Impact of Socio-Economic Characteristics of the Livestock Farmers on the Usefulness of Governmental Services in Punjab (Pakistan)

Muhammad Saleem[1], Shoukat Ali[2], Ahmad Shah Shinwari[3], Muhmmad Iftikhar[4], Salman Asghar[5], Aimal Kakar[6], Muhammad Asghar[7], Muhammad Shoaib[8], Shafiq Ur Rehman Zia[9], Zain Ul Abdeen[10] and Shazia Batool[11]

Abstract

Pakistan is prosperous in animals, and their potential is unmatched worldwide in population and production. Despite the vast livestock population, a handsome amount is spent on importing livestock products and byproducts to meet the needs of the people. The reason might be the low potential of livestock or the poor management practices. Management practices are usually linked with the provision of livestock extension services. Keeping in view this, the present study was designed in the Faisalabad (Purposively selected) district of Punjab-province which has a maximum number of registered farmers (194758) by the Livestock and Dairy Development Department (L & DD). It also has a vast population of cows (534499), buffaloes (999087), goats (528203), and sheep (87691). The sample size was calculated using the online sample size calculator from surveymonkey website which was 383 farmers. Three hundred eighty-three farmers chosen through multistage random sampling were interviewed face-to-face on a structured schedule. Binary logistics regression was applied to the data to explore the impact of different socioeconomic attributes on the awareness and usefulness of the services. Results (P-Value) indicated that age, education, land size, milking method, income sources, and the number of cattle had a statistically significant relationship with awareness. Education, land size, milking method, and the number of cattle had a statistically significant association with usefulness. Training programs for the farmers and synergistic working of public and private livestock sectors can persuade farmers to be and improve the use of the provided services.

Keywords: Education, Awareness, Usefulness, Livestock Services, Milking Method.

Introduction

Pakistan is recognized as an agricultural nation, dominating various facets of the agriculture sector. Livestock is documented as the most promising area of agriculture with tremendous potential to flourish. In fiscal 2021-22, the livestock sector contributed 61.9% to total agriculture and 14% to Pakistan's national GDP. Over 8 million people in Pakistan, especially in rural areas, are directly

[1]*Institute of Agricultural Extension Education and Rural Development, University of Agriculture Faisalabad. Email: saleemshykh@gmail.com*
[2]*Institute of Agricultural Extension Education and Rural Development, University of Agriculture Faisalabad.*
[3]*Department of Agricultural Economics and Extension, Nangarhar University, Jalalabad, Nangarhar, Afghanistan*
[4]*Institute of Agricultural Extension Education and Rural Development, University of Agriculture Faisalabad.*
[5]*Institute of Agricultural Extension Education and Rural Development, University of Agriculture Faisalabad.*
[6]*Department of Agricultural Education and Extension, Sindh Agriculture University, Tandojam*
[7]*Institute of Agricultural Extension Education and Rural Development, University of Agriculture Faisalabad.*
[8]*Institute of Agricultural Extension Education and Rural Development, University of Agriculture Faisalabad.*
[9]*Institute of Agricultural Extension Education and Rural Development, University of Agriculture Faisalabad.*
[10]*Institute of Horticultural Sciences, University of Agriculture, Faisalabad*
[11]*Department of Plant Breeding and Genetics, Bahauddin Zakriya University, Multan*

engaged in livestock management and production, earning around 40% of their income. Animal husbandry is a vibrant economic activity for rural dwellers in Pakistan. In 2022, the livestock sector witnessed a 3.26% increase in its gross value, reaching 5,441 billion compared to the previous year's value of 5,269 billion (Government of Pakistan, 2022).

Pakistan's diverse culture and fascinating topography allow for livestock management nationwide. Livestock is managed under different traditional and modern production systems. Among the four provinces—Punjab, Khyber Pakhtunkhwa, Sindh, and Baluchistan—Punjab is considered the densest regarding livestock population and production potential. However, livestock production in Punjab is reported as lower than its potential for various reasons. Jalil et al. (2009) identified key constraints, including a lack of training, inadequate dairy-related education, high transportation costs, mismanagement in milk distribution, and poor marketing in the livestock production sector. Awan et al. (2021) found that inadequate training, poor access to loans, and high veterinary service costs were significant constraints in the livestock production system. The Government of Punjab has established a specialized department to address these challenges and assist farmers.

