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# Factors Affecting Farmers' Adoption of Drought Hazard Coping Strategies in the Context of Climate Change: Evidence from Drought Prone-Areas of Punjab-Pakistan

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**ABSTRACT**

Climate change severely affected agrarian economies while developing countries particularly those having a major dependency on agriculture were rigorously influenced. In a couple of decades, agriculture has undergone substantial yield and productivity losses owing to severe disasters and risks of drought hazards. The significant objective of this research is to examine the farmer's socioeconomic determinants and preferences of farmers about climate change adaptation strategies. A multivariate probit model was used for empirical estimation of the independent variables and farmers' assessments to apply the adaptation strategies. Estimates of the study illustrated soil conservation, rainwater harvesting, ponds, spillway terraces, and changing dates of crop planting were particular approaches applied by farmers to cope with drought risks. Moreover, socioeconomic determinants played a considerable role in the adoption of these drought-based strategies. In the scenario of such empirical findings, farmers must be educated and provided more easy access to climate change information, usage of climate-based apps, print media, electronic media, and social media for developing strategies and mitigation measures to overcome the severe impacts of drought.



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## 1. Introduction

From the global perspective, the current era has estimated a perceptible increase in the magnitude and occurrence in climate persuaded hazards such as drought, floods, wildfire, landslides, heat waves and storms (Ahmad & Afzal, 2022; H. C. Teo et al., 2019; Wheeler & Lobley, 2021). Dynamic climatic variations with enhancing temperature, prolonged drought and erratic rains have increased hazards vulnerability (Brenes, Fornaguera, & Sequeira-Cordero, 2020; Lecina-Diaz et al., 2021; Muricho, Otieno, Oluoch-Kosura, & Jirström, 2019) because of consecutive encounters in the environment and humans which amplified the severity of human livelihood status in this susceptible hazards world (Week & Wizor, 2020; Zhang et al., 2018).

In various climatic extremes, drought is always severe and recurrent increasing global temperature that causing higher demand for precipitation (S. Abbas, 2022; Alisha A Shah et al., 2021). Tsunamis, earthquakes and flood disasters are related to a particular region from a global perspective (Shirazi, Mei, Liu, & Liu, 2022) while drought severity is a worldwide phenomenon that can target any region or area of the world (Week & Wizor, 2020). Water scarcity gradually circumstances varying from some months to make longer years are known



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as drought (Ahmad, Afzal, & Rauf, 2021; Kreft, Eckstein, & Melchior, 2016). Forest fire is considered a long-lasting aspect of drought (Sam et al., 2021) while fodder supply decline, poor growth of pastures and crop production losses are direct outcomes of short-term phenomena of drought(Ahmad & Afzal, 2021; IPCC, 2020a). From a global perspective, each region confronted with drought destruction losses (Ahmad & Afzal, 2022) such as the Caribbean, Latin America and African countries faced agricultural losses of almost $13 billion from 2005 to 2015. Asian region faced an agriculture cost of $29 billion from 2005 (Bank, 2021). The European nations confronted annual agriculture costs of €6.2 billion (EED, 2017) while the USA faces annual agricultural losses of $8 billion (NCDC, 2015). During the year 2006 to 2016, particularly in developing countries, 80% of agricultural losses were based on natural disasters while from an overall damages perspective, 23% of losses were because of natural disasters (FAO, 2019; IPCC, 2020b). (FAO, 2019)

Pakistan's economic scenario during a couple of decades was extremely destabilized because of the severe effects of natural disasters such as drought (NDMA, 2020). More particularly the significance of the present study is to understand how climate change caused the farming community to face a wider range of risks (Tariq, Rajabi, & Muttil, 2021). The susceptibility to climate change can be reduced and output levels can be maintained by adopting climate-based adaptations farming measures (N. A. Khan, Gao, Abid, & Shah, 2021), the significant number of farmers according to their perceived capabilities and vulnerability perception adopting climate-based strategic measures (Paudel, Wang, Zhang, Rai, & Paul, 2021; Zhang et al., 2018). The agriculture sector and the population associated with cultivation for their livelihood (Arbuckle et al., 2013; Week & Wizor, 2020) have to countenance rigorous grave penalties for the reason that of climate-induced risks and disasters (Gerkensmeier & Ratter, 2018).

