Determinants of Utilization and Satisfaction: An Empirical Analysis of Agricultural Extension Services in Pakistan

Waqas Shair[1], Muhammad Tayyab[2], Haleema Afzal[3], Usman Bashir[4]

[1,] Senior Lecturer, Minhaj University Lahore, Pakistan, Email: waqasshair689@gmail.com (Corresponding Author)
[2,] Associate Professor, Minhaj University Lahore, Pakistan, Email: hod.eco@mul.edu.pk
[3,] Independent researcher, Pakistan, Email: halimaafzal96@gmail.com
[4,] National College of Business Administration & Economics (NCBA&E), Pakistan. Email: bashirusman465@gmail.com

Abstract

Agricultural extension services are crucial for the development and sustainability of the farming communities. These services equip farmers with access to modern agriculture techniques, technologies, and scientific knowledge. Such information empowers farmers to enhance crop yields, utilize resources more effectively, and respond to environmental and market challenges. Moreover, extension programs enhance the overall productivity and economic stability of agricultural sectors by ensuring that innovations are tailored to local needs. Recognizing the significance of agricultural extension, this study is an attempt to investigate the factors affecting farmers' utilization and satisfaction with these services. The study uses the Pakistan Social and Living Standard Measurement (PSLM) Survey conducted in 2020. The study uses the ordered logit model to estimate the impact of various covariates on utilization and satisfaction. The aftermaths of the regression model suggest that socio-economic, demographic, and regional factors play an important role in shaping the use and satisfaction of agricultural extension services. Notably, the accessibility factors, such as time, distance, and mode of transport to visit the service locations also play a crucial role. The findings of the study offer valuable insights for government agencies, agricultural researchers and development organizations in undertaking measures to improve the effectiveness and utilization of agricultural extension services.

Keywords: Agricultural extension, Farmers, Ordered Logit, Pakistan

DOI:	https://zenodo.org/records/14281192
Journal Link:	https://jai.bwo-researches.com/index.php/jwr/index
Paper Link:	https://jai.bwo-researches.com/index.php/jwr/article/view/68
Publication Process	Received: 18 Jul 2024/ Revised: 15 Sep 2024/ Accepted: 23 Sep 2024/ Published: 10 Oct 2024
ISSN:	Online [3007-0929], Print [3007-0910]

| *Indexing:* | |
| *Publisher:* | BWO Research International (15162394 Canada Inc.) https://www.bwo-researches.com |

Introduction

Agricultural extension services are crucial in connecting farmers with modern innovation and research in agriculture. Their main objectives are to enhance productivity, ensure food security, improve rural livelihood, and promote sustainable agriculture at the macro level (AL-Sharafat et al., 2012). These services offer specialized and technical advice on innovative farming techniques, pest management, and the introduction of advanced irrigation methods to improve yields (Lukuyu et al., 2012). The extension services play an important role in protecting the environment by advocating sustainability through organic farming (Shah et al., 2010).

In the context of the critical role that agricultural extension services play, Pakistan also set up various agricultural extension services under provincial governance. The inclusiveness of these services is crucial for operational efficiency and fully tapped potential benefits across the distribution. However, the study by Riaz (2010) states that extension services in Pakistan are not effective for small-scale farmers who lack resources and less education. The factors contributing to the low use of services include poor delivery mechanisms, inadequate personnel, and lack of equipment. This, in turn, has turned many farmers to private sector advisory services which are relatively more reliable than public services (Mengal et al., 2012). The low uptake of public extension systems struggles with limited budgets, untrained staff, and bureaucratic management which hinders effective agricultural development (Baloch & Thapa, 2014).

As of the 18th Amendment in Pakistan, the provinces are now legally responsible for providing all direct services to citizens. These reforms are subject to improving the quality of both governance and public service delivery. This study is an attempt to evaluate the state of the public service delivery of the agricultural extension. The objective of the study is two-fold. Firstly, it empirically examines the factors influencing the utilization of agricultural extension services. Secondly, it estimates the impact of various factors affecting satisfaction from the agricultural extension services. Plenty of studies have examined these reforms' effects on education (Kakar et al., 2022) and health (Nishtar, 2011). The study that is close to our research is Hussain et al. (2023) and Mir et al (2023), these studies focused on healthcare services utilization and satisfaction. Sparse studies have been conducted on agricultural extension services. The findings of the study offer valuable insights for government agencies, agricultural researchers and development organizations in undertaking measures to improve the effectiveness, utilization and perceived satisfaction of agricultural extension services.

