmers need adequate knowledge about how extension services work, where to access them, and how to seek emergency support. Since education and knowledge are not synonymous, it is important to assess knowledge alongside formal education. However, many past studies have focused solely on education, which appears to be a significant limitation.

Participation in extension activities was the second most influential factor. Notably, 84% of the farmers reported limited or infrequent participation in extension programs. Farmers' intrinsic motivation to learn significantly influences their decision to engage in such programs. Bangladeshi farmers vary in their willingness to invest time in extension activities (Uddin *et al.*, 2016), and a lack of proper motivation was cited by respondents as the primary reason for low participation. Further research is warranted to explore additional underlying factors that influence farmers' engagement in extension services.

Need-based training was the third variable to enter the regression model (Table 5), with 74% of respondents

stating they had not received any training (Table 1). Training is one of the most effective strategies for increasing farmers' ability to resolve production challenges (Caffaro *et al.*, 2020), thereby improving their overall satisfaction. Targeted training programs help farmers adopt a more professional approach and foster learning, as supported by Lobley *et al.* (2013).

In contrast, 71% of respondents reported a negative perception of extension service providers, a finding consistent with Arifullah *et al.* (2014). The primary reason for this poor perception was the unavailability of timely services during critical periods. Additionally, a low perceived economic return from extension services contributed to the low satisfaction levels. Perceived economic return accounted for 3.5% of the variation in satisfaction (Table 5). Economic benefits not only provide financial security but also promote long-term competitiveness. It is reasonable to conclude that greater economic returns from extension services are associated with higher levels of satisfaction, in line with Elias *et al.* (2016).

Younger farmers reported higher satisfaction levels compared to older farmers. This may be because younger farmers are less dependent on face-to-face visits from extension agents, whereas older farmers, who are more accustomed to this traditional mode of support, may feel disappointed when such interactions do not occur as expected. Age explained 3.0% of the variation in satisfaction levels (Table 5), consistent with Ganpat *et al.* (2014).

Education plays a crucial role in acquiring knowledge (Mardy *et al.*, 2018). It equips farmers with the ability to identify appropriate communication channels with extension agents. Educated farmers can engage

with agents through various means such as video calls or text messages even when in-person visits are infrequent. This enables quicker problem-solving and increases satisfaction.

The findings of this study suggest that there is room for improvement in DAE's crop extension services. It is essential that local extension agents visit farmers regularly. Moreover, moving beyond a "one-size-fits-all" model to a demand-driven extension service approach, rather than the current supply-driven one, is imperative. Active outreach to farmers is recommended to promote participation in extension programs and training initiatives, enabling them to better understand and benefit from DAE's services. Special efforts should be made to involve young farmers, who are the stewards of future food security. To avoid the common tendency of extension agents focusing only on large-scale farmers, restructuring of responsibilities is advised assigning a few agents to large-scale farmers and others to small-scale farmers (Ganpat *et al.*, 2014). This will help small farmers feel more valued. Additionally, the government should prioritize improving farmers' satisfaction with extension services as part of its goal to achieve food self-sufficiency. Increasing the extension service budget is essential, especially given the current high farmer-to-agent ratio, which limits service coverage. Under the present constraints, adopting a group-based approach instead of an individual one could enhance both satisfaction and the acceptance of extension services.

Finally, among notable studies on farmers' satisfaction with extension services, Ganpat *et al.* (2014) explained 35% of the variation, and Elias *et al.* (2016) explained 41%. In contrast, the variables used in this study's regression analysis accounted for 59% of the variation using the enter method and 55% using the stepwise method significantly higher than previous findings. While a more detailed analysis is needed to explain the remaining variation, this study represents the first empirical evaluation of crop farmers' satisfaction with extension services in Bangladesh. It confirms the importance of several well-established factors influencing satisfaction and highlights the need for further rigorous research to uncover additional contributing variables.

Declarations

Ethics approval and consent to participate: Due to the

absence of an institutional ethical board for approving social science research, there was no opportunity to apply for Research Ethics Board (REB) approval. However, the researchers carefully ensured that there were no ethical issues. Each participant was informed about the objective of the study and informed consent was taken from each of them.

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Novelty Statement

As an organization, it is essential for the Department of Agricultural Extension to know about the satisfaction level of the farmers regarding the services provided by them. This research will provide an idea about the current situation.

Author's Contribution

Saifur Rahman: Conceptualization, formal analysis, writing the original draft.

Mohammad Jiaul Hoque: Writing-review, supervision; interpretation.

Mohammed Nasir Uddin: Writing-review, co-supervision.

Joseph L. Donaldson: Review, editing, language checking.

Generative AI and AI-assisted technology statement

The authors stated that they didn't use generative AI and AI-assisted technology in preparing this manuscript.

Conflict of interest

The authors disclosed no possible conflicts of interest.

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