Perceptions on Climate Change and Satisfaction on Adaptive Measures: Farmer Field Evidence from Punjab, Pakistan

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Abstract: - Climate change poses a serious threat to the agrarian economy of Pakistan. Future agriculture productivity of the country can only be secured through the adaptation of climate change strategies. This research is designed to investigate the farmers' perceptions of climate change and their satisfaction with the adaptation measures in the Punjab province of Pakistan. The questionnaire-based data was collected in 36 districts, from 360 respondents through the field survey. Both random and convenient sampling techniques were employed. For empirical analysis, a Multinomial Logistic regression model was operated. The results indicate that an increase in per-hectare yield lessens the farmer's vulnerability to climate change. This research found that the farmers observed that changing precipitation patterns, extreme climate events, mutable sowing and harvesting time, temperature variation, night temperature, and traditional crop varieties are key vulnerable factors of climate change. These may create an alarming situation for agriculture productivity in the province. It is registered that farmers are not satisfied with adaptation measures particularly concerning heat-resistant and drought-resistant varieties. Agriculture extension services could not deliver optimally to protect the agriculture output from climate vulnerability. The results show that farmers are not satisfied with the performance of climate-resilient and research institutions. It is recommended that the government, research institutions, and climate-resilient institutions design new sowing and harvesting patterns, new seed varieties, new climatic zones, and alternative crop switching. The whole paradigm of extension services needs to be modernized and mechanized with the wider application of ICTs. The extension department should timely disseminate the climate information and educate the farmers on climate resilience and adaptation.

Key-Words: - Climate Change, Climatic Adaptive Measures, Farmers perception, farmers Satisfaction, Agriculture Output, Multinomial Logistic Model

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1 Introduction

The climate change is considered as a global phenomenon. It has extensive implications across the time and regions, [1]. The developed countries are situated at higher latitudes. They will get benefits from the current changes in temperature and heat waves if prolonged for twenty to thirty years, [2], [3]. The yearly mean temperature has expanded to around 0.5 C^0 globally. Different regions are already extremely affected due to climatic variation. Developing countries are most prone to climate change (CC) though they have less than a 10 percent contribution to global carbon emission, [2]. According to climate scientists, the impact of climate vulnerability is higher in developing countries than that of developed countries, [3], [4], [5]. The level of green technology in developing countries is insufficient to address the climatic challenges and enhance their agriculture production.

As far as the dangerous climatic impact is concerned, Pakistan is the 7th most vulnerable country. She is dubbed as the hotspot of the world. She is ranked 134th in environmental damages (corban emission production), [6]. Currently, she is experiencing climatic effects through a series of floods and droughts that directly affect agriculture productivity, [7], [8]. The discrepancy in rainfall cycles and shifting temperature has negative impacts on agriculture productivity. Additionally, the changing weather is destroying agriculture productivity, decimation of livestock herds, and farmer's livelihood, and creating food insecurity in Pakistan, [9]. The climate changes have left wide-running effects, influencing water accessibility, and expanding recurrence of extreme climate events, [6]. Pakistan has rich natural resources, including agricultural land, mineral deposits, and gas reserves. Primarily, the agriculture sector contributes 19 percent to Gross Domestic Product (GDP) and provides 37 percent employment, [10]. In Pakistan, most of the agricultural land is cultivated through surface water but fewer areas are dependent on rainfall. The changing pattern of rainfall directly affects agriculture productivity and thus the GDP of the country. The government of Pakistan established and implemented the climate change policy in 2012 nationally. The immediate and effective purpose of this policy was to prevent future environmental damages such as soil erosion and deforestation, [11]. Globally, Pakistan is ranked 18th out of 191 countries in the disaster risk index. This index has been driven particularly at the national level by exposure to flooding, earthquakes, and the risk of internal conflict, [11]. The global disaster ranking highlighted that Pakistan is the most vulnerable and at a high risk of climate change. So Pakistan needs a workable policy to avoid the bad impact of climate change, adapt to climate change, and follow mitigation wherever required, [9], [12].

The adaptation of climate change measures is directly influenced by farmer's perception of the climate-resilient institutes and their satisfaction level [2]. The Environmental Kuznets Curve (EKC) suggests that initially, economic development deteriorates the environment at a certain level. But after a particular period, the economy begins improving, and the environmental degradation reduces. The results of the Kuznets hypothesis reveal that the agriculture production infrastructure required reconsideration of climatic measures to avoid production inefficiency, [13], [14]. Additionally, the tremendous economic development reduces agriculture productivity, land conservation, land fertility, and environmental efficiency, [5], [7]. The problem with over energy consumption is that it affects the environment and produces carbon emission gasses, [15], [16]. It was found that economic growth has a positive impact on environmental pollution, [17].

Similarly, in an important research, it has been argued that energy consumption has a positive contribution to environmental degradation and economic growth in Pakistan, [18]. The increased growth level has enhanced the environmental degradation and thus validated the EKC hypothesis, [19]. Another study, [20], found that environmental damages like agriculture methane, agriculture nitrous, and CO_2 emission are a reaction to over-energy consumption in Pakistan. Annually, precipitation has demonstrated noteworthy changeability over seasons in Pakistan. Average rising temperature and ecological variation affect agrarian crop planning and rainstorm precipitation. Consequently, this will fundamentally affect the agricultural production of water subordinate areas and profitability, for example, energy and horticulture, [21], [22]. Farmer's eagerness and adjustment capacity of agriculture framework relies on variation in the atmosphere and see vulnerabilities of extreme occasions, [5], [23]. The Punjab government developed a climatic policy in view of farmers' networking, extension services, assessment programs, and collaboration with stockholders to develop appropriate climate policy to overcome future climatic vulnerability. The Punjab government is facing a dilemma on an institutional alliance, which creates difficulties in controlling the destructive impacts of CC, [6], [7], [9], [24]. Farm-level adaptation measures involve two categories: perceiving a variation in CC and deciding whether to opt or not opt the useful adaptation strategies, [4], [25], [26], [27].

The literature provides evidence that climatic vulnerability affects agricultural productivity globally, [3], [7], [8], [28], [29], [30]. In addition, a list of studies exhibits that climatic variation has a mixed effect. Some studies demonstrated that high temperature is suited for the crop sector (especially wheat), [23], [31], [32], [33]. Others suggested that the changing climate is adversely affecting agricultural productivity, [34], [35]. The adaptive measures of climate change are meant to overcome the farmer's uncertainty of agriculture productivity by introducing new cycles of sowing and harvesting crops. It is imperative to realize how some policy shifts may make changes in the pattern of the likely impact of climate change on the agrarian economy of the country. In this regard, the existing studies focused on climate change effects on agriculture yield, cereals, and disruption the food availability and accessibility, which can be reduced through pecuniary and precautionary measures to avoid climatic vulnerability in Pakistan, [9], [33], [36], [37], [38], [39], [40], [41], [42]. Based on the existing research gap, the present study raises the following research question: Do the farmers have knowledge about climate change? What is the farmer's perception of climate change in the Punjab province of Pakistan? What is the impact of climate change on agricultural productivity? Do the farmers are following the adaptation measures for climatic vulnerability? Do the farmers are satisfied with climate change adaptation measures in Punjab, Pakistan?