Methodology

Ordered Logit model

The objective of the study is to determine the impact of covariates on the utilization of agricultural extension services. In the microdata setting, the choice of the econometrics solely depends upon the nature of the outcome variable. In the study, the outcome variable for the first objective is related to the utilization of service which follows qualitative outcomes as specified ordinal categories in nature. The ordinal Logit model becomes relevant in the case of ordinal categorical variables (McCullagh, 1980). In the previous study, Hussain et al. (2023) used the order logit model for the utilization of healthcare services. The baseline econometric model is as follows:

$$y = \boldsymbol{x}'\beta + u \quad (1)$$

Where y is a dependent variable defined as utilization frequency of agricultural extension services; $\boldsymbol{x}$ is the vector of covariates; β is the vector of regression coefficients; u is the error term, assumed to follow a standard logistic distribution.

In the ordered Logit model, an underlying score is estimated as a linear combination of the independent variables accompanied by a series of thresholds or cut points. The likelihood of observing a specific outcome i is equivalent to the likelihood that this computed score, adjusted for random error, falls within the bounds defined by the cut points associated with that outcome:

$$\Pr(outcome_j = i) = \Pr(k_i - 1 < \beta_1 x_{1j} + \beta_2 x_{2j} + \ldots + \beta_k x_{kj} + u_j \leq k_i) \quad (2)$$

u_j is assumed to be logistically distributed in ordered logit. We can estimate the coefficients $\beta_1, \beta_2, \ldots, \beta_k$ together with the cut points $k_1, k_2, \ldots, k_{k-1}$, where k is the number of possible outcomes. k_0 is taken as $-\infty$, and k_k is taken as $+\infty$. This is a generalization of the simple Logit model with dichotomous outcomes.

The description of the outcome variable and other covariates has been presented in Table 1.

Logit model

Another objective of the study is to determine the impact of covariates on satisfaction with agricultural extension services. The outcome variable in this setting is a dichotomous qualitative variable which can be estimated by using the Logit model. In the previous study, Mir et al., (2023) used the Logit model for the satisfaction from the healthcare services. The baseline econometric model is as follows:

$$z = \boldsymbol{x}'\beta + u \quad (3)$$

where z is a dependent variable defined as 'yes' if satisfied with agricultural extension services, 'no' if dissatisfied; $\boldsymbol{x}$ is the vector of covariates; β is the vector of regression coefficients; u is the error term, assumed to follow a standard logistic distribution.

Here is the equation for the basic logit model:

$$Logit(P(Y=1|X)) = \log\left(\frac{P(Y=1|X)}{1-P(Y=1|X)}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k \quad (4)$$

Here $Logit$ is the log-odds function, representing the logarithm of the odds of $Y = 1$. The description of the outcome variable and other covariates has been presented in Table 1.

Table 1. Definition of the variables

Variable	Description
Dependent variables:	
Utilization	Ordinal categorical variable on the use of agricultural extension services, coded 1 not at all, 2 once in a while, 3 often, 4 always
Satisfied	Binary categorical variable, coded 1 if household responded satisfaction from services, zero otherwise.
Independent variables:	
Age	Age of the individual in years old
Female	Dichotomous variable coded 1 if female, zero otherwise
Education	Year of education
Digital resources	Nominal categorical variable, coded 1 if an individual does not use mobile and internet, 2 if uses mobile, 3 if used internet, 4 if uses both mobile and internet.
Urban	Dichotomous variable coded 1, if belongs to an urban area, zero otherwise
Province	Multinomial categorical variable, coded 1 for KPK, 2 for Punjab, 3 for Sindh, 4 for Balochistan
Distance	Ordinal categorical variable, coded 1 for 0-0.5 (km), 2 for 0.5-1 (km), 3 for 1-2 (km), 4 for 2-5 (km), 5 for 5+ (km)
No. of farmers	Number of farmers in the household