The Punjab government initiated the Mobile Veterinary Dispensaries (MVDs) project to provide livestock services directly to farmers on their doorstep. In addition, Veterinary Officers and Veterinary Assistants throughout Punjab have been equipped with motorbikes to address emergencies. At the same time, mobile vans have been allocated to all Tehsil Headquarters Hospitals to ensure quality service delivery in the field (Govt. of Punjab, 2018e).

The department has implemented an automated Robo call system featuring prescheduled voice messages and guidance for the targeted audience. Robocalls are particularly useful for illiterate farmers who may not receive alerts through the SMS alert service. This service aims to inform farmers about departmental initiatives and campaigns and alert them about any disease outbreaks, among other relevant information. All Robocalls are operated through the shortcode 9211. Short Message Services (SMS) utilize standardized communication protocols for information dissemination by the department to the targeted audience (Govt. of Punjab, 2020).

Virtual Governance (9211) was introduced in 2014. This system is also utilized for record-keeping, allowing every department activity to be documented and accessed at any time. It records details such as the availability and quantity of vaccines in a specific area, the type of work performed by individuals, the names and numbers of farmers in a particular area, and the number of animals they own.

The Virtual Governance system is an ICT-based system specifically designed to efficiently transfer extensive data through mobile apps controlled by the staff. Under this system, all villages (25,892) in Punjab are codified, and a comprehensive database of 7.4 million farmers and their animals in Punjab has been established (Govt. of Punjab, 2018e).

Extension Services Delivery and Socioeconomic Attributes

Extension services provide farmers with timely and relevant information, assisting them in addressing agricultural challenges and making more informed decisions in their farming practices (Kassem et al., 2021).

Various demographic and economic factors, such as age, education, religious affiliation, occupation, income, firm size, and type of enterprise, influence farmers' awareness and technology adoption (Ansah et al., 2015). Higher-income farmers are generally more adept at adopting advanced technologies due to their elevated financial risk tolerance. The successful adoption of technology is influenced by factors like the technology's attributes, characteristics of adopters, the

role of change agents (such as extension workers), and the socioeconomic, biological, and physical environment in which the technology is implemented (Kinnucan et al., 1990).

A positive correlation was identified between farmers' experience levels and technology adoption. Farmers with extensive experience are more inclined to adopt dairy technology, mainly because of their access to comprehensive information through various channels (Abdullahi & Bichi, 2019). A study in Ghana revealed that technology adoption by farmers depends on socioeconomic attributes, including farm size, expected benefits, access to credit facilities, and extension services (Akudugu et al., 2012).

Livestock sector development is crucial for economic growth, requiring good management practices and access to information sources. An essential aspect is a demand-driven extension approach, but insufficient extension services contribute to low livestock production and farmers' reluctance to adopt improved technologies. Well-trained personnel providing extension services are imperative for unlocking the full potential of the livestock industry and improving production outcomes (Idrees et al., 2007).

Elderly farmers show more interest in extension activities than younger farmers, likely due to a higher sense of responsibility in this age group (Luqman et al., 2014). Women have less access to livestock extension services than male farmers, primarily because household heads are often male farmers. This gender disparity affects the efficiency of female farmers in utilizing livestock services (Zahoor et al., 2013). Rural women's participation in extension activities is linked to farm size, emphasizing the need to ensure the involvement of every farmer without discrimination (Mihiret & Tadesse, 2014).

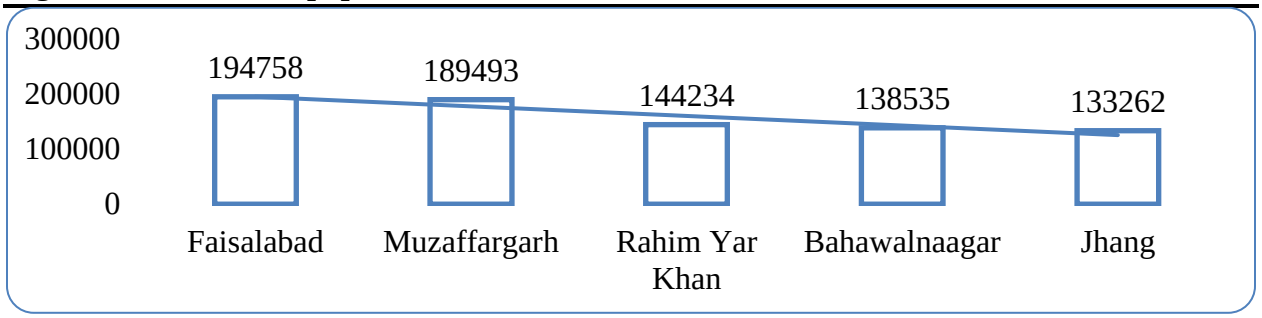
Objectives of the study

1. To identify the socioeconomic attributes of the respondents
2. To find out the Impact of socioeconomic attributes on awareness among farmers about livestock services
3. To identify the Relationship between the socioeconomic characteristics of farmers and the usefulness of services.