1.1 Objectives of the Study

1. To investigate the farmer's knowledge about climate change in Punjab Pakistan
2. This research examines the farmer's perception of Climate Change (CC) policy and their satisfaction with adaptive measures taken by the government of Punjab, Pakistan.
3. This study investigates the impact of climatic policy on agricultural productivity.
4. This study explores the role of climatic vulnerability in agricultural output and government actions to avoid production inefficiency in Punjab, Pakistan. This allows evaluation of the climatic policy adaptation and its implementation consequences on the agricultural business.
5. The implicit research idea is to arrive at some policy framework for mitigation and adaptation to climate change.

2. Review of Literature

2.1 Climate Change and Policy Development

According to the climate change profile of Pakistan, the climatic changes have unexpected impacts on productivity, affecting water accessibility, agriculture efficiency, and extended recurrence of harmful climatic occasions, [10]. In coming decades, the CC-related common perils may augment in seriousness and recurrence. Tending to these crises involves an environmental variation to be mainstreamed into a national approach and methodology.

Farmers' willingness and capacity to adopt the environmental framework depend on the availability and capability of climatic knowledge. The gap is found in terms of easy access and reliable information to farmers. There is an inconsistency between farmers' precipitation about climatic vulnerability and actual atmosphere record, [23], [42]. Training, farming background, landholding, land property, expansion, participation, access to CC adaptation, lack of extension services, and access to new information are the key elements affecting the adaptation stages. The carbon tax will help in accommodating the policies and also in environmental protection through inflicting pollution taxes. Developing countries can reduce environmental harmony through effective energy consumption policies, emission taxes, and workable policies to control environmental damaging factors, [43], [44].

The literature shows that most agrarian economies do not consider environmental variation as a potential risk for agricultural output. The farmers are not enthusiastic to adopt innovative cultivation techniques and follow the adaptation measures to climate change, [9], [12], [22]. The newly developed cultivation techniques are providing higher crop productivity and overcoming the climatic challenges, [28]. Unfortunately, environmental variations in Pakistan are genuine and detrimental, but the question is, do the farmers acknowledge it or not? Further, farmers adopt appropriate measures to overcome climatic vulnerability, [33], [45]. The main limitation in adaptation is the lack of a suitable functional climate and financial policy for the farmers. Access to innovation and availability of agriculture credit are helpful in the form of adaptation measures for the farmers, [46]. Further, farmer recognition and education on environmental change, current adaptation measures, and basic leadership procedures are the fruitful factors for the adaptation of climatic-resistant methodologies, [45]. The necessary actions taken by the government are helpful in empowering the farmers through versatile climatic adaptive measures and providing an enabling environment to cope with harmful climate issues, [47].

The climatic vulnerability affects the agribusiness and farm yield particularly, in South Punjab, Pakistan. The potential production of rice, wheat, sugarcane, and maize has been affected by climatic changes in the last decade, [1]. The rising temperature harms the crop's yield than the drop in temperature during winter. Moreover, the erratic pattern of rainfall has negative impacts on all crops except wheat. The connection between CC adaptation procedure and sustenance security is positive while having a negative relationship between environmental change and adaptation techniques, [1]. Another study, [48], demonstrated that a paradigm shift is required in research endeavors, and research focused on climate change on two heads. It is necessary to increase household family resources and consciousness by bringing down the expense of adaptation. Evaluating the adaptation strategies, they found that aside from the Climatic Change Arrangement of Nepal, none of the strategies practiced in other South Asian Countries is transboundary scale adaptation, [48], [49]. Therefore, a comprehensive policy should be formulated that could avoid considering the transboundary impacts of CC in collaboration with other countries in the region.

2.2 Climate Change and Adaptations Measures

Pakistan is a climate-vulnerable country and faces extreme climatic events like droughts and floods, [6]. It has been examined in six Khyber Pakhtunkhwa (KPK) districts the adaptation measures opted for by the farmers to nullify the impact of adverse climatic shocks, [39]. The findings revealed that climate change generates subsequent issues in the agriculture sector of Pakistan, such as the loss of soil fertility, water scarcity, changes in sowing and harvesting patterns, and crop diseases. The climatic variation affects the world, especially the South Asian agriculture sector, where the adaption and mitigation tendency among the farmers is poor, [32], [40]. The instruments affecting the climate are GHGs, which depend upon human-related activities, deforestation, transportation, industry, agriculture, urbanization, livestock, and energy uses. The farmer endures that CC accumulated the sowing and harvesting periods are changed, [39], [50]. Most farmers indicate that crop diseases come into the picture due to warm temperatures. However, a timely adaptation strategy by agrarians in the respective areas is helpful for variation in the crop calendar.

Climatic adaptation affects the production gain and the farmer bears the cost, [51]. The productivity gains have a significantly positive contribution for rice producers who adapted but trifling for wheat producers. The small farmers have utilized Ecosystem-based adaptation strategies due to climatic variation while the ecosystem is disturbed, [52]. The farmers who have social capital and institutional access and availability used more adaptation strategies, and small farmers used adaptation strategies, but still a need to improve adaptation through government policies. Erratic patterns of rainfall, temperature, and CC have altered the harvesting and sowing period of major crops in Punjab and thus substantially influenced the farm incomes of poor farmers are adversely which are affected by these CCs, [6], [23], [38]. The small farmers have to either shift to innovative crop varieties to maintain their level of income or need extra credit to cope with the issue, and both are beyond the reach of poor farmers. The systematic review analysis on adaptations and climate changes, [53] focused on the adaptation strategies and concluded that the climatic changes by meta-analysis and systematic review method. The first suggestion for the qualitative study is to make an in-depth analysis and explanation of farmers' adaptation and decision-making, [33], [48]. Global livestock will be doubled by 2050 and climate change is a main threat to meat production because of low-quality crop feed and forage, availability of water for animals, livestock diseases, biodiversity, and animal reproduction, [54]. Therefore, livestock production transformation into sustainability requires assessments related to the use of mitigation and adaptation measures and policies that could support and facilitate the CC implementation, [55]. Climate change directly affects the crop sector and indirectly it affects the livestock sector. Directly, the area under cultivation is declined, crop productivity is reduced, cultivation cycle is diversified which increases the farmer's uncertainty about sowing and harvesting of the crops, [56], [57], [58]. Some researchers, [59], have found that climatic changes significantly affect the mean temperature, precipitation, rainfall pattern, and deforestation. Similarly, [37], found that people are well aware of climate change and farmers are taking adaptations to control and reduce climate vulnerability.