Ln(farm income)	Log of form income
Farm work priority	Multinomial categorical variable coded 1 if farming is the first occupation, 2 if farming is the second occupation, and 3 if farming is a first and second occupation.
Farming occupation	Multinomial categorical variable coded 1 if the individual is own cultivator, 2 if sharecropper, 3 if contract cultivator, 4 if livestock

Data and Descriptive analysis

Data source

This study uses the Pakistan Social and Living Standards Measurements (PSLM) survey conducted in 2019-20. The dataset was sourced from the official website of the Pakistan Bureau of Statistics (PBS). The current round of PSLM covers 176,790 households across Pakistan. The scope of the study focuses specifically on households reporting farm activities, with data indicating that 45,295 households and 47,159 individuals were engaged in such farm activities.

3.2 Descriptive analysis

In the study, utilization of the agricultural extension services is a dependent variable. We presented the distribution of utilization of services in Figure 1a. This distribution suggests a significant gap in the utilization of agricultural extension services, with a large number of individuals not engaging with these services at all. For instance, approximately 80 per cent of the respondents do not use agricultural extension services at all. A smaller segment, about 9.4%, use these services often, 7% of the respondents utilize the services occasionally, and 4.5%, consistently use agricultural extension services.

In the sample, staggering respondents did not use agricultural extension, the distribution of reasons for not using agricultural extension services is presented in Figure 1b. The largest segment of respondents, nearly 40 percent responded that agricultural extension services are not available to them. About 24.5% of the respondents cited other unspecified reasons, approximately 12.7% reported that the services are too far from their location, and 10.7% feel that there are insufficient facilities within the available services. Around 9% feel that the services do not suit their specific needs, while a smaller percentage (below 3 per cent) cited either the lack of tools/staff or higher costs associated with the use of services.

The distribution of satisfaction from agricultural extension services is presented in Figure 1c. Among the respondents utilizing the services, 74 percent are those who are satisfied with the agricultural extension services they receive. On the contrary, a quarter of the respondents indicate dissatisfaction with the services. For all those who utilize services, the breakdown of their evaluation of the state of services is reported in Figure 1d. A significant majority of respondents, around 78 percent, perceive the performance of the agricultural extension services to be consistent with previous years. Approximately 14.5 percent of respondents feel that the services have improved, while 5.3% believe that the services have deteriorated. A minimal percentage (2.5 percent) of respondents are unsure about the performance comparison over time.

In a nutshell, underutilization of agricultural extension services is visible and it is due to distinct barriers such as lack of availability, distance and insufficient facilities. Despite the challenge of underutilization, among those who do utilize the services, most of them are satisfied indicating the effectiveness of the services when accessible. Nonetheless, perceptions of service performance suggest stability in the quality of the services rather

than improvement, which underscores the need for continued enhancement according to the evolving needs of the agricultural community.