Methodology

Study area: Pakistan comprises four provinces: Punjab, Sindh, Baluchistan, and Khyber Pakhtunkhwa. The country is rich in animal resources, with Punjab leading in livestock population (Awan, 2021). Punjab is divided into thirty-six districts, and the Faisalabad district was purposively selected for this study. According to the Livestock Population Census 2017, Faisalabad district has the highest number of registered livestock farmers, as reported by the Livestock and Dairy Development Department (Figure 1). Five hundred thirty-four thousand four hundred ninety-nine cows, 999,087 buffaloes, 528,203 goats, and 87,691 sheep are reported in this district. The district has 40 Civil Veterinary Hospitals, 50 Civil Veterinary Dispensaries, 3 Mobile Veterinary Dispensaries, and 2 Disease Diagnostic Labs (Government of Punjab, 2020).

Figure 1 District wise population of livestock



Source: Government of Punjab, 2017.

Population of the Study

The population of the study comprised all farmers (194,758) residing in the study area.

Sample Size Calculation

The sample size for the study was determined using the online sample size calculator www.surveymonkey.com. When calculating the sample size for the population (194,758), a confidence level of 95% and a margin of error of 5% were considered. The calculated sample size was 383.

Sampling Method

A multistage sampling method was employed to select respondents. In the first stage, the study district was purposively chosen, as it has 194,758 registered farmers, who constituted the population of the study. In the second stage, the sample size of 383 was determined through the online sample size calculator at www.surveysystem.com. In the third stage, respondents were selected using a stratified proportionate sampling technique from the five tehsils (sub-districts) of the study district. Through proportionate sampling, 109, 71, 75, 25, and 102 farmers were selected from the tehsils Faisalabad, Samundri, Tandlianwala, Jaranwala, and Jhumra, respectively (Table 1).

Table 1 Selection of sample from the five tehsils of district Faisalabad

Name of tehsil	Registered farmers	Proportionate sample
Faisalabad	55431	109
Samundri	36203	71
Tandlianwala	38344	75
Jaranwala	12909	25
Jhumra	51871	102
Total	194758	383

Data Collection and Analysis

An interview schedule was prepared to collect data from the selected respondents. The reliability of the interview schedule was tested using Cronbach's Alpha, and the obtained value was 0.69, which is an accepted value for alpha, as suggested by van Griethuijsen et al. (2014). Data were collected through face-to-face interviews. The collected data were analyzed using the Statistical Package for Social Sciences (SPSS). Frequencies and percentages were calculated, and binary logistic regression was also employed.

Research Design

The study utilized a cross-sectional research design. This design involves examining data from a population at a specific point in time, and it does not involve manipulating variables.

Logit Regression Model

The binary logistic regression method has been used in different agricultural extension, and economics studies to explore the impact of independent variables on the dependent variables and the prediction of a dichotomous outcome such as usefulness or not useful. Binary logistic regression requires the dependent variable to be converted into a dichotomous binary variable coded 0 and 1. For this study the logistic model is developed as follows:

The logit equation based on Greene, (1993) is written as

$$\Pr(Y = 1) = \frac{e^{\beta' x}}{1+e^{\beta' x}} \quad \text{……… (1)}$$

With the cumulative distribution function given by

$$F(\beta' x) = \frac{1}{1+e^{\beta' x}} \quad \text{……….(2)}$$

The cumulative logistic distribution function (Eq 2) is expressed as (after Adunni and Doppler, 2007):

$$p = \frac{1}{1+e^{-z}} \quad \text{……... (3)}$$

If p_i is the probability of awareness and usefulness of services then the probability otherwise is 1-p_i, which in logistic function can be expressed as

$$1-p_i = 1-\frac{1}{1+e^{-z}} \quad \text{……… (4)}$$

$$= \frac{1}{1+e^{-z}} \quad \text{……… (5)}$$

The ratio of Eq 4 and 5 will give the odd ratio

$$\frac{p_i}{1-p_i} = \frac{1+e^{-z}}{1+e^{z}} \quad \text{……….(6)}$$

$$\frac{p_i}{1-p_i} = e^{z} \quad \text{……... (7)}$$

Equation 7 is the odd ratio in favor of awareness and usefulness. It is the ratio that a respondent has the rate of awareness and usefulness to the probability of otherwise