3 Materials and Methods

3.1 Multinomial Logistic Regression

For microdata analysis, Multinomial Logistic Regression (MLR) is relatively more suitable when the targeted variable has more than two choices, and the explanatory variables are of any type: continuous, ordinal, or nominal. The MLR model does not include categorical predictors and involves the coding strategy. Categorical predictor variables may be entered into the equation directly as key factors in the MLR dialog menu box, [60], [61], [62], [63]. The ordered logit model follows the normal distribution, through which it is easy to interpret by using the odds ratios. The multinomial regression analysis has utilized the maximum likelihood method, [64]. For categorical analysis, we have the following model:

Yij= 1, if the respondent i chooses alternative j (j=2, 3, 4 and 5).
In this equation, 1 represents strongly disagree and 5 represents strongly agree.

$$y_{ij} = b_0 + b_1 x_{i1} + b_2 x_{i2} + b_3 x_{i3} + \dots\dots\dots + b_k x_{ik} + u_{ij} \quad (1)$$

In the above equation, ‘y’ is an unobservable variable, ‘x’s’ are explanatory variables and uij is a residual term. Whereas the term i" represents the different cross-sections. For multiple response categories, the dummy variable follows order or rank, and ordered logit and probit models should be applied when choices are more than two such as strongly disagree, disagree, neutral, agree, and strongly agree. Such models presume that the experimental Di is determined through D∗i as follows:

$$D_i = 1\ if D * i \leq \gamma 1 \quad (2)$$
$$D_i = 2\ if \gamma 1 \leq D * i \leq \gamma 2 \quad (3)$$
$$D_i = 3\ if \gamma 2 \leq D * i \leq \gamma 3 \quad (4)$$
$$M if \gamma M \leq D * i \quad (5)$$

In this case, value 1 is for the lowest response (strongly disagree), 2 represents the incremental response (disagree), and so on 5 represents the ‘strongly agree’ scale. In this study, the coefficient was estimated by adopting the MLR in SPSS software. The coefficient value indicates the logistic estimates for each predicted variable, with an alternative category of the estimated variables, [65], [66]. Therefore, the alternative categories do not refer to the response category. The MLR coefficient represents the expected value of responsive change in logistic probability in each predictor. The MLR model anticipates the odds and risk and uncertainty analysis of response categories of predictor and explained variables. The estimated result also displays the Wald statistic, standard error, DF, Sig. (p-value); as well as the odds ratios (Exp (B)). The Wald test with its associated p-value is applied to evaluate the MLR coefficient, whether it is or not different from one. The predictor variable is expected to increase the MLR odd-ratios and risk from response variables, to display greater than 1.0. The predictor decreases the MLR will have Exp(B) values less than 1.0, while those predictors that do not affect the MLR display an Exp(B) of 1.0, [60], [61], [62], [63], [64], [65], [66].

3.2 Econometric Model of Farmer Perception of Climatic Change

Regression analysis is essential for economic dependency among economic phenomena. The multinomial logit model is applied for survey analysis where the dependent variable has more than two responses from the respondents. MLR is an advanced form of binary logistic regression, which provides us with the coefficient matrix and odd ratios of the selected model, [61], [66]. The empirical model to measure the farmer’s perception of CC is as follows:

$$y_{ij} = b_0 + b_1 x_{ij} + b_2 x_{ij} + b_3 x_{ij} \dots\dots\dots . b_9 x_{ij} + u_{ij} \quad (6)$$

In the above model, yij is a dependent variable which represents ‘Farmer's perception about agriculture vulnerability to CC’ and bo is the intercept, and b1, b2, ... b9 are slope coefficients. While xij are cross-sectional independent variables such as ‘Per Hectare Yields’, ‘Increase in Temperature’, ‘Night Temperature’, ‘Harvesting Time’, ‘Crop Varieties’, ‘Extension Services’, ‘Women Farmers’, ‘Small Farmers Vulnerability’ and ‘Soil Fertility’ respectively.

3.3 Model of Farmers' Satisfaction with Climatic Measures

The MLR for farmer’s satisfaction with climatic adaption measures is designed to identify the farmer’s response to government policy adaption. The farmer’s satisfaction level about climate change resilient institutions is investigated through Likert Scale data. MLR is an advanced form of binary-logistic regression which provides us with the coefficient matrix and odd ratios to interpret the dependency relationship among variables, [61], [64], [65], [66].

$$y_{ij} = b_0 + b_1 x_{ij} + b_2 x_{ij} + b_3 x_{ij} \ \ldots\ldots\ldots . b_9 x_{ij} + u_{ij} \quad (7)$$

In the above model, yij is a farmer's satisfaction with climate change resilient institutions in Punjab bo is the intercept, and b1, b2, ... b9 are slope coefficients. While, there are independent variables such as the Punjab Government, Laws & Regulations, Research Institutes, Weather Mechanisms, NGOs, International Organizations, Community Interventions, Climate Funds, and Public-Private Partnership (PPP) respectively.

3.4 Data Framework

This study examines the farmers' perception of CC and their satisfaction with adaptation measures taken by the government of Punjab, Pakistan. For research objectives, the microdata were collected through a field survey from farmers. The questionnaire consists of three sections covering demographic, and agrarians’ perceptions regarding climatic changes, and the third section covers the farmers' satisfaction regarding adaptation measures. The questionnaire-based field survey was conducted in 36 districts of Punjab, Pakistan. 10 questionnaires were filled through farmer interviews from each district (Table 1, Appendices). The data was collected from small, medium, and large-scale farmers. This research was based on a designed questionnaire and data was collected through a field survey. Equal weight was provided to all districts because a suitable climate is important for all farmers and implementation of the climatic policy has equal importance. As per conventional wisdom, around 10 respondents were selected from each district of Punjab, Pakistan. Literature justifies and supports such a number of farmers. The sample size consists of 360 observations collected randomly. The survey was carried out through a multistage sampling technique, and respondents were selected through a convenient sampling technique. Collected data is the best representative of the population in terms of statistical specification.