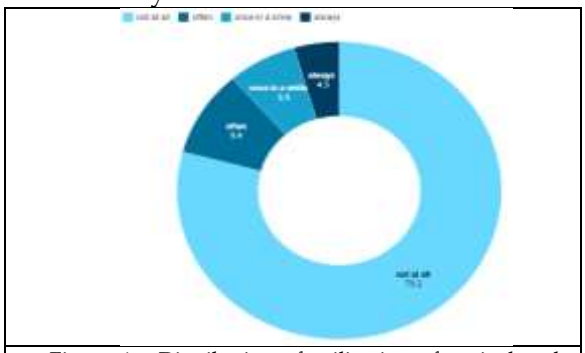

Figure 1a. Distribution of utilization of agricultural extension services

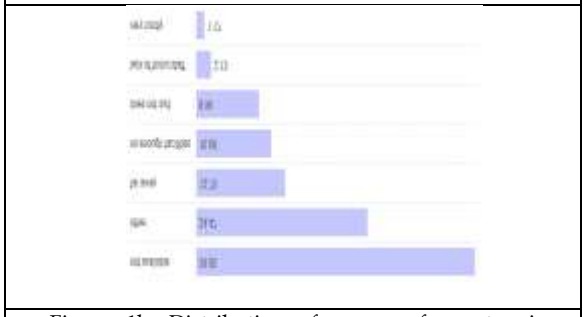

Figure 1b. Distribution of reasons for not using agricultural extension services

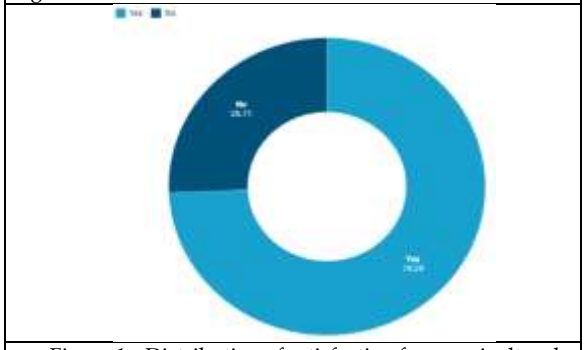

Figure 1c. Distribution of satisfaction from agricultural services

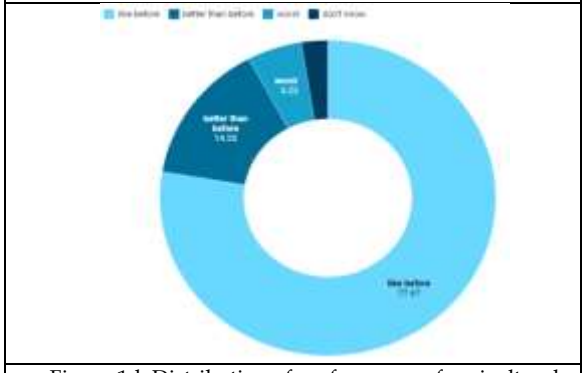

Figure 1d. Distribution of performance of agricultural extension serviCES

In Table 2, we presented the descriptive statistics of the variables used in the study. The sample dataset was grouped into different categories of agriculture extension utilization ('not at all,' 'once in a while,' 'often,' 'always') and satisfaction ('Yes' and 'No'). The mean utilization score of 1.39 suggests a predominant inclination towards minimal or no use of agricultural extension services. However, satisfied individuals are more inclined to frequent use of services, while dissatisfied with the minimal use. Importantly, satisfaction rates demonstrate a clear trend, increasing from 49 percent among those who seldom use the services to 92 percent among those who use them more frequently.

The average age of the individuals is 43 years old, the higher age is patterned with higher use of services. Female respondents make up 11 percent of the sample, 5 out of 100 are satisfied with the services. The average years of schooling are 3.5, while individuals satisfied with services have an average education of 4.3. In terms of access to digital resources, 25 percent of the sample has no digital resources, 66 percent have mobile phones, 0.3 percent have internet access and only 9 percent have both mobile and internet access. Urban respondents constitute 6 percent of the sample. The regional distribution includes 14 percent from KPK, 51 percent from Punjab, 21 percent from Sindh, and 12 percent from Balochistan. When examining utilization, those who do not utilize the services at all, 53 percent from Punjab, 16 percent from KPK, 20 percent from Sindh, and 11 percent from Balochistan.

Regarding the information on the distance from the service, 47 percent of the sample lived more than 5 km away. Among those who always utilize the services, 66 percent responded less than 5 km away, while 34 percent responded more than 5 km away. There are on average 1.08 farmers in the whole sample. This number

remains relatively consistent across different categories of utilization and satisfaction, varying slightly from 1.06 (for those who always utilize) to 1.11 (for those who often utilize). The average log of farm income is 9.26 for the whole sample. Notably, the farm income of respondents not at all use services is less than the respondents who use services more frequently. Likewise, the farm income of respondents satisfied with the services is slightly higher than the respondents dissatisfied with the services.

In the sample, some of the respondents have more than one occupation. For instance, 85 percent of individuals have only a farming occupation, 13 percent have farming second occupation and only 3 percent have farming first and second occupation. For more utilization, this percentage tends to be higher for the individuals who responded to farming's first occupation. Amongst the different types of farming, 51 percent are own cultivators, 20 percent sharecroppers, 8 percent are contract cultivators, and 21 percent responded livestock.

