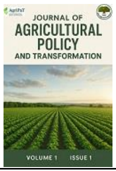

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Climate Change Adaptation and Farmers' Resilience in Pakistan

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ABSTRACT

To avoid the hazardous impact of climate change in agriculture sector particularly small farm holder, the adaptation to climate change requires time. The degree of adaptive responses has been slow among the famers since they have low adaptive capacities in developing countries like Pakistan owing to their ignorance. Thus, the purpose of study is to determine the awareness degree of the farmers, to examine the factors that impact the adaptive to climate change. Moreover, the type of the study is cross-sectional and 280 farmers data is gathered with the assistance of well-developed questionnaire on the basis of former researches. Multistage method is applied in collecting data in district Vehari. To carry out the data analysis, binary logit model and odd ration model is used in finding out the factors contributing to the adaptive capacity of climate change. In the foundation of the analysis of data presented in this paper, it is stated that climate adaptation to the climate change is talkative with the growth of information resources: technology can make agriculture too efficient and the climate change awareness. The facts presented in the current study are borne out by facts that indicate the need to award credits and finance long term, agricultural technologies that will hasten the ACC and in the short-term information on climate should be disseminated among the agricultural circles.

1. Introduction

Climate change has become one of the most burning issues in the world in the 21 st century with agriculture being the most susceptible one, especially in the developing nations like Pakistan. Pakistan was one of the top 10 nations which were the most affected by extreme weather events in the previous 20 years. Floods, droughts, heat waves, and inconsistent rain patterns have had a critical effect on the agricultural productivity and livelihoods in the country (Adil et al., 2025).

Pakistan has a GDP of approximately 23.54 that is contributed by agriculture and around 37 percent of the labor force is employed by agriculture (GOP, 2025). The industry however is highly climate-vulcanized since a majority of the arable land relies on the Indus Basin irrigation which is itself facing the risk of glacial melt, water deficiency and unreliable monsoon seasons. Research estimates the percentage of climate change decreases in major crop yields in Pakistan of 8-10 percent in wheat and 15-20 percent in rice without proper adaptive actions by 2050 (FAO, 2022).

The farmers are the first line of climate change victimization, and the way they can adapt to this depends on their climate change awareness and adaptive capacity (AC). Adaptive capacity defines the human, financial, physical, social and natural resources that help farmers to cope with changes in climate. However, in Pakistan, the smallholder farmers who comprise about 80 percent of the farming society frequently experience shortage of resource, inability to access technology, low quality of the extension, and lack of institutional support.

Awareness of climate change is also of great importance. In a national survey of Ali and Erenstein (2017), fifty percent of farmers in Punjab had even heard of climate change, and among those who have, only 36 percent could link climate change to making a modification to the way they live their agricultural lives. The implication of such poor knowledge is that it takes a long time before there is awareness about how to adapt to the changes, such as the planting date, change of crops, use of water, and diversification of crops and livestock.

This study is therefore highly important as it seeks to examine how farmers awareness and adaptive capability can help Pakistan to adapt to climate change. Understanding these factors better can not only provide insights into what prevents adaptation, but it can also inform policy makers of the need to initiate certain intervention such as improving agricultural extension, spreading climate information services and availability to financial and technological opportunities. These are vital projects that will contribute in safeguarding Pakistan food security and offer sustainability of Pakistan agricultural industry in the long term in response to uncertainty in climate. Therefore, the study has objectives -The aim of the study is 1) To determine the extent of the climate change awareness of the farmers about adaptation 2) To determine the factors that may affect the adaptation to climate change in South Punjab.