3.5 Sampling Framework

In Punjab, there are 5,249,800 agriculture farms located the 36 districts (Census of agriculture 2016-17). The targeted population is farm managers and we considered the 5,249,800 farms as the agriculture farmer’s population. The rationale of the unbiased selection of agriculture farms is to get the climatic impact on each farm in all 36 districts of Punjab Pakistan. In order to get the true outcome and farmers’ perception and satisfaction about climatic challenges in Punjab, we gave them equal importance and selected the 10 responses from each district. This research adopted a snowball sampling technique to collect the data from the respondents. The determined sample size is a representative sample from the agriculture farm managers, which is calculated according to the [67], sample calculator. This study took a 0.06 percent precision level with a 94 percent confidence interval.

$$n = \frac{N}{1+N(e)^2} \quad (8)$$

Where n is the sample size and n is the size of the population and precision level are denoted by (n) and (e) respectively. Based on study objectives, a rigorous literature review has been performed to identify the problem-relevant variables for said study and to finally incorporate those in the form of askable statements in the questionnaire. Keeping in view the study area’s specific agro-climatic conditions, we pre-tested our designed questionnaire by conducting a pilot survey of 10 percent of the total sample size via interviewing one farmer from each district i.e., 36 farmers in total. Contingent our the field insights we got from interviewing these 36 farmers, we rectified our questionnaire by excluding the irrelevant questions and including the most relevant ones in our questionnaire. Furthermore, we have also interviewed the progressive farmers from targeted communities as well as field experts from the local agriculture department to further validate our designed questionnaire. Lastly, the farmers interviewed during the process of pre-testing and the progressive farmers were not been included in our final sample of 360 farmers.

4 Results and Discussion

4.1 Summary Statistics

The results of descriptive statistics presented in Table 2 (Appendices) show that the average respondent age is 44 years, which indicates that the survey was carried out by knowledgeable and experienced farmers, who are well aware of the agriculture business. The farmer's average landholding is 18.42 acres, so the survey is classified into large-scale, medium-scale, and small-scale farmers. The questionnaire consists of 15 instruments regarding the farmer's perception of climatic changes and 10 questions regarding farmers' satisfaction with climate institutions. The maximum response on all instruments is 5 (strongly agree), except four questions and the minimum response of all instruments is 1 (strongly disagree). The 'lack of precipitation' contains the maximum response of the farmers on a scale of 4, which means that farmers do not strongly disagree about it and are considered (lack of precipitation) an essential instrument for CC.

4.3 Results of Farmers' Perception of Climatic Vulnerability

4.3.1 Model Processing Summary and Goodness of Fit

The model processing summary results show that 87 percent of farmers strongly agreed that agricultural productivity is highly vulnerable to CC in Punjab, Pakistan (Table 3 Appendices). Around 7.8 percent of respondents are not aware of CC and its effect on agricultural productivity. Further 5 percent disagree about the climatic vulnerability on agricultural production. The results of the processing summary concluded that farmers in Punjab are knowledgeable about climate change and its vulnerable effects on agriculture output, [9], [28], [31].

The goodness of fit of the model is supportive and predicts policy messages. The results of the efficiency and validity of estimates are given in Table 4 (Appendices). The estimated value of the Chi-Square of likelihood measure is high (119.52) with zero probability value, which rejects the null hypothesis significantly. So, the estimated model is well-fitted, and estimates are good for drawing messages for policy purposes. The value of Chi-Square is high, which shows the independent variables have a strong influence on the probability of agriculture vulnerability to CC. Similarly, the estimated value of Pearson is highly significant (at 0.036 probability value) and Deviance is highly insignificant (at 1.00 probability value) which is a recommendation of the goodness of fit of the estimated model. In a similar line, the estimate of Pseudo R-Square (Nagelkereke test) is 0.317, which shows the estimated model is well-fitted. The value of Pseudo R-Square shows that 31.7 percent variation in agriculture climatic vulnerability is because of selected variable, while other 68.3 percent vulnerability of climate change is because of some other non-agricultural measures (might be industrial sector, household emission production, or neighboring countries producing a harmful effect on agriculture productivity).

4.4 Results of Climatic Vulnerability and Farmers' Perception

The results of multinomial logistic regression are given in Table 5 (Appendices). The strongly disagree response is considered as a reference category about the farmer's perception of climatic vulnerability in agriculture output. Where, the dependent variable is agriculture's vulnerability to climate change, while independent variables are Per Hectare Yields, Soil Fertility, Rise in Temperature, Crop Varieties, Night Temperature, Harvesting Time, Women Farmers, Extension Services, and Small Farmer's Vulnerability. The estimates show that most results are significant at 10, 5, and 1 percent levels of significance. The probability values of estimated coefficients are consistent with our expected hypothesis. The regression coefficient values are in Table 5 (Appendices), which represent the ordered multinomial logit model, the odds coefficient, and odd ratios.

(i) Strongly Agree Estimates

The slope coefficient of the variable 'per hectare yield' is -2.20, which is statistically significant. If the per hectare yield increases, the agriculture climatic vulnerability will reduce by (2.20) and vice versa. The estimated results indicate that 'per hectare yield' is a factor that can overcome the farmer's climatic vulnerability. Higher crop yield is the main instrument to identify the farmer's perception and highlights the climatic damages by keeping the other productivity instruments constant, [14], [57], [58]. The farmer's perception of CC is reflected by a change in per-hectare yield. If the climate is pleasant, the agriculture per hectare yield will increase, while rapidly changing weather is problematic for agricultural output. The estimated results are inconsistent with the findings of a research, [36], and consistent with the results of other study, [41]. As, [36], concluded that climate change is reducing agriculture productivity over time because of its harsh impact on per-hectare yield. The slope coefficient of the variable 'increase in temperature' is negative (-2.73) and statistically significant. The farmers strongly agreed that an increase in temperature is a primary factor for agricultural crops, and crop yield is dependent on favorable temperature. As the temperature increases, the farmer's vulnerability to climate change will reduce by 2.73 units. The increase in temperature has a varied effect on different crops depending on the location, crop varieties, and categories (like wheat, rice, cotton, etc.). Consistently, an increase in temperature and duration does not mean that crop yields and output will reduce, [36], [57], [58]. The findings are in contradiction with the outcome of a research, [21], which concluded that soil moisture is affected due to an increase in night temperature, which badly affects the growth of crops and productivity.