Table 2. Descriptive statistics

Variable	Whole sample	Utilization				Satisfied	
		not at all	once in a while	often	always	Yes	No
	Mean	Mean	Mean	Mean	Mean	Mean	Mean
Utilization	1.39					3.05	2.41
Satisfied	0.74		0.49	0.84	0.92		
Age	42.76	42.62	43.33	43.88	41.86	43.48	42.62
Female (=1)	0.11	0.12	0.03	0.04	0.07	0.05	0.04
Education	3.49	3.35	3.8	4.39	3.64	4.28	3.31
Digital resources:							
None (=1)	0.25	0.27	0.23	0.15	0.16	0.17	0.22
Mobile (=1)	0.66	0.65	0.66	0.72	0.7	0.7	0.69
Internet (=1)	0.003	0.003	0.002	0.003	0.003	0.003	0.002
Both (=1)	0.09	0.08	0.1	0.13	0.13	0.13	0.09
Urban(=1)	0.06	0.06	0.05	0.05	0.06	0.06	0.04
KPK (=1)	0.17	0.16	0.19	0.24	0.05	0.21	0.12
Punjab (=1)	0.51	0.53	0.37	0.53	0.41	0.46	0.42
Sindh (=1)	0.21	0.2	0.24	0.12	0.41	0.25	0.16
Balochistan (=1)	0.12	0.11	0.2	0.11	0.12	0.09	0.3
Distance:							
0-0.5 (km)	0.12		0.09	0.12	0.19	0.14	0.07
0.5-1 (km)	0.09		0.06	0.08	0.16	0.1	0.05
1-2 (km)	0.12		0.07	0.15	0.13	0.13	0.1
2-5 (km)	0.2		0.2	0.21	0.18	0.2	0.19
5+ (km)	0.47		0.58	0.45	0.34	0.43	0.6
No. of farmers in HH	1.08	1.08	1.07	1.11	1.06	1.09	1.06
Ln(farm income)	9.26	9.18	9.51	9.69	9.42	9.57	9.56
Farm work priority:							
Farming first occupation	0.85	0.84	0.85	0.86	0.93	0.86	0.9
Farming second occupation	0.13	0.14	0.12	0.1	0.06	0.1	0.08
Farming first & second occupation	0.03	0.02	0.03	0.04	0.01	0.03	0.02
Farming occupation :							
Own cultivator	0.51	0.47	0.64	0.68	0.61	0.66	0.62
Sharecropper	0.2	0.21	0.2	0.12	0.14	0.14	0.2
Contract cultivator	0.08	0.07	0.09	0.13	0.19	0.14	0.11
Livestock	0.21	0.25	0.07	0.08	0.06	0.07	0.07

Results and Discussion

Utilization of Agricultural Extension Services

We presented the aftermaths of the OLogit model in Table 3. We preferably presented log odds of the OLogit model instead of the marginal effects for each category. The log odds are preferable when interested in the direction and magnitude of the coefficient. The coefficient of the age suggests that a one-year increase in age is associated with a 0.005 increase in the log odds of being in the higher category of the dependent variable. On the flip side, it suggests that an increase in age is associated with a higher likelihood of more frequent use of agricultural services. This finding supports the notion that older farmers, with their experience and better understanding, can potentially extract the

benefits of agricultural services by seeking support and advice.

Being female is linked to lower log odds of being in frequent utilization of extension services than the male counterpart. The infrequent use of extension services highlights the gender gap females encounter due to cultural norms, lack of access to resources and societal fragmentations. Bridging this gap can ensure equitable access to services and support to fully utilize the capabilities of the agricultural female labour force.

The coefficient of education is positive and indicates a higher likelihood of frequent use of services instead of attaining higher education. Educated farmers possess a higher level of self-efficacy which makes them able to have a better understanding and advanced agricultural techniques. Moreover, educated individuals recognized the importance of advisory services and navigated the systems that offer these services.