Taking the natural log of both sides of Eq 7

$$L_i = ln\frac{p_i}{1-p_i} = z \quad \text{……… (8)}$$

L_i = the log odds ratio, which is also referred to as the logit

$$z = \beta_0 + \beta_1 x_1 - \beta_2 x_2 + \beta_3 x_3 + \dots\dots\dots\dots + \beta_k x_k + \mu \quad \text{……… (9)}$$

Where,

x_i = the household-specific indicators hypothesized to various socio-economic attributes

β_i = vector of parameters to be estimated using the maximum likelihood method

β_0= constant term

μ = error term which is normally distributed with zero mean and variance

$\delta^2 = \frac{1}{N_i\, p_i\, (1-p_i)}$ ……..… (10)

N_i = Number of observations

Although z is a linear combination of variables that have both upper and lower bounds, no bounds can be assigned to the variable z itself, as values assumed by z will depend on the values of the unknown parameters β_i s also. In other to obtain the values of z, the likelihood of observing the sample was formed by introducing a dichotomous variable Y_i such that $Y_i = 1$ and $Y_i = 0$ if otherwise.

Factors influencing awareness and usefulness

$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \ldots + \beta_kX_k + U$……..…… (11)

Where,

Y = Logit for awareness/usefulness = Logit (p)

β_0 = Constant

$\beta_1, \beta_2, \ldots\beta_k$ = the regression coefficients which interpret the effect of X on Y

$X_1, X_2 \ldots X_k$ = independent variables

K = number of independent variables

P = probability of presence of characteristic of interest

U = Stochastic error

The considered as independent variables are:

X_1 = Age (years)

X_2 = Education

X_3 = Family size (number)

X_4= land size (acres)

X_4 = income sources

X_5 = number of cattle (Number)

X_6 = milking method

X_7= access to public sector extension

X_8= access to private sector extension

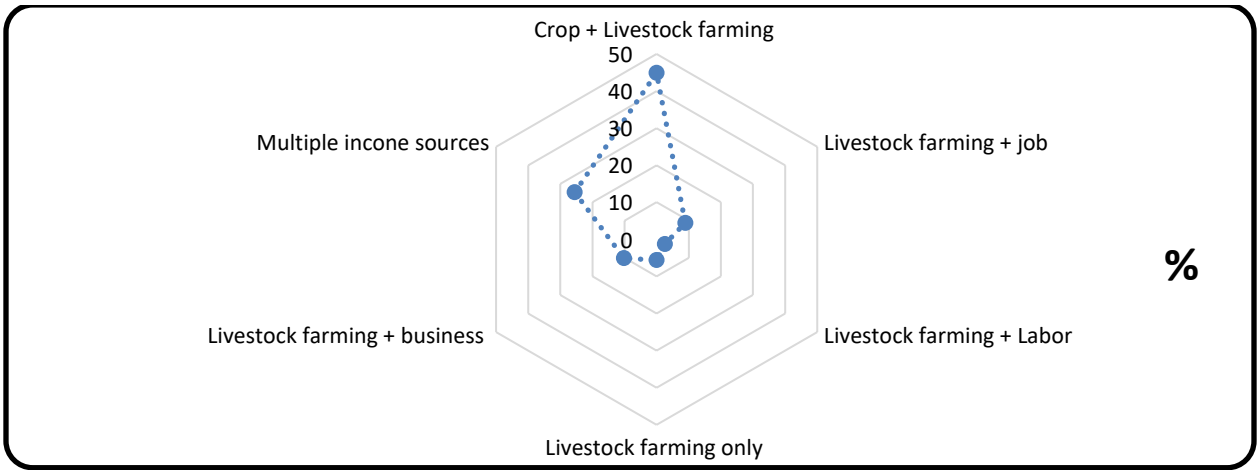
X_9= tenancy status

Results of the study

Sources of Income

Figure 2 indicates that 44.9% of the farmers rely on both crop farming and livestock farming for income generation. This level of reliance highlights the high potential of integrated crop and livestock farming in the study area. Among the respondents, only 5.6% of the farmers solely depend on livestock for income generation. This underscores the importance of integrating livestock with crop farming to enhance profitability in the study area. These findings align with those of Wan et al. (2016), who observed that farmers diversifying their income sources experienced increased income, stable livelihoods, and greater opportunities to adopt innovations to cope with challenges.