The change in harvesting time is a challenging issue for the farming community because the harvesting time affects the sowing pattern of the subsequent crops. The coefficient value of the harvesting time variable has a statistically significant and negative impact on agricultural vulnerability to climate change. The coefficient value is -1.8 with a probability value of 0.060. Change in harvesting time affects the whole sowing and harvesting circle, which causes less agricultural productivity. The findings are consistent with the outcome of, [31], [36], [41]. The coefficient value of crop varieties has an insignificant impact on agriculture vulnerability. The reason is that the agricultural crop varieties are not climate-reliant to protect output and grow smoothly in varying/harsh environments, [9], [25]. The estimated coefficient of extension services is significant and negative. The contribution of the extension department in the provision of awareness about climatic vulnerability to farmers is negative. This shows that the extension department is not performing a productive role in educating and guiding the farmers about the climatic challenges. These outcomes are consistent with a study, [3], in which it was concluded that the government must focus on running a policy of extension services and implement it to facilitate the farmers regarding early adaptation measures to climate changes, [3], [4].

The empirical results of the variable ‘vulnerability of women farmers’ have a positive and insignificant impact on agriculture's vulnerability to climate change. Women farmers are not highly vulnerable to climate change due to their limited role in managerial activity and in decision-making in sowing and harvesting activities, [24], [68], [69]. The slope coefficient value of ‘small farmer’s vulnerability is highly significant and negative impact on agriculture vulnerability to CC. The coefficient value of a small farmer’s vulnerability is -1.3, which is significant at 0.07 percent. In Pakistan, agricultural land is not uniformly distributed, and small farmers hold a larger share of cultivated land, [7], [24]. The fundamental reason for a small landholder’s vulnerability to CC is a lack of information and resources for adaptive measures. The estimated coefficient of the soil fertility variable is negative but insignificant. Soil fertility does not provide any impact on agriculture's vulnerability to CC, [24].

(ii) Agree Estimates

In the case of agreed estimates, the significance level of slope coefficients of all independent variables is consistent with the results of strongly agreed estimates. However, there is a small variation in the magnitude of slope coefficients in both categories of estimates. The consistency in estimated results of ‘strongly agree’ and ‘agree’ responses is a validation of analysis and reflects the true policy message for stakeholders. The coefficient value of ‘per hectare yield’ is -2.06, which is statistically significant and follows the outcome of the strongly agreed coefficient. Similarly, the agreed slope coefficient of variables ‘increase in temperature’, ‘harvesting time’, ‘crop varieties’, ‘extension services’, ‘vulnerability of women farmers’, and ‘small farmer’s vulnerability’ are consistent with the estimated results of strongly agreed estimates. The results are justified and consistent with the outcomes of some other studies, [4], [9], [25], [68].

(iii) Neutral Estimates

The neutral coefficients show that only one variable has a significant impact on the agriculture climatic vulnerability. This indicates that the farmers’ perception of climatic vulnerability is clear, and farmers’ response is realistic about the environmental factors. The results of independent variables under neutral response are not significant and the explanatory variables show either agreed response or disagreed impact on climatic vulnerability and agriculture productivity. The slope coefficient of per hectare yield is negative and statistically significant, which is consistent with the outcome of strongly agree. The farmers are not considering that climate change is not the only indicator for a reduction in per hectare yield as there are a lot of other pitiful factors affecting agriculture productivity. Further, the list of other variables shows the insignificant impact on agriculture's vulnerability to CC.

(iv) Disagree Estimates

In the case of a disagreeing response, the level of significance has a contradiction with strongly agreed choices. Most variables are insignificant except four variables, such as ‘per hectare yields’, ‘harvesting time’, ‘extension services’, and ‘crop varieties’. The other variables have contradictory responses. Additionally, the farmers strongly agreed and have a consistent behavior under the regressive analysis. The crop varieties variable shows an opposite response compared to the strongly agreed response, the crop variety variable has a significant and positive impact on agriculture's vulnerability to climate change. This indicated that farmers disagreed about the importance of innovative seed varieties which are climatic resilient and pest control. The extension services do not provide knowledge about innovative seeds and farmers use their traditional seeds for future sowing process. It concluded that farmers do not have access and resources for early adoption of innovative crop varieties, [56], [59].

The coefficient value of the variable per hectare yield is -1.9, which is significant and consistent with the strongly agreed coefficient. The per hectare yield depends on a couple of factors like water availability, crop variety, fertilizers, pesticides, soil fertility, farmer's working ability, agricultural credit, climate change, pleasant weather, etc., [1], [41]. The farmers are significantly disagreeing with the statement of changing of harvesting pattern. The coefficient value of the variable of harvesting time is consistent with a strongly agreed coefficient with high magnitude. Besides, the coefficient value of crop varieties has a positive and significant impact on agriculture vulnerability to CC. The magnitude of the slope coefficient of crop varieties is -2.40, which is higher than the 'strongly agreed' coefficient. The extension services coefficient has a highly significant (0.01) impact on farmers' satisfaction with climatic resilient institutions. The coefficient value of extension services is significantly positive, which indicates that farmers are not satisfied with the provision of suitable extension services. The contribution of the extension department in knowledge provision about climatic challenges in agriculture production is negative.

4.5 Model Processing Summary and Goodness of Fit

The model processing summary results are given in Table 3 (Appendices), showing that 33.9 percent of farmers responded neutrally, which indicates agrarians are not well know about the functioning of the climate change institute in Punjab. Despite this, 38 percent of respondents are not satisfied with the performance of climate change institutes. The findings are in line with the outcomes of some other studies, [4], [25], [26], [36]. 28 percent of respondents are satisfied with the performance, working pattern, and facilitation of climate-resilient institutes in Punjab. The farmer's satisfaction with the resilient institute is captured through multinomial regression analysis, and model-fitted estimates are given in Table 4 (Appendices). The empirical results in the goodness of fit of the given model show the legitimacy of the estimated coefficient. The estimated value of the Chi-Square of likelihood measure is high (22.72) with zero probability value, which rejects the null hypothesis significantly. So, the estimated model is well-fitted, and estimates are good for policy purposes. The value of Chi-Square is high, which shows the independent variables have a strong influence on the probability of agriculture vulnerability to CC. Similarly, the estimated value of Pearson is highly significant (at 0.00 probability value) and Deviance is highly insignificant (at 1.00 probability value). This justifies the goodness of fit of the estimated model. The results show that the value of the likelihood ratio test is statistically significant (at 0.00) and high (222.72), so the model provides fruitful results for the policy aspect.

(i) Strongly Satisfied Estimates

For MLR analysis, the predicted variable is the climate-resilient institutions in Punjab, while independent variables are related to farmers' satisfaction level regarding CC policies and institutional setup. The independent variables are Laws and Regulations, Weather Mechanisms, NGOs, International Organizations, Community interventions, Climate Funds, and Punjab Government Institutions. The regression coefficient values are given in Table 6 (Appendices). The estimated result shows that the slope coefficient of variable laws and regulations has a negative (-1.30) and significant (0.002) relationship with climate-resilient institutional structure in Punjab, Pakistan. The results indicate that due to the lack of laws and regulations, the climate change resilient institute cannot function properly. The negative coefficient of law and regulation highlights that farmers do not have information about the functioning and importance of the climate-resilient institutions in Punjab. Mere policy development is not the real achievement; execution of the climate change policy is highly needed, [25], [28], [46], [54].