The role of access to digital resources is inescapable in shaping the utilization of agricultural services. For instance, a farmer having mobile access is associated with 0.286 higher log odds of more frequent use of services than a person without mobile access. Likewise, an individual with access to the internet only or having both mobile and internet keeps higher log odds of more frequent use of services than a person without mobile phone access. Amongst the digital resources, the impact of having access to both mobile and internet has a more profound impact on the utilization of services. These findings highlight that digital resources can bridge information gaps, provide timely updates and facilitate more efficient service delivery which can markedly boost agricultural productivity and service utilization.

Notably, an individual from an urban area is associated with lower log odds of being more frequent use of service as compared to a person from a rural area. Individuals from the KPK, Sindh, and Balochistan have higher log odds of being more frequent users of agricultural extension services than a person from the Punjab. The higher utilization is amongst the individuals from Balochistan. These regional differences can be attributed to differences in agricultural practices, the availability of services, or local policies supporting agricultural extension services.

We presented model 2 with an addition of the number of farmers in the household and farm income as covariates. The coefficient of the OLogit model suggests that an increase in one farmer in the household is associated with 0.212 log-odds of being in the more frequent use of agricultural extension services. A greater number of farmers in a household indicates more labour resources to adopt and implement the recommendations provided by the agricultural extension office more effectively. Moreover, larger farming households might foster a more collaborative environment where information and resources are shared, enhancing overall interaction with the agricultural services office.

The coefficient of farm income suggests that an increase in farm income by one log point is associated with a 0.297 increase in log odds of being in more frequent use of services. The frequent visits to extension services require resources to bear the transaction cost which could be only affordable by the higher farm income individuals. Moreover, higher-income farms may soften the financial constraint of investing financial resources to invest in new technologies and practices recommended by the extension services office.

Compared to those whose second occupation is farming, the individuals whose primary occupation is farming have 0.288 higher log odds of being more frequently used of services. A similar pattern was observed for the individuals who responded to farming as their first and second occupation. These findings highlight the critical role of primary farming engagement in driving frequent interaction with agricultural extension services because full-time farmers are more reliant on and benefit more from these services.

The findings suggest that the own cultivator has 1.224, the sharecropper has 0.438, contract cultivator has 1.605 higher log odds of being more frequent use of services as compared to individuals engaging in livestock. It can be inferred that among different farming occupations, individuals who are engaged in contract cultivation are more inclined to frequent visits to agricultural extension services. This suggests that contract cultivators rely on agricultural services due to the demands of meeting contractual obligations and ensuring crop productivity.

In a nutshell, the findings indicate that an increase in age, education, farm income, as well as access to digital resources such as mobile and internet, significantly contribute to increasing the frequent use of agricultural extension services. On the contrary, being female or even residing in an urban area is associated with lower utilization of services. Moreover, the analysis underscores the importance of farm work priority and farming occupation types in shaping the utilization of services. These insights underscore the multifaceted influences on the usage of agricultural services, with access to digital resources and occupation type playing pivotal roles.