In Pakistan, agriculture not only supplies the dietary needs of the country's inhabitants, industrial sector raw materials while contributing 18.5 percent of the country's GDP[1] and 38.5 percent of employment to the labor force of the nation (PBS, 2021). Drought, floods and fire are some significant climate-induced disasters that severely affect and cause major destruction in the agriculture sector of Pakistan (Ahmad, Kanwal, & Afzal, 2022; Ali, 2017; Eckstein, Künzel, Schäfer, & Winges, 2019; A. Khan, Ali, Shah, Khan, & Ullah, 2019). Agriculture is considered the backbone of Pakistan’s economy where rural communities required an appreciation of the significance of adaptation clarification to climate change (M. Teo, Goonetilleke, Ahankoob, Deilami, & Lawie, 2018) where put in practice climate change is a fraction of agricultural adaptation (Ahmad & Afzal, 2020). Reactive or reactionary adaptation practices, public and private adaptations, planned adaptation, self-directed adaptation and anticipatory adaptations are some forms of adaptation strategies particularly applied (Roka, 2019). In the context of managing climate change risks in agriculture particular policies such as farm-based measures are considered to be more effective (Ahmad & Afzal, 2019; Hassan & Nhemachena, 2008). In the aspect of handling and minimizing the effects of increasing precipitation and temperature from a global perspective the role of agricultural adaptation has become more serious and critical (Pradeep & Mendelsohn, 2007; Ashfaq Ahmad Shah et al., 2021). For enhancing adaptive capacity and resilience among farming communities need to promote capturing and limiting the damages from the severe influence of climate change(FAO, 2019). From the Agricultural perspective for reducing climate change's harmful consequences among other policy options, the adaptation measures option is more productive (Ozor, Madukwe, Enete, & Amaechina, 2012).

The research gap of the study is that in previous research work climate change picture conversed with different aspects, as some studies discussed climate change mitigation strategies (Baills, Garcin, & Bulteau, 2020; Ollikainen, Lankoski, & Lötjönen, 2020), climate change assessment (I. Khan et al., 2020; Kongsager, Locatelli, & Chazarin, 2016) and climate change feasible adaptation strategies (Mugi-Ngenga et al., 2021; Yaqoob et al., 2022). The climate change aspect illustrated various hazards such as flood hazards (Ahmad & Afzal, 2020, 2022) and riverbank erosion (Ashraf & Shakir, 2018; Hoq, Raha, & Hossain, 2021; I. Khan et al., 2020; Markou et al., 2020) while climate change drought hazards aspect, particularly to Punjab province not properly addressed in the literature. In such a scenario to detect this

[1] Gross Domestic Product

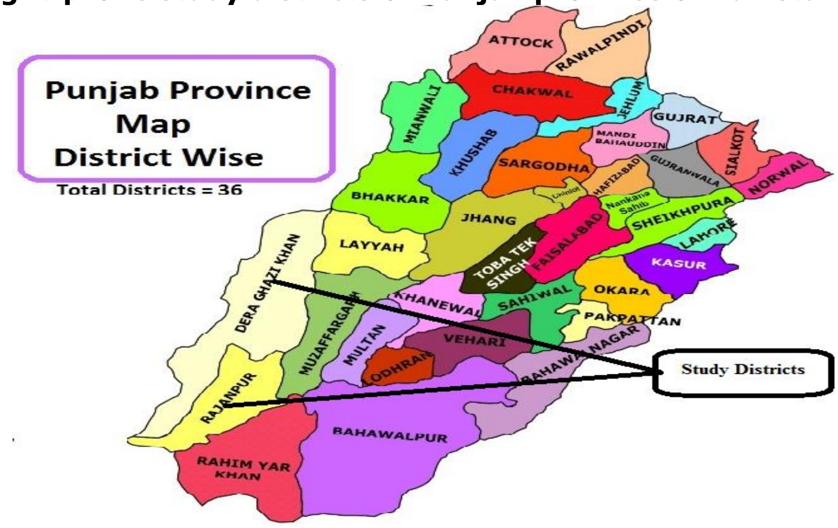
research breach, this study pays attention to examining the climate change farmer's adoption of coping adjustment strategies in drought prone-areas of Punjab, Pakistan. This study work is categorized into four sections the first section elaborated on the introduction, material and methods discussed in the second section, the third section indicated the empirical estimates and discussion and the study the last section consists of the conclusion and suggestions.

## 2. Materials and Methods

### 2.1 Study Area for Research

For several substantial factors, Punjab is further favored in selected for this research work. In the first aspect, Punjab is privileged for the reason of covering 26% area, is mainly populated at 52.95% and contributes 53% to the agricultural GDP of the country (BOS, 2018; PBS, 2021). In the second aspect, Punjab to a certain extent than other provinces appearance increasing sternness of natural disasters like drought because of some consecutive eras of drought due to no or limited rains in the province frequently (PDMA, 2019). In the third aspect, rain-fed areas southern Punjab region in the province is mainly considered owing to confronted severe drought in the province-focused study (NDMA, 2020; PBS, 2021). In the fourth aspect, the region of southern Punjab, the two lowest irrigated and rain-fed land districts Rajanpur and Dera Ghazi Khan were mainly considered because these districts frequently face drought owing to limited rain and the majority population of such districts mainly affianced in farming practices for their livelihood as indicated in figure 1.