The slope coefficient of the variable 'weather and disaster alert' has a significant and positive impact. The coefficient value is 0.92, which is significant at 0.002. The estimates show that weather and disaster alert departments work proficiently and guide the farmers on time. The farmers are satisfied with the working procedure of weather and disaster alert institutes, [1], [9], [26]. The climate change structural development is independent of the role of NGOs, which highlights that there are not sufficient NGOs working on climate change information distribution in Punjab. The estimated outcomes are consistent with the findings of [24], [46], who argued that the NGOs working on climate change have not diffused the information to farmers on time. They have a very limited and unproductive role in information disbursement to the farmers in Punjab, Pakistan.

The coefficient value of the variable ‘international organizations’ is negative (-0.73) and statistically significant. This means that the Farmers’ satisfaction level with international organizations is negative. The international organizations collect the climate funds for institutional development in Pakistan, but the funds are not utilized for the structural development of institutes, [6], [24]. Results are consistent with the findings of a few studies, [70], [71]. The estimated coefficient of climate-related funds and community-level intervention shows an insignificant impact on institutional structure in Punjab. The results show that climate change funds are not utilized to incentivize the farmers and institutional development in Punjab, [4], [46]. The farmers can attain more benefits from institutional setup and easy access to climatic information to increase agriculture productivity. The coefficient value of the variable Punjab government climatic response is negative and significant. This shows that the Punjab government has a negative impact on institutional development. The government policy regarding farmers' awareness and education about climatic challenges is farmers in Punjab, Pakistan. But in reality, farmers are not satisfied with the Punjab government's actions on climatic change knowledge disbursement among the farmers, [33].

(ii) Satisfied Estimates

In the case of satisfied estimates, most of the variables have similar outcomes with strongly satisfied estimates. The empirical estimate shows that the slope coefficient of variable laws and regulations is consistent with strongly satisfied estimates. The role of climate change resilient institutes is weak because of poor climate change laws and their implementation. The coefficient value of the variable ‘weather and disaster alert’ is statistically significant and positive, whereas the outcomes are consistent with results of strongly satisfied. The farmers are satisfied with the working procedure of weather and disaster alert institutes, [1], [9], [26], [70]. The coefficient values of NGOs have no significant impact on the institutional setup and development of climate change-resilient institutes in Punjab. The slope coefficient of the variable international organizations is negative and statistically significant. The agrarian's satisfaction level with international organizations is negative, so the results are consistent with strongly satisfied results. The outcomes are in line with the findings of some studies, [23], [46], in which it has been argued that the international organizations on CC have not diffused the information to farmers on time and have a very limited and unproductive role in information disbursement to the farmers in Punjab, Pakistan. Consistently, the estimated coefficient of climate-related funds and community-level intervention shows an insignificant impact on institutional structure in Punjab. Further, the estimates of the Punjab government's response to climatic changes are negative and significant, which emphasizes that government policies are just papers and are not working at the field level to facilitate the farmers about climatic challenges, [70].

(iii) Neutral Estimates

In the case of neutral responses, the estimated coefficient has a consistent outcome with strongly satisfied results, except ‘community interaction’ and ‘climatic funds’ variables. The results of neutral choices show that the slope coefficient of the variable ‘laws and regulations’ has a negative (-0.80) and significant (0.006) relationship with climate-resilient institutional structure in Punjab, The results indicate that the lack of laws and regulations, the climate change resilient institute cannot functioning properly. The negative coefficient of law and regulation highlights that farmers do not have information about the functioning and importance of climate-resilient institutions in the province. The policy development should not be considered as an achievement; execution of the climate change policy is highly needed, [24], [46]. The coefficient value of ‘community-level’ interaction is positive and significant, so community-level interactions have a neutral response in the development of climate-resilient institutes in Punjab. This indicated that at the community level, people do not have information about climatic institutions and their functional role for the farmers, [9], [28]. Similarly, the coefficient results of climate-related funds are inconsistent with strongly satisfied results and show a significant impact in climate-resilient institutes in Punjab. The results show that climate change funds are not working for institutional development in Punjab even farmers are not aware of climatic funds. The coveted outcomes of climate fund utilization are not being attained because of poor management and misuse of available funds.

(iv) Dissatisfied Estimates

In the case of dissatisfied estimates, one variable is significant (Punjab Government response), while all other variables are insignificant and have inconsistent results with strongly satisfied results. The coefficient value of the 'Punjab government' has a positive and significant impact on climate-resilient institutional setup. This indicates that farmers are dissatisfied with the functioning of government climate institutions in Punjab. The results are consistent with the outcomes of [33], [70], who argued that the government has a poor institutional structure for the framers to provide knowledge about climate vulnerability. The insignificant behavior of other indicators shows that all the variables have consistency in a dependency relationship with the climatic institutional setup in Punjab. This highlights that the results address the policy message, and there is no contradiction in estimated outcomes.

5 Conclusion and Policy Recommendations

Broadly speaking, climate vulnerability increases agriculture uncertainty, which ultimately reduces agriculture productivity. Temperature variation, changing patterns in precipitation, mutable sowing, and harvesting time create an alarming situation for agriculture productivity in the province. Based on the results of multinomial logistic regression, it is concluded that the farmers' perception of climate change is dependent on per-hectare yield. As the per hectare yield increases the farmer's vulnerability to climate change declines over time. The farmers strongly agreed that increasing temperature is destroying the sowing and harvesting pattern of the crop as the favorable temperature is highly essential for agricultural productivity. The farmer's perception of night temperature is positive. They concluded that night temperature affects the soil moisture. The coefficient value of the variable 'harvesting and sowing time' has a negative impact on farmer's climatic vulnerability. The farmers held the opinion that changing the sowing and harvesting cycle caused the agriculture productivity negatively. The coefficient value of crop varieties has an insignificant impact on agriculture climatic vulnerability. This shows that the agricultural crop varieties are not climate resistant to protect output and grow smoothly in varying/harsh environments. The farmers' perception of the role of extension services is negative. The extension department failed to educate the farmers, disseminate the climate information, and guide the farmers about the vulnerable effects of upcoming weather. The results indicate that women farmers are vulnerable to climate change. This is so because women farmers have limited roles in managerial activity and decision-making in cultivation. The small farmer's perception of adaptive measures of climatic challenges is negative because the small farmers with small landholders lack the resources and information about climatic challenges.