Table 3. Estimates of the OLogit model – log odds

Variables	model 1	model 2	model 3	model 4
Age	0.00545***	0.00284***	0.00268***	-0.000596
	(0.000860)	(0.000871)	(0.000865)	(0.000895)
Female(=1)	-0.823***	-0.568***	-0.623***	-0.243***
	(0.0555)	(0.0561)	(0.0568)	(0.0626)
Education	0.0187***	0.0142***	0.0159***	0.00520*
	(0.00281)	(0.00283)	(0.00284)	(0.00291)
No mobile (base)				
Mobile (=1)	0.286***	0.232***	0.247***	0.139***
	(0.0308)	(0.0309)	(0.0309)	(0.0316)
Internet (=1)	0.423**	0.386*	0.386*	0.318
	(0.207)	(0.203)	(0.204)	(0.215)
Mobile &internet (=1)	0.547***	0.411***	0.444***	0.295***
	(0.0488)	(0.0496)	(0.0498)	(0.0510)
Urban (=1)	-0.182***	-0.241***	-0.244***	-0.236***
	(0.0541)	(0.0551)	(0.0551)	(0.0566)
Punjab (base)				
KPK(=1)	0.265***	0.459***	0.469***	0.365***
	(0.0324)	(0.0328)	(0.0330)	(0.0345)
Sindh	0.284***	0.380***	0.352***	0.565***
	(0.0320)	(0.0319)	(0.0320)	(0.0378)
Balochistan (=1)	0.316***	0.284***	0.262***	0.369***
	(0.0359)	(0.0365)	(0.0365)	(0.0375)
No. of Farmers		0.212***	0.204***	0.276***
		(0.0556)	(0.0557)	(0.0579)
Ln(farm income)		0.297***	0.270***	0.195***
		(0.0115)	(0.0123)	(0.0130)
Farming second occupation (base)				
Farming first occupation			0.288***	0.282***
			(0.0387)	(0.0397)
Farming first & second occupation			0.207***	0.253***
			(0.0760)	(0.0798)
Live stock (base)				
Own cultivator				1.224***
				(0.0458)
Share cropper				0.438***
				(0.0559)
Contract cultivator				1.605***
				(0.0557)
/cut1	1.963***	4.865***	4.862***	4.975***
	(0.0549)	(0.131)	(0.132)	(0.138)
/cut2	2.459***	5.368***	5.366***	5.489***
	(0.0555)	(0.131)	(0.132)	(0.138)
/cut3	3.702***	6.619***	6.617***	6.757***
	(0.0579)	(0.135)	(0.137)	(0.142)
Observations	47,159	47,159	47,159	47,159

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Satisfaction from the Agricultural Extension services

In Table 4, we displayed the outcomes of the Logit mode. We opted to present the log odd of the Logit model rather because log odds are when the focus is on understanding the direction and magnitude of the coefficients. The coefficient of the age suggests that a one-year increase in age is associated with a 0.005 increase in log odds of being satisfied with services. The log odds of being satisfied are statistically insignificant for the female which indicates that there is no difference in the satisfaction across the gender. The coefficient of education is statistically significant is indicates that each additional year of education is associated with a 0.02 increase in log odds of being satisfied with the services. In the context of research, access to a mobile device is associated with an increase of 0.36 in the log-odds of reporting satisfaction, and having both mobile and internet access is associated with an increase of 0.544 in the log-odds of reporting satisfaction, compared to individuals without mobile access.

There is no difference in the log odds of being satisfied for the urban and rural individuals because its coefficient is statistically insignificant. However, the individuals from the KPK and Sindh have 0.55 and 0.29 higher log odds of being satisfied than the individuals from the Punjab. The individuals of Balochistan are less inclined to be satisfied with the services than the individuals from Punjab. Notably, each scale point increase in the distance is associated with 0.27 log odds of being satisfied with the services.

The coefficient for the number of farmers indicates that an increase in farmers in households increases the log odds of being satisfied by a 0.53 scale point. It indicates that with more farmers in the household are more likely to be satisfied with the services. This can be attributed to the practice of shared knowledge and collaborative use of physical and human resources, which can transmit enhanced effectiveness and perceived benefits of the services. The coefficient of the farm income implies that a one-unit increase in the log of farm income is associated with a 0.135 log-odds of being satisfied with the services. Higher-income farms may have better access to resources and be better positioned to implement the advice and practices recommended by the service, leading to higher satisfaction.

The coefficient of farming as a first occupation suggests individuals responded to farming as a primary occupation and people having farming as a first and second occupation are more satisfied with the extension services than the person having farming as a second occupation. Amongst the different categories of farming occupations, the likelihood of being satisfied with extension services did not differ for the own cultivator, contract cultivator, and livestock. However, the sharecropper is less likely to be satisfied with the agricultural extension services. This discrepancy could be due to challenges sharecroppers face including limited access to resources, financial constraints, and possibly less tailored support from the extension services. This highlights the targeted intervention to enhance service satisfaction among sharecroppers.