**Figure 1: Drought-prone study districts of Punjab province of Pakistan**




### 2.2 Geographical Features of the Study Area

Rojhan, Rajanpur, and Jampur are three tehsils of district Rajanpur with 1.99 million population, 12318 km$^2$ area and consists of 69 union councils (PBS, 2021). Rajanpur district has mostly 119mm average rainfall, hot and long summers with the highest 52 ˚C and lowest 1˚C temperature with mainly considered mild winter throughout the seasons (PDM, 2019).

### 2.3 Data Collection and Sampling Technique

In this study multistage sampling methodology was applied for the collection of data with several perspectives in the first stage, owing to significant numbers of 13 districts out of 36 districts of Punjab having rain-fed areas and limited irrigation land which frequently confronted with drought as purposively chosen for the study in four provinces for this research work (PBS, 2021; PDMA, 2018). Secondly, in Punjab, southern Punjab districts are mainly favored in this research work owing to the higher vulnerability to recurrent drought (BOS, 2019). In the third stage, two drought-prone districts Rajanpur and Dera Ghazi Khan among thirteen drought-prone districts of Punjab were better preferred for this research work because of their raised sternness of drought hazards (PDMA, 2019) as illustrated in the abovementioned Figure 1. In the fourth stage, related to rising drought hazard susceptible two tehsils from each district and from each tehsil two union councils were preferred related to available information handover by DDMA[2], the local officer of land record (patwari) and the agricultural officer. In the last stage, related to drought destruction and severity from every

[2] District Disaster Management Authority

union council three villages were preferred and almost sixteen respondents were erratically preferred and were interviewed regarding study objectives and developed questionnaires.

The size of the sample is indicated as SS in equation 1 wherever Z(±1.96 at 95%) showed a confidence interval intended for point selection, percentage preferences as p, (0.5 applied requisite sample size) elucidate decimal and e(0.07 = ± 7) detailed precision value.

$$SS = \frac{Z^2(p)(1-p)}{e^2} \quad (1)$$

Directly interaction approach with household respondents was given priority focus where the pre-tested and well-versed questionnaire was used in the collection of data procedure from October 2020 to January 2021.

## 2.4 Data Analysis

Multivariate and multinomial probit models are mostly used in the empirical estimation related to two or more two possible outcomes concerning models of behavioral response. Advanced irrigation systems, multiple cropping, rearing livestock, pond structures, terrace with spillways, planting date variations, soil conservation practices and harvesting of rainwater are several considerable adaptation approaches mostly applied by farmers in drought-prone areas. Furthermore, the abovementioned adaptation strategies related to farmers' response to adoption rate (higher than 50%) pond structures, terraces with spillways, planting date variations, soil conservation and collecting rainwater were more preferably selected for this research work. The methodology of the multivariate probit model is mostly used when there is considered probably a contemporaneous association among strategies of adaptation (R. Ullah & Shivakoti, 2014). In the situation of association among binary dependent variables for empirical analysis, the more preferable approach is multivariate probit analysis (Xu et al., 2012). Farmers can use multiple adaptation approaches concurrently and enhance odds of simultaneous adaptation (W. Ullah, Nafees, Khurshid, & Nihei, 2019) in such aspect multivariate model approach is considered more appropriate model for empirical estimation of such type of data (Saqib, Arifullah, & Yaseen, 2021). In the estimation of the influence of different independent factors on sampled farmers' decisions to adopt adaptation strategies, a multivariate probit model is applied as indicated in Equation 2.

$$Y_{ij} = X_{ij}\ \beta_j + \varepsilon_{ij,} \quad (2)$$

In the above-mentioned equation alternatives of risk management reported as $Y_{ij}$ (j=1,…..m) where m= 5 confronted by the ith producers (i=,…..n), vectors of observed variables $x`_{ij}$ is a 1×k that affect the assessment to adopt particular adaptation strategies, unknown parameters vectors estimated denoted as $\beta_j$ is k×1 while unobserved error term is as such $\varepsilon_{ij}$. In such aspect, every $Y_j$ is a binary variable and so equation 2 is the system of m equations that will empirically estimate.

$$Y_1^* = \alpha_1 + X_i\,\beta_{i1} + \varepsilon_1 \quad (3)$$
$$Y_2^* = \alpha_2 + X_i\,\beta_{i2} + \varepsilon_2 \quad (4)$$
$$Y_3^* = \alpha_3 + X_i\,\beta_{i3} + \varepsilon_