Literature review and conceptual framework

This part of study explained the dependent and independent variables in detail and also elaborated the previous studies

Adaptation to climate change

In agricultural practice, farmers are using various climate change adaptations strategies to deal with climatic risks. These encompass changing crop Varity (CCV) e.g. adoption of stress-resistant cultivars; changing the date of planting (CPD); and changing the type of crop (CTC) i.e. farmers switching to other types of crops when the original ones become very susceptible to the effects of the climate (Zenda & Rudolph, 2024). The use of diversification strategies (DSs) (intercropping, livestock rearing, planting various types and varieties of crops, etc.) is also a common practice in order to minimize both climatic and economic risks (Danso-Abbeam et al., 2021). Moreover, soil conservation (SC) and water conservation (WC), are quite frequent practices associated with erratic rainfall and increasing temperatures (Marie et al., 2020; Sinore and Wang, 2024). These ACC practices combined will reduce risks and alleviate the intensity of climate change effects (Ahmad et al., 2024).

Climate change awareness

Communication, knowledge, education, and information sharing play a significant role in the transfer of the farmers to effective adaptation to climatic changes strategies (ACC) with limited resources (Zorrilla-Miras et al., 2024). The availability of adequate information puts the smallholder farmers in a better position to address the challenges of adaptation despite having limited resources (Eise and Rawat, 2021; FAO, 2019). In one of the studies, Belay et al. (2017) demonstrated that climate information plays a paramount role in the adaptation of farmers in Ethiopia, and Piya et al. (2013) emphasized that it is a paramount role in the practices of adoption among Nepalese farmers. It has been noted that the application of climate information is a key determinant of adaptation based on an enormous body of research (Ali et al., 2021; Ali and Rose, 2021; Khanal and Wilson, 2019; Mehmood et al., 2021).

Farmers (CCK) awareness of climate change is typically affected by previous experience of climate variability, personal perceptions, social values and personal opinions, but tends to be informed by little scientific evidence (Thottadi & Singh, 2024). This subjective interpretation may lead to critical gaps of knowledge that must be addressed by scientific facts and evidence. Such subjective interpretation could result in critical knowledge gaps that have to be filled by scientific facts and evidence (Appiah et al., 2025; Prajapati et al., 2025). Nevertheless, there is some evidence, which indicates that not all farmers have enough CCK, and it restricts its potential in modification strategies (Ali et al., 2021). This ambiguous evidence points to the necessity of legitimizing the knowledge of farmers by using a scientific viewpoint(Mao et al., 2024). Therefore, the study of the role of CCK in ACC strategies in rural Punjab needs to be continued to advance further.

The availability of climate change information is usually kept as a control variable when analyzing factors that influence adaptation (Zagre et al., 2024). It is conceptualized in most instances to be the simple acquisition of information. In filling this gap, the current study expands the conceptualization of information by investigating how education (volume), joining farmer organizations (type of channel), and access to extension services (frequency) influences the way adaptation measures are formed. Earlier researchers have indicated that education has a significant impact on adaptation strategies (Chaudhary et al., 2025), whereas farmer-to-farmer interactions via organizations play a significant role in adaptation plans implementation (Koch et al., 2025; Prajapati et al., 2025).

Climate change adaptive capacity

Adaptive capacity (AC) is the potential of individuals, households or systems to react successfully to climate variability and extremes by diminishing potential risks, using arising opportunities, and managing environmental challenges. Researchers emphasize that the adaptive ability of households is one of the major factors that dictate the success of climate change adaptation (Chishiba, 2024; Wright et al., 2024; Hossain et al., 2019). The adaptive ability involves physical and non-physical resources. It is not new that the resources at the local context, particularly livelihood assets play a critical role in increasing AC.

Furthermore, When it comes to the sphere of agricultural systems, farmer competence and skills are critical in determining their awareness and understanding of the uncertainty of climate change, thus their ability to counteract them (Jatav et al., 2024) . Prior investigations have indicated that factors such as educational attainment agricultural experience, the composition of household size (Chatsiwa, 2024; Chaudhary et al., 2025; Arshad et al., 2018), and the availability of labor resources (Byrne, 2014) constitute essential components of human capital that bolster farmers' adaptive capacity (AC) and, as a result, their adaptive capacity to climate change (ACC). Likewise, the presence of social capital is instrumental in fortifying community resilience (Suhaeb et al., 2024).