Table 4. Estimates of the Logit model – log odds

Variables	model 1	model 2	model 3	model 4
Age	0.00504***	0.00509***	0.00519***	0.00451**
	(0.00188)	(0.00193)	(0.00193)	(0.00197)
Female(=1)	0.153	0.171	0.180	0.120
	(0.127)	(0.126)	(0.128)	(0.129)
Education	0.0200***	0.0188***	0.0189***	0.0154**
	(0.00615)	(0.00619)	(0.00622)	(0.00629)
No mobile (base)				

Mobile (=1)	0.359***	0.382***	0.385***	0.372***
	(0.0647)	(0.0645)	(0.0647)	(0.0653)
Internet (=1)	0.671	0.627	0.609	0.609
	(0.487)	(0.495)	(0.503)	(0.513)
Mobile &internet (=1)	0.544***	0.546***	0.559***	0.535***
	(0.103)	(0.103)	(0.104)	(0.104)
Urban (=1)	-0.0108	-0.0516	-0.0592	-0.0635
	(0.122)	(0.123)	(0.123)	(0.123)
Punjab (base)				
KPK(=1)	0.550***	0.689***	0.698***	0.705***
	(0.0768)	(0.0816)	(0.0821)	(0.0822)
Sindh	0.298***	0.437***	0.453***	0.588***
	(0.0710)	(0.0744)	(0.0752)	(0.0793)
Balochistan (=1)	-1.198***	-1.120***	-1.100***	-1.068***
	(0.0704)	(0.0703)	(0.0712)	(0.0716)
Distance	-0.266***	-0.280***	-0.283***	-0.278***
	(0.0208)	(0.0215)	(0.0216)	(0.0222)
No. of Farmers		0.533***	0.541***	0.521***
		(0.151)	(0.152)	(0.156)
Ln(farm income)		0.135***	0.126***	0.115***
		(0.0289)	(0.0303)	(0.0308)
Farming second occupation (base)				
Farming first occupation			0.00538	0.0274
			(0.0926)	(0.0932)
Farming first & second occupation			0.603***	0.614***
			(0.196)	(0.198)
Live stock (base)				
Own cultivator				-0.0185
				(0.103)
Share cropper				-0.456***
				(0.115)
Contract cultivator				-0.00101
				(0.121)
Constant	1.553***	-0.332	-0.276	-0.0803
	(0.149)	(0.334)	(0.335)	(0.348)
Observations	9,816	9,816	9,816	9,816

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Conclusion

This study empirically examines the impact of factors affecting the use and satisfaction of agricultural extension services in Pakistan. Regarding the utilization, the aftermaths of the OLogit model depict that an older person, higher education, higher farm income, and access to digital resources, significantly contribute to increasing the frequent use of agricultural extension services. On the other hand, females, residents of urban areas are less inclined to frequent use of extension services. Furthermore, the empirical analysis suggests that farm work priority and the nature of the farming occupation undertaken by the individual is shaping the utilization of services.

Regarding the satisfaction perceived by individuals from the use of extension services, the estimates of the Logit model suggest that certain demographic and socio-economic variables positively contribute to the satisfaction from extension services. Among these factors, are individuals from older cohorts, higher education, and access to digital resources, residents of less deprived regions, and engagement in farming as a primary occupation. On the other hand, covariates such as being female or residing in urban areas do not significantly enhance the probability of being satisfied with the services.

The implications based on the findings of the study suggest that enhancing education through targeted education programs with a focus on formal education and agricultural training could not only elevate the utilization but also contribute towards the satisfaction from the extension services. Digital resources play a vital role in shaping the use and satisfaction of the services, so developing the digital infrastructure and providing wider access to mobile and the internet is relevant. Moreover, digital literacy programs can also help farmers effectively utilize mobile and internet resources for agricultural purposes. Deprived provinces like Balochistan are highly utilizing the extension services but depict lower satisfaction which needs to be uplifted. For this purpose, it requires tailored support programs, better access to resources, and culturally sensitive training sessions. The sharecropper is less satisfied with the use of

extension services, possibly due to a lack of resources and financial constraints. The specialized support programs in required to increase their satisfaction. The distance to extension services lowers the satisfaction which requires the establishment of more local extension services centers to reduce the distance farmers need to travel. In this regard, mobile extension units could be deployed to reach remote areas with the aim of inclusive use of extension services.

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