It is concluded that the farmers are not satisfied with the functioning of climate-resilient institutions. They are not satisfied with the 'laws and regulations' of climate institutions. They do not have information about the functioning and importance of climatic resilient institutions in Punjab. They are not satisfied (even unaware) with government and climate-resilient institutional structure and their responsibility to educate the farmer about vulnerable climate. Farmers are dissatisfied with the performance and functioning of research institutions and NGOs in Punjab. The coefficient values of NGOs have a negative and insignificant impact on institutional setup and development of climate change resilient institutes in Punjab in case of neutral response. The results show that climate change funds are not utilized for climate institutional development in Punjab. Another coefficient value shows that the Punjab government has a negative impact on institutional structure building. Following policy recommendations may be taken up with an appropriate effective implementation plan:

1. The government and research institutions should focus on the development of crop varieties to be drought-resistant, heat-resistant, and absorb climate shocks.
2. It is a challenge for policy experts, research institutes, and NGOs to predict new sowing and harvesting patterns to avoid detrimental CC in the agriculture sector of Punjab, Pakistan.
3. The extension department should educate the farmers, about the sowing and harvesting pattern of crops that could help in increasing productivity.
4. Government should develop the coordination between climate-resilient institutions and agrarians to introduce new climate zones, through which farmers can

adopt alternative crops according to a particular climate.

5. The performance of public-private partnerships may be helpful to protect climate vulnerability.
6. The government should focus on the appropriate allocation of climate funds and their utilization through public-private partnerships.
7. The government can also increase the adaptation measures through a suitable credit policy for the farmers in Punjab Pakistan.

6 Limitation and Way forward

This research has been pursued with maximum efforts within the stipulated time period. Due to financial constraints, the sample size could not be widely extended to the highest optimal level. Lack of education and ignorance on the part of many of the respondents, the important information could not be retrieved. The variation across District and Tehsil levels might not be fully addressed. The main focus was on male farmers. In the future, it would be more appropriate to follow a gender-sensitive approach in such field surveys by focusing on the exclusive impact of climate change on rural women. Similarly, in future climate studies, all the quantitative analysis should be testified through the prism of opinion and perception of all key stakeholders, particularly the farming community. Some minute issues may also be highlighted if Focus Group Discussions (FGDs) and in-depth interviews are arranged with the farmers. This is how the research gaps that remained unfilled in terms of sample errors and structural issues of time series data may be addressed reasonably.

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APPENDICES

Table 1. Study districts of Punjab, Pakistan

Attock	Bahawalnagar	Bahawalpur	Bhakkar	Chakwal	Chiniot
D.G.Khan	Faisalabad	Gujranwala	Gujrat	Hafizabad	Jhang
Jhelum	Kasur	Khanewal	Khushab	Lahore	Layyah
Lodhraan	Mandi Bahuddin	Mianwali	Multan	Muzaffargarh	Nankana Sahib
Narowal	Sahiwal	Okara	Pakpattan	Rahim Yar Khan	Rajanpur
Rawalpindi	Sargodha	Sheikhupura	Sialkot	T.T.Singh	Vehari

Table 2. Summary statistics

Sr. No	Variables	N	Mean	Minimum	Maximum	Std. Deviation
D1	Respondent Age	351	44.37	22.0	75.0	9.96
D2	Acres of land holding	360	18.42	0.0	147.0	19.99
P1	Vulnerability to CC	360	1.78	1.0	5.0	0.85
P2	Per Hectares Yield	360	2.180	1.0	5.0	0.98
P3	Increase in temperature	360	1.76	1.0	5.0	0.69
P4	Lack of precipitation	360	1.79	1.0	4.0	0.76
P5	Night temperature	360	2.36	1.0	5.0	0.97
P6	Sowing Time	360	2.18	1.0	5.0	0.94
P7	Harvesting Time	360	2.23	1.0	5.0	0.90
P8	Crop Varieties	360	2.42	1.0	5.0	0.92
P9	Extension Services	360	2.80	1.0	5.0	0.99
P10	Women Farmer	360	2.75	1.0	5.0	1.00
P11	Adaptation measures	360	2.82	1.0	5.0	1.14
P12	Small Farmers Vulnerability	360	2.16	1.0	5.0	1.10
P13	Extreme Events	360	3.37	1.0	5.0	1.21
P14	Soil Fertility	360	3.51	1.0	5.0	1.21
P15	Farming Migration	360	2.54	1.0	5.0	1.14
S1	Punjab Government	360	2.95	1.0	5.0	1.12
S2	Institutional Structure	360	3.14	1.0	5.0	1.02
S3	Laws & Regulation	360	3.32	1.0	5.0	1.11
S4	Research Institutes	360	3.18	1.0	5.0	1.13
S5	Weather Mechanism	360	2.81	1.0	5.0	1.23
S6	NGOs	360	3.26	1.0	5.0	1.02
S7	International Organizations	360	3.18	1.0	5.0	1.10
S8	Community Interventions	360	3.01	1.0	5.0	0.99
S9	Climate Funds	360	3.46	1.0	5.0	1.14
S10	Public Private Partnership (PPP)	360	3.35	1.0	5.0	1.07

Where D's represent the demographic variables, P's represent the variables about the farmer's perception regarding CC, and S's are used for farmer satisfaction level about policy adoption related to CC.

Respondent age was measured in years, while the land holding of the farmers was measured in the number of acres. The variables representing the farmer's perception of climate change were measured on a Likert Scale of strongly agree to strongly disagree with the range starting from 1 to 5. The variables related to the farmer's satisfaction with climatic resilient institutions and policies were also measured on a Likert scale of strongly satisfied to strongly dissatisfied with the range starting from 1 to 5.

Source: Author's Calculation.

Table 3. Model processing summary

Scale	Agriculture's Vulnerability to Climate Change		Farmer's Satisfaction with Climate Resilient Institutes	
	N	Marginal Percentage	N	Marginal Percentage
Strongly Agree	150	41.7	15	4.3
Agree	163	45.3	84	23.9
Neutral	28	7.8	119	33.9
Disagree	14	3.9	103	29.3
Strongly Disagree	5	1.4	30	8.5
Valid	360	100.0	351	100.0

Source: Author's Calculation.