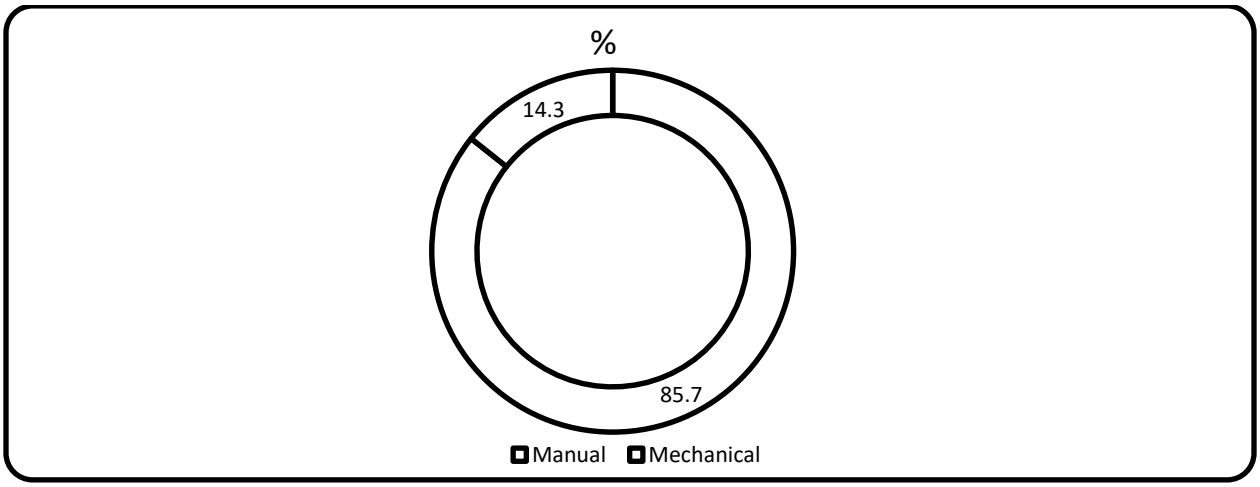
Figure 2 Distribution of different income sources in the study area



Milking Methods

The milking method demonstrated a statistically significant association with awareness ($P < 0.05$). Through the adoption of different milking techniques, there was a likely 1.696% increase in awareness among farmers. In the study area, 85.7% of respondents adopted manual milking, while 14.3% adopted the mechanical milking technique (Figure 3). Information needs may vary among farmers based on their milking technique. Farmers adopting mechanical milking may require more awareness regarding its technical understanding, use, efficacy, potential side effects on animals' health, and government subsidies on milking machines. Similarly, farmers using manual milking may have information needs related to safe milking practices and maintaining their health. This is emphasized by the significant association between the milking method and awareness.

Figure 3 Milking methods preferred by the livestock farmers



Impact of socio-economic attributes on awareness among farmers about livestock services

The relationship between socio-economic attributes and awareness of services was explored through binary regression analysis. The results indicated that age, education, land size, milking method, income sources, and the number of cattle had a statistically significant relationship with awareness ($P < 0.05$), whereas tenancy and extension contact had an insignificant relationship ($P > 0.05$) (Table 3).

Table 2 Relationship between characteristics of farmers with the awareness of services

	B	S.E.	Wald	df	Odds Ratio
Constant	.644	.637	1.022	1	1.904
Age (Years)			1.781	2	
< 30	.031	.310	.010	1	1.032*
>30	-.291	.284	1.053	1	.747
Education			.064	2	
Illiterate	-.026	.312	.007	1	.974
Literate	.051	.261	.038	1	1.052**
Land (acres)			5.330	3	
<5	.196	.378	.269	1	1.217
6-10	-.419	.544	.593	1	.658
>10	1.010	.644	2.459	1	2.745**
Tenancy			2.462	2	
Owners	.374	.390	.919	1	1.453
Tenants	-.339	.291	1.356	1	.713
Income sources			11.065	5	
Crop + Livestock farming	.883	.466	3.600	1	2.419**
Livestock farming + job	.305	.750	.165	1	1.357
Livestock farming + Labor	-.356	.482	.546	1	.700
Livestock farming only	-.377	.427	.779	1	.686
Livestock farming + business	-.771	.344	5.027	1	.463
Milking method	.528	.359	2.161	1	1.696*
No. of cattle			1.300	3	
1-5	.070	.288	.059	1	1.072*
6-10	-.304	.858	.126	1	.738
>10	-1.318	1.265	1.086	1	.268
Extension contacts					
Access to public sector extension	-.204	.240	.718	1	.816
Access to private sector extension	-.030	.413	.005	1	.971