On the base of above explanation, current study selected the Adaptation of climate change strategies as dependent variables and climate change awareness and climate change adaptive capacity as independent variable.

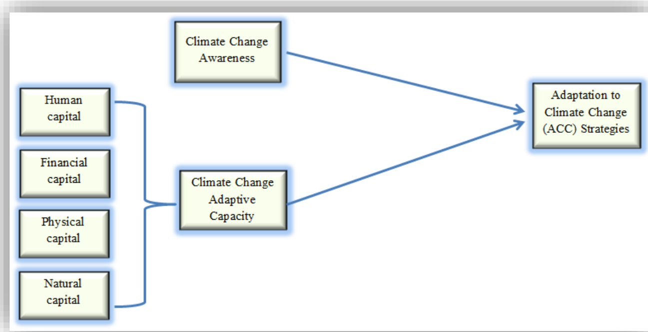

Figure 1 Conceptual framework

In this figure 1 the climate change capacity is measure with the help of human capital, financial capital and physical capital and natural capital.

3. Materials and Methods

Sample size and data collection

This study adopted a quantitative research design. Primary data were collected from the Punjab province, the most densely populated region of Pakistan, using a multi-stage random sampling method. The survey gathered information on farmers' knowledge of climate change, focusing on temperature, rainfall, and seasonal as well as weather patterns. Questions related to sea level rise were excluded since Punjab is not a coastal region. To overcome communication barriers, the questionnaire was translated into Urdu and Punjabi. Farmers were assured of anonymity, and informed that the data would be used solely for research purposes. Trained monitors were engaged to conduct the field survey, ensuring consistency in data collection. In total, responses were collected from 280 farmers between August and September 2024, coinciding with the wheat harvesting and rice sowing seasons, when farmers are most actively involved in agricultural activities. Further, this study has applied binary logit model for the data analysis by using STATA.

Measurement of variable

In this study following table explains the nature of variables, proxies and measurements scales.

Table 1: Explanation of variables and measurement

Variable	Dimension	Measurement / Coding
Adaptation to Climate Change (ACC) Strategies	CCV, CCT, CPD, SC, WC, DSs	(1=Adopted, 0=Not adopted)
Climate Change Awareness (CCA)	Knowledge about climate change	1 if knowledge present; 0 otherwise
Human Capital	Age, Education, Family Size, Labor	Years; Schooling; Household size; No. of workers
Financial Capital	Agricultural Credit, Marketing Access, Off-Farm Income	1=Yes, 0=No
Physical Capital	Tube Well, Transport, Sowing & Harvesting Tools	1=Owned, 0=Not owned
Natural Capital	Landholding, Tenancy Status,	Acres; 1=Owner, 0=Tenant;

Note: Change Crop Variety (CCV), Change Crop Type (CCT), Change Planting Date (CPD), Soil Conservation (SC), Water Conservation (WC), Diversification Strategies (DSs), Climate Change Awareness (CCA)

This table explains that dimension of Adaptation to Climate Change (ACC) Strategies which is dependent variables, while Climate Change Awareness (CCA) and farmer's adoptive capacity are independent variable. The farmer's adoptive capacity is measure with human capital, physical capital, financial capital and natural capital.

Empirical model

Current study has applied binary logit model to elaborate the variable effecting the Adaptation to Climate Change (ACC) Strategies. Following equation is used for the logit model: -

$$\ln\left(\frac{L_i}{1-L_i}\right) = \alpha + \sum_{i=1}^{18} \beta_i X_i + \varepsilon \qquad (1)$$

Where $\ln\left(\frac{L_i}{1-L_i}\right)$ represents the logit for the farmers' ACC strategies (e.g., L_i is the probability of the farmers adopting the i ACC strategy, while $1-L_i$ is the probability of the farmers not adopting the particular strategy).

The set of independent variables and their short forms, measurements, means, standard deviations, and minimum and maximum values are provided in Table 3.

The econometric equations of this study is following

$$\begin{aligned} ACC = \alpha &+ \beta_1 CCA_1 + \beta_2\ age_{\ 2} + \beta_3\ edu_{\ 3} + \beta_4 FS_4 \\ &+ \beta_5 \text{ labor}_{\ 5} + \beta_6 AC_6 + \beta_7 \text{ MP}_{\ 7} \\ &+ \beta_8 \text{ OFI}_{\ 8} + \beta_9 TW_9 + \beta_{10} TT_{10} \\ &+ \beta_{11} ST_{11} + \beta_{12} \text{ HT}_{\ 12} + \beta_{13} \text{ land}_{\ 13} \\ &+ \beta_{14} TS_{14} + \varepsilon_{\text{t}} \qquad (2) \end{aligned}$$

$$\begin{aligned} l\,n\left(\frac{L_i}{1-L_i}\right) = \alpha &+ \beta_1 CCA_1 + \beta_2\ age_{\ 2} + \beta_3\ edu_{\ 3} \\ &+ \beta_4 FS_4 + \beta_5 \text{ labor}_{\ 5} + \beta_6 AC_6 + \beta_7 \text{ MP}_{\ 7} \\ &+ \beta_8 \text{ OFI}_{\ 8} + \beta_9 TW_9 + \beta_{10} TT_{10} \\ &+ \beta_{11} ST_{11} + \beta_{12} \text{ HT}_{\ 12} + \beta_{13} \text{ land}_{\ 13} \\ &+ \beta_{14} TS_{14} + \varepsilon_{\text{t}} \qquad (2') \end{aligned}$$

Furthermore, this study also analyzed the odds ratio. For this purpose, following equation is used.

$$\frac{p_i}{1-p_i} = \exp\left(\beta_0 + \sum_{i=1}^{18} \beta_i X_i\right) \qquad (3)$$

4. Results and Discussion

Results

To calculate the statistical software, the current study used STATA. Logit regression models of the chosen strategies of adaptation.

Descriptive statistics

The descriptive statistics demonstrate the significant attributes of the farmers, their resources and the adaptation strategies they adopt to address climate change. These findings indicate that most farmers are already adapting with 64% switching to different types of crop varieties, 54% switching to different types of crops, and 49% changing the planting dates. Fifty-five percent and 48% of farmers respectively had soil and water conservation techniques and 59 percent diversified by means of intercropping, livestock or alternative means. Climate change awareness was also high with 75% of the farmers expressing that they were aware of issues related to climate, which means that the climate information is quite prevalent in the area. Regarding human capital, the mean age of farmers was 30 years with the age of farm workers spanning between 17 and 80 years, indicating that there were young and experienced farmers. Education levels were low with an average of seven years of schooling and family sizes were relatively large with an average of 9 members and 3 contributing laborers.

In terms of financial capital, access to agricultural credit and access to markets stood at 49 percent and 44 percent respectively, off-farm income was reported by only 31 percent, indicating lack of financial diversification. There was a relatively high level of physical capital with 68 percent of the farmers having tube wells, 69 percent having tools of transport and more than half of the farmers having sowing and harvesting tools and harvesting tools. Natural capital showed great inequity, with the average landholding of 15.6 acres with a variation of 1 to 100 acres, showing there was an unequal distribution of land. In addition to this, land tenure was important as only 44 percent of farmers were landowners and the remainder were tenants; therefore, land tenure facilitated the adaptation decisions. In general, the results indicate that farmers are implementing various adaptation strategies and have average access to physical resources, but lack of education and financial assistance and unequal land distribution remains a challenge that limits their adaptive capacity.

Table 2: Determinant of the ACC strategies

Variables	**CCV**	**CCT**	**CPD**	**SC**	**WC**	**DS**
Climate Change Awareness	0.9187 (0.3520) ***	0.9248 (0.3651) **	1.3412 (0.4225) ***	1.1086 (0.3998) ***	-1.0854 (0.4030) ***	0.8539 (0.4201) **
Human Capital						
Age	0.0527 (0.0184) ***	0.0375 (0.0121) ***	0.0971 (0.0111) ***	0.0079 (0.0126)	0.0588 (0.0096) ***	0.0114 (0.0118)
Education	0.1614 (0.0371) ***	0.1086 (0.0388) ***	0.0553 (0.0378)	0.0415 (0.0416)	0.0852 (0.0372) ***	-0.0295 (0.0415)
Family size	0.0352 (0.0398)	0.0034 (0.0381)	0.0877 (0.0382) **	0.0221 (0.0445)	0.0081 (0.0487)	0.0998 (0.0465) **
Labor	0.0738 (0.0934)	0.1031 (0.0847)	0.0742 (0.0725)	-0.2762 (0.1052) **	0.2701 (0.0838) ***	0.0012 (0.0781)
Financial Capital						
Agricultural credit	1.1743 (0.3356) ***	0.6915 (0.3167) **	-0.2103 (0.3375)	0.7942 (0.3741) **	1.4261 (0.3085) ***	0.5169 (0.3949)
Marketing access	1.0824 (0.3664) ***	0.5032 (0.3609)	1.3241 (0.3267) ***	0.4263 (0.3702)	-0.4519 (0.3640)	0.2084 (0.3699)
Off-farm income	0.0961 (0.4029)	0.4525 (0.3762)	-0.1218 (0.3271)	0.9726 (0.3758) ***	0.0551 (0.3215)	1.6732 (0.3625) ***
Physical Capital						
Tube well	-0.3587 (0.4079)	-0.4059 (0.4046)	-0.4821 (0.4041)	0.4051 (0.3958)	0.9368 (0.3842) **	-0.2968 (0.4583)
Transport tools	1.0498 (0.4337)**	-0.0764 (0.4540)	0.4221 (0.3975)	-0.1075 (0.4971)	0.1925 (0.3774)	1.1393 (0.4741) **
Sowing tools	-0.4821 (0.4438)	0.5126 (0.3801)	0.1812 (0.3792)	0.8195 (0.3586) **	-0.0518 (0.3643)	0.6291 (0.3529) ***
Harvesting tools	-0.4256 (0.3602)	0.3415 (0.3611)	0.0192 (0.3203)	0.9517 (0.3621) ***	0.4425 (0.3268)	0.1502 (0.3972)

Natural Capital						
Landholding	-0.0023 (0.0094)	-0.0015 (0.0083)	-0.0015 (0.0083)	0.0341 (0.0161) **	-0.0022 (0.0098)	0.0169 (0.0099) ***
Tenancy status	0.3082 (0.3985)	0.6305 (0.3759) ***	-0.4109 (0.3345)	-0.6518 (0.4181)	0.2292 (0.3457)	-0.3097 (0.3958)
Model Fit						
Wald χ^2	129.84	114.27	98.32	106.81	91.54	110.29
Prob > χ^2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pseudo R^2	0.3572	0.3875	0.3591	0.4583	0.3172	0.4115

The results of this research point to the fact that the response of farmers to climate change depends greatly on the interplay of socioeconomic, institutional, and resources factors. Climate change awareness turned out to be a determinant factor, with a significant probability of implementing the adoption of a strategy of changing crop varieties, changing crop type, changing the planting date, and conserving the soil (Muchacka & Miarka-Żukowska, 2024; Tayan et al., 2024). Interestingly, awareness was observed to have a negative impact on water conservation behavior, which is a possible indication that even with awareness, structural and resource limitation or constraints suppress the application of water-saving methods in practice. There was also a significant influence on socioeconomic variables like age, education, family size and off-farm income. With regard to the adoption of modern practices, especially those related to the crop, older farmers and those who were more educated were more inclined to adopt modern practices, and it seems that experience and knowledge increase adaptive decision-making (Mastrorillo et al., 2024). The care of more laborers in bigger households supported crop diversification and income diversification policies whereas the off-farm income greatly supported the soil conservation and diversification policies.