Table 4. Model fitted information

Test	Agriculture's Vulnerability to Climate Change	Farmer's Satisfaction with Climate Resilient Institutes
Likelihood Ratio Tests		
Chi-Square	119.526 (0.000)	222.724 (0.000)
Goodness-of-Fit		
Pearson	1414.236 (0.036)	1424.45 (0.000)
Deviance	667.713 (1.000)	837.43 (1.000)
Pseudo R-Square		
Nagelkerke	0.317	0.499
Cox and Snell	0.283	0.470

Table 5. Estimated coefficient of agriculture vulnerability to climate change in Punjab

Scale	Variables	Coefficient	Std. Error	Wald	Sig.	Odd ratios
S.A	Intercept	25.05	9.37	7.14	0.01	
	Per Hectares Yield	-2.199	0.746	8.688	0.003	0.111
	Increase in temperature	-2.732	1.254	4.744	0.029	0.065
	Night temperature	-0.261	.621	.177	0.674	0.770
	Harvesting Time	-1.800	0.957	3.535	0.060	0.165
	Crop Varieties	0.928	0.909	1.042	0.307	2.529
	Extension Services	-1.486	0.902	2.718	0.099	0.226
	Women Farmer	1.106	0.834	1.758	0.185	3.023
	Small Farmers Vulnerability	-1.369	0.757	3.276	0.070	0.254
	Soil Fertility	-0.195	0.631	0.096	0.757	0.823
A	Intercept	25.114	9.362	7.196	0.007	
	Per Hectares Yield	-2.065	0.745	7.686	0.006	0.127
	Increase in temperature	-2.366	1.248	3.595	0.058	0.094
	Night temperature	-0.033	0.617	0.003	0.957	0.968
	Harvesting Time	-1.861	0.955	3.802	0.051	0.155
	Crop Varieties	0.888	0.907	0.957	0.328	2.430
	Extension Services	-1.606	0.900	3.185	0.074	0.201
	Women Farmer	0.790	0.832	0.903	0.342	2.203
	Small Farmers Vulnerability	-1.238	0.754	2.695	0.100	0.290
	Soil Fertility	-0.409	0.628	0.425	0.515	0.664
N	Intercept	20.122	9.412	4.571	0.003	
	Per Hectares Yield	-1.720	0.757	5.160	0.023	0.179
	Increase in temperature	-1.953	1.266	2.381	0.123	0.142
	Night temperature	-0.235	0.645	0.133	0.715	0.790
	Harvesting Time	-1.462	0.974	2.252	0.133	0.232
	Crop Varieties	1.096	0.925	1.405	0.236	2.993
	Extension Services	-1.238	0.912	1.841	0.175	0.290
	Women Farmer	0.611	0.848	0.519	0.471	1.842
	Small Farmers Vulnerability	-1.129	0.766	2.172	0.141	0.323
	Soil Fertility	-0.479	0.639	0.561	0.454	0.619
D.A	Intercept	16.332	9.421	3.005	0.083	
	Per Hectares Yield	-1.910	0.779	6.011	0.014	0.148
	Increase in temperature	-1.442	1.298	1.234	0.267	0.236
	Night temperature	0.100	0.666	0.022	0.881	1.105
	Harvesting Time	-2.094	1.004	4.347	0.037	0.123
	Crop Varieties	1.710	0.954	3.217	0.073	5.531
	Extension Services	-2.403	0.964	6.207	0.013	0.090
	Women Farmer	1.104	0.873	1.600	0.206	3.017
	Small Farmers Vulnerability	-.541	0.784	0.476	0.490	0.582
	Soil Fertility	-.404	0.670	0.363	0.547	0.668

Whereas S.A is Strongly Agree, A is Agree, N is Neutral and D.A is Disagree

Source: Author's Calculations

Table 6. Results of farmer's satisfaction about climatic institutional development

	Variables	Coefficient	Std. Error	Wald	Sig.	Odds
S.S	Intercept	15.30	2.93	27.19	0.00	
	Laws & Regulation	-1.304	0.421	9.595	0.002	0.272
	Weather Mechanism	0.920	0.301	9.307	0.002	2.508
	NGOs	-0.441	0.418	1.113	0.291	0.643
	International Organizations	-0.724	0.426	2.890	0.089	0.485
	Community Interventions	0.266	0.425	0.390	0.532	1.304
	Climate Funds	-0.564	0.412	1.869	0.172	0.569
	Punjab Government	-2.502	0.536	21.825	0.000	0.082
S	Intercept	12.243	2.286	28.676	0.000	
	Laws & Regulation	-0.913	0.306	8.881	0.003	0.401
	Weather Mechanism	0.503	0.239	4.433	0.035	1.653
	NGOs	-0.456	0.307	2.213	0.137	0.634
	International Organizations	-0.554	0.320	2.997	0.083	0.574
	Community Interventions	0.199	0.281	0.499	0.480	1.220
	Climate Funds	-0.395	0.280	1.989	0.158	0.673
	Punjab Government	-1.579	0.292	29.181	0.000	0.206
N	Intercept	8.491	2.208	14.787	0.000	
	Laws & Regulation	-0.807	0.291	7.674	0.006	0.446
	Weather Mechanism	0.578	0.219	6.994	0.008	1.783
	NGOs	-0.516	0.294	3.076	0.079	0.597
	International Organizations	-0.177	0.304	0.337	0.562	0.838
	Community Interventions	0.555	0.260	4.551	0.033	1.742
	Climate Funds	-0.229	0.267	0.740	0.390	.795
	Punjab Government	-1.258	0.268	22.033	0.000	0.284
D.S	Intercept	3.512	2.105	2.784	0.095	
	Laws & Regulation	-0.156	0.280	0.310	0.578	0.856
	Weather Mechanism	0.190	0.202	0.890	0.345	1.209
	NGOs	-.338	0.282	1.436	0.231	0.713
	International Organizations	0.038	0.293	0.017	0.897	1.039
	Community Interventions	0.200	0.237	0.716	0.398	1.222
	Climate Funds	-0.020	0.254	0.006	0.937	0.980
	Punjab Government	-0.518	0.247	4.378	0.036	0.596

Here S.S is Strongly Satisfied, S is Satisfied, N is Neutral and D.S is Dissatisfied

Source: Author's Calculation.

Contribution of Individual Authors to the Creation of a Scientific Article (Ghostwriting Policy)

This is the part of the research project in which Z.S.R. pursued his M.Sc. (Climate Change) at University College London (UCL), UK. I. H. diligently articulated some of the fundamental ideas in the synopsis of this paper. A.S. pursued quite carefully all the literature review and questionnaire development for this research project. M.U. worked on data collection, data compilation, data analysis, write-up of methodology, results, and discussion and conclusion. L.K.A, M.U., and N. M worked on the reviewer's comments incorporation and revised the whole manuscript in the light of the reviewer's comments. S.S. took great care of the field affairs in data collection and methodological considerations. N.M. and L.K.A reviewed the manuscript and worked as corresponding authors.

Consent to Participate:

The respondents were briefed about the research purpose and then the interview was conducted upon their full willingness to provide the requested information.

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Conflicts of Interest

The authors declare no conflict of interest.