Table 2 illustrates the relationship between awareness of various services provided by the Livestock and Dairy Development (L&DD) and different attributes of the farmers. The results indicate that the age group less than 30 years had a statistically significant relationship ($P < 0.05$) with the dependent variable awareness. This suggests that young farmers, aged less than 30 years, had a more substantial impact on awareness compared to those aged over 30 years ($P < 0.05$). The odds ratio (1.032) confirms that young farmers may have 1.032 times more awareness than those aged over 30 years. This suggests that young farmers were more aware and inclined to take risks,

making timely decisions to familiarize themselves with new technologies. Research by Tauer (1995) found a significant decrease in farm productivity with farmers exceeding 45 years of age, indicating that younger farmers were more active in adopting management practices.

Education of the respondents was highly statistically significant with awareness (P = 0.000), and the odds ratio (1.052) indicates that educated farmers had a more significant impact on awareness compared to uneducated farmers. Literate farmers were likely to have 1.052 times more awareness than illiterate farmers, suggesting that an increase in farmers' education is associated with higher awareness. Educated farmers, especially those with more schooling years, may have higher awareness due to their inclination towards modern information technology and better access to livestock extension services. Illiteracy had a non-significant association with awareness (P > 0.05), but the inverse relationship implies that increasing illiteracy will have an adverse impact.

The tenancy status of respondents had an insignificant relationship with awareness (P > 0.05). The sub-categories of tenancy, owners, and tenants both were insignificant with positive and negative relationships, respectively. Being an owner of the land may increase awareness in particular circumstances.

In developing countries, farmers engage in off-farm income sources along with on-farm income sources (Wan et al., 2016). The income sources of the farmers had a highly statistically significant relationship with awareness of the services (P = 0.000). Among the different income source categories, crop farming + livestock farming was statistically significant and had more impact on awareness compared to other relevant categories. Farmers relying on crop and livestock farming for their income had 2.419 times (odds ratio) more awareness, emphasizing that crop farming and livestock farming were profitable income sources in the study area compared to other sources like laboring, business, and jobs.

Cattle are a significant part of the livestock system for various reasons, especially high profitability through milk, meat, and other by-products. The number of cattle in the herd had different impacts on awareness. The category 1-5 animals had a statistically significant relationship (P < 0.05) with awareness. The odds ratio (1.072) indicated that farmers with 1-5 animals were likely to have more awareness compared to those having 6-10 and more than 10 cattle. Farmers with 1-5 animals had 1.072 times more awareness than other farmers, suggesting that small farmers were more concerned with animal production and focused on their cattle and associated information. Additionally, small farmers often rely on government-led facilities that are mostly free or subsidized, increasing their awareness of various services. On the other hand, farmers with a large number of animals may have adequate financial stability and can afford private services.

Impact of Socio-economic Attributes on Awareness Among Farmers

The relationship between socio-economic attributes and the usefulness of services was explored through binary regression analysis. The results indicated that education, land size, milking method, and the number of cattle had a statistically significant relationship with usefulness (P < 0.05), whereas the age of farmers, tenancy, income sources, and extension contact had an insignificant relationship (P > 0.05) (Table 3).

Table 3 Relationship between characteristics of farmers with the usefulness of services

	B	S.E.	Wald	df	Odds Ratio
Constant	.644	.637	1.022	1	1.904
Age (Years)			1.781	2	
< 30	.031	.310	.010	1	1.032
>30	-.291	.284	1.053	1	.747
Education			.064	2	
Literate	.051	.261	.038	1	1.052**
Illiterate	-.026	.312	.007	1	.974
Land (acres)			5.330	3	
<5	.196	.378	.269	1	1.217
6-10	-.419	.544	.593	1	.658
>10	1.010	.644	2.459	1	2.745*
Tenancy			2.462	2	
Owners	.374	.390	.919	1	1.453
Tenants	-.339	.291	1.356	1	.713
Income sources			11.065	5	
Crop + Livestock farming	.883	.466	3.600	1	2.419
Livestock farming + job	.305	.750	.165	1	1.357
Livestock farming + Labor	-.356	.482	.546	1	.700
Livestock farming only	-.377	.427	.779	1	.686
Livestock farming + business	-.771	.344	5.027	1	.463
Milking method	.528	.359	2.161	1	1.696*
No. of cattle			1.300	3	
1-5	.070	.288	.059	1	1.072*
6-10	-.304	.858	.126	1	.738
>10	-1.318	1.265	1.086	1	.268
Access to public sector extension	-.204	.240	.718	1	.816
Access to private-sector extension	-.030	.413	.005	1	.971