The Wald χ^2 values across all six adaptation models (ranging from 91.54 to 129.84) are statistically significant at the 1% level (Prob > χ^2 = 0.0000). This confirms that, overall, the explanatory variables included in the models jointly influence farmers' adaptation decisions, and the models are a good fit for the data.

The Pseudo R^2 values range between 0.3172 and 0.4583, indicating that the explanatory variables account for approximately 32% to 46% of the variation in the adoption of different adaptation strategies. While these values are modest, they are considered reasonable for behavioral and social science models where individual decision-making is influenced by multiple unobservable factors. Among the models, soil conservation (Pseudo R^2 = 0.4583) shows the strongest explanatory power, followed by diversification strategies (Pseudo R^2 = 0.4115), suggesting that the included variables are particularly effective in explaining these two adaptation practices.

Table 3: Odd ratio of selected strategies

Variables	CCV	CCT	CPD	SC	WC	DS
Climate Change Awareness	2.53***	2.55**	3.92***	3.09***	0.33***	2.39**
Age	1.06***	1.04***	1.10***	1.01	1.06***	1.01
Education	1.18***	1.12***	1.06	1.04	1.09***	0.97
Family size	1.04	1.00	1.09**	1.02	1.01	1.11**
Labor	1.08	1.11	1.08	0.75**	1.32***	1.00
Agricultural credit	3.32***	2.02**	0.81	2.25**	4.24***	1.69
Marketing access	3.02***	1.67	3.85***	1.54	0.63	1.24
Off-farm income	1.10	1.59	0.88	2.68***	1.06	5.48***
Tube well	0.69	0.66	0.61	1.51	2.59**	0.74
Transport tools	2.91**	0.93	1.54	0.90	1.22	3.20**
Sowing tools	0.61	1.68	1.20	2.31**	0.95	1.89***
Harvesting tools	0.65	1.41	1.02	2.62***	1.57	1.17
Landholding	1.00	1.00	1.00	1.04**	1.00	1.02***
Tenancy status	1.38	1.91***	0.66	0.51	1.26	0.73

Such findings suggest that the capacity at the household level, both human and financial resources continue to be central to development of resilience in relation to climate change. Agricultural credit contributed significantly to adopting crop technology and conservation practices a sign that the value of financial support in addressing climate-related risks is significant. Equally, the access to the market influenced favorably the diversification strategies, and the role of linkages to value chains in the development of adaptation. The farmers that could get access to tools and tube wells were more likely to adopt conservation measures that show that availability of resources directly positively impacts adaptive capacity.

Discussion

In this current study, there are climate change awareness and adaptive capacity are the independent variables. The results indicate that climate change awareness (CCA) plays a central role in determining how the farmers respond to the climate change. Farmers who are more climate-aware will be in a better position to implement diverse practices such as altering crop variety (CCV), alteration of crop type (CCT), planting date (CDP), soil conservation (SC) and diversification strategies (DSs). This means that adaptive capacity is extremely facilitator of awareness and knowledge. Further, this study explains that the Availability of these physical resources increases the capacity of the farmers to embrace new practices successfully. As an illustration, transport and irrigation systems facilitate the implementation of changes in crop preferences or in planting times, contemporary tools facilitate the practice of soil and water conservation. The results are a line with (Appiah et al., 2025; Panja et al., 2024; Prajapati et al., 2025; Thottadi & Singh, 2024)

Additionally, if it is considered the natural capital, tenancy and landholding have ambivalent impacts. The overall impact of landholding is not so strong, but it has a positive impact on soil conservation and diversification policies. The status of tenancy on the other hand has a big influence on the adaptation decisions: tenants would be more willing to change the type of crop (CCT), whereas landowners would be more willing to change the soil conservation practices. This explains why access and ownership of land defines the kind of strategies that farmers seek (Mehmood et al., 2018; Rabbany et al., 2021; Jounior et al., 2021).

Age, education, family size, and labor are some of the human capitals that exhibit high and positive effects on the strategies such as CCV, CCT, CPD, SC, and DSs. Farmers who are educated and those who have family support can take more adequate measures regarding adaptation. Yet, the most interesting observation is that labor availability is negatively associated with soil conservation, which may be due to the fact that households that possess more labor tend to prefer short-term income-generating activities to long-term soil management. The results are a line with (Chishiba, 2024; Koch et al., 2025; Prajapati et al., 2025; Wright et al., 2024)

Lastly, financial capital is also identified to be a key facilitator of adaptation. Agricultural credit facilitates farmers to use the strategies, including CCV, CCT, SC and water conservation (WC). Market access encourages farmers to adopt new crop types and changes planting dates whereas off-farm earnings are a major factor in diversification. Finance, therefore, gives the farmers the freedom and assurance to invest in climate resilient practices and lessen the reliance on a single source of income (Hussain et al., 2022).

5. Conclusion

In conclusion, the findings of this study highlight that climate change awareness and adaptive capacity are crucial determinants of farmers' climate adaptation behavior. Farmers with higher awareness and strong adaptive capacity are more likely to adopt multiple climate-resilient strategies such as crop variety and type adjustments, planting date alteration, soil conservation, and diversification. Access to physical resources, including irrigation, transportation, and modern agricultural tools, further strengthens their ability to implement these practices effectively.

The study also underscores the role of natural capital, particularly landholding and tenancy status, in shaping adaptation choices. While landholding has a modest effect overall, it supports soil conservation and diversification efforts, whereas tenancy encourages crop-type changes. Similarly, human capital factors especially education, age, family size, and labor availability significantly influence adoption behavior. However, the negative association between labor availability and soil conservation suggests a preference for short-term economic gains over long-term land sustainability in households with more labor resources.

Finally, financial capital emerges as a key enabler, empowering farmers through credit access, market linkages, and off-farm income opportunities, which collectively support the adoption of climate-resilient strategies. Overall, strengthening awareness, improving access to resources, enhancing education, and promoting financial support systems are essential pathways to building resilient farming systems capable of confronting climate change challenges effectively.

6. Limitations and recommendations for future studies

Despite the fact that this research gives significant results about the knowledge of farmers about climate change and their adaptation strategies, it is not without its limitations. First, the research was confined to the Punjab province of Pakistan, which limits the applicability of the results to other areas with other characteristics in terms of socio-economic, cultural, and environmental factors. Second, the study utilized self-reported data that is also prone to biases in terms of erroneous recall or social response desirability. Third, the research was mainly based on quantitative research and lacked inclusion of qualitative data which would have given further insights into how the farmers thought and how they made their decisions. Last but not the least is the cross-sectional design of the study which hinders the possibility of adopting long term changes in adaptive behaviour and climate changes influence among farmers. Research in the future may also broaden the geographical area to other provinces of Pakistan and comparisons across countries (such as South Asia) to increase the external validity of the results. To identify subtle views and cultural drivers to adaptation, including qualitative approaches, focus group discussions or in-depth interviews would be helpful. It is also suggested to use longitudinal research designs to monitor the changes in the adaptive capacity and behavior. Additionally, further studies can be done on how policy interventions, institutional support and technological innovations influence adaptive strategies of farmers. In the end this study also suggest that comparative analysis is also needed to find out the outcome form the adaptation from different area and farmer.

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