The age of the participating farmers was statistically non-significantly related to the usefulness of the services (P > 0.05). This implies that irrespective of age categories, the rate of the usefulness of the provided services was almost the same. However, among farmers with ages more than 30 years, the usefulness was likely to decrease. Although the association is insignificant, there was a difference in the odds ratio of the less than 30 (Odds: 1.032) and more than 30 years (Odds: 0.747) age group farmers.

Education had a highly statistically significant relationship with the usefulness of services (P = 0.000). The odds ratio of 1.052 confirms that literacy had more impact on the usefulness than illiteracy. With the unit increase in the educational level, there was likely 1.032 times more usefulness of services. To expedite the usefulness, it is imperative to transform illiteracy into literacy.

Regarding land size, farmers with large land sizes (>10 acres) had more usefulness of the services (Odds: 2.745) compared to farmers with less than 5 and between 6-10 acres of land. Land size and usefulness were statistically significantly related (P < 0.05). The odds ratio suggests that among

farmers with more than 10 acres of land, there was 2.746 times more usefulness of the services. Large farmers were more concerned with the usefulness of services, and their strong financial capabilities and access to different information sources might have triggered the rate of usefulness among farmers.

The tenancy status of respondents had an insignificant relationship with the usefulness of services ($P > 0.05$). The sub-categories of tenancy, owners, and tenants both were insignificant with positive and negative relationships, respectively. Being an owner of the land may increase usefulness in particular circumstances.

As Wan et al. (2016) reported, farmers in developing countries mostly engage themselves in off-farm income sources to earn more income. Similarly, in the study area, farmers rely on multiple income sources. Although the relationship between income sources and usefulness was non-significant ($P > 0.05$). None of the income source groups i.e. crop farming + livestock, livestock farming + Job, Livestock farming+ business, Livestock farming only, and multiple sources had a statistically significant relationship with usefulness. This can be deduced that the usefulness of the services was not dependent on any particular income source but on the technical understanding and adaptability of the farmers.

Within the milking methods, manual and mechanical milking were in practice among farmers. Milking methods had a statistically significant relationship with the usefulness of services ($P < 0.05$). During milking, the health of animals remains a serious concern; therefore, the usefulness of services was likely to increase with any change in milking methods. Silvi et al. (2021) reported that the automatic milk meter system was perceived as highly useful by the farmers. This indicates that usefulness is associated with modern technologies that can assist farmers.

The number of cattle had a statistically significant relationship with the usefulness of services ($P < 0.05$). Farmers having 1-5 cattle had 1.072 times more usefulness of the services provided by the livestock department. This suggests that, for small farmers with 1-5 animals, the disseminated awareness and usefulness were a great matter of concern. They had neither the affordability of private services, thus the services provided to the farmers free of cost or at subsidized rates were found more useful.

Access to public sector extension and private sector extension had an insignificant association with the usefulness of services ($P > 0.05$). This indicates that public and private sector extensions failed in promoting the usefulness of services. There is also a possibility that farmers may have more contact with traditional information sources.

Conclusion

The livestock sector is crucial for the economic development of livestock farmers. Strengthening the livestock sector is indispensable for the growth of farmers in Pakistan. This study highlights that the Punjab province is well-versed in Livestock and Dairy Development (LD & DD)-led extension services. It emphasizes that awareness among farmers and the usefulness of the disseminated information are of great value to farmers. The study reveals that awareness and usefulness of services are directly associated with the socio-economic position of the farmers. Age, education, land size, milking method, income sources, and the number of cattle had a statistically significant relationship with awareness. Similarly, education, land size, milking method, and the number of cattle had a statistically significant relationship with usefulness. This underscores the importance of improving the socio-economic status of farmers to enhance awareness and the practical application of provided services.

Recommendations

Livestock and Dairy Development Department should

1. Implement structured training programs for farmers.
2. Raise awareness about the livestock extension sector through targeted campaigns.
3. Facilitate collaboration between public and private sector extension staff.
4. Utilize modern communication tools like social media and ICT for farmer awareness.
5. Combine traditional and modern communication methods for effective outreach.
6. Monitor and evaluate programs to ensure their impact and relevance.
7. Provide financial support or incentives for farmers participating in training.
8. Ensure the participation of every farmer in extension activities without discrimination.

Implementing these recommendations can enhance livestock farming practices and promote sustainable development.

References

- Abdullahi, A., & Bichi, J. M. (2019). Effects Of Socio-Economic Characteristics of Pastoralists In Enhancing Technological Innovation For Livestock Production In Kachia And Bobi Grazing Reserves, Nigeria. *Journal of Agripreneurship and Sustainable Development, 2*(2), 59-69.
- Akudugu, M. A., Guo, E., & Dadzie, S. K. (2012). Adoption of modern agricultural production technologies by farm households in Ghana: What factors influence their decisions. *Journal of Biology, Agriculture and Healthcare, 2*(3).
- Ansah, I. G. K., Eib, D., & Amoako, R. (2015). Socioeconomic determinants of livestock production technology adoption in northern Ghana. *Asian Journal of Agricultural Extension, Economics & Sociology, 5*(3).
- Awan, Z.A., Akhtar, K., Khan, L.A., Imran, A.U. (2021) Women's participation and their constraints in livestock management activities: A case study of district Bahawalpur in Punjab, Pakistan. *Int J Vet Sci Res, 7*(2), 083-087. DOI: 10.17352/ijvsr.000085
- *Economic Survey of Pakistan, (*2022). Government of Pakistan. Finance Divisions Islamabad, Pakistan.
- Idrees, M., Mahmood, Z., Hussain, D., Shafi, M., & Sidique, U. (2007). General problems regarding extension services with livestock and dairy farmers of Peshawar District, Pakistan. *Sarhad journal of agriculture, 23*(2), 527.
- Jalil, H., Rehman, H. U., Sial, M. H., & Hussain, S. S. (2009). Analysis of milk production system in peri-urban areas of Lahore (Pakistan): A case study. *Pakistan Economic and Social Review*, 229-242.
- Kassem, H. S., Alotaibi, B. A., Muddassir, M., & Herab, A. (2021). Factors influencing farmers' satisfaction with the quality of agricultural extension services. *Evaluation and Program Planning, 85*, 101912.
- Kinnucan, H., Hatch, U., Molnar, J. J., & Venkateswaran, M. (1990). Scale neutrality of bovine somatotropin: Ex ante evidence from the Southeast. *Journal of Agricultural and Applied Economics, 22*(2), 1-12.
- *Livestock and Dairy Development Department*, (2020). Government of Punjab. District Profile Detail. Available at: https://livestock.punjab.gov.pk/.

- Luqman, M., Shahbaz, B., Ali, S., Butt, T. M., & Ashraf, S. (2014). Rural women's involvement and their constraints in accessing livestock extension services in district Faisalabad-Pakistan. *Glob. Vet*, *12*(4), 550-556.
- Mihiret, M., & Tadesse, A. (2014). Women's role and their decision making in livestock and household management. *Journal of Agricultural Extension and Rural Development*, *6*(11), 347-353.
- Silvi, R., Pereira, L. G. R., Paiva, C. A. V., Tomich, T. R., Teixeira, V. A., Sacramento, J. P., & Dórea, J. R. R. (2021). Adoption of Precision Technologies by Brazilian Dairy Farms: The Farmer's Perception. *Animals*, *11*(12), 3488.
- *Virtual Governance System* (2018)e. Government of Punjab. Virtual Governance System. Livestock and Dairy Development Department. Available at: http://www.livestockpunjab.gov.pk/page/pages/9211virtual governance.
- Wan, J., Li, R., Wang, W., Liu, Z., & Chen, B. (2016). Income diversification: A strategy for rural region risk management. *Sustainability*, *8*(10), 1064.
- Zahoor, A., Fakher, A., Ali, S., & Sarwar, F. (2013). Participation of rural women in crop and livestock activities: a case study of tehsil Tounsa Sharif of southern Punjab (Pakistan). *Int. J. Adv. Res. Manage. Soc. Sci*, *2*(12), 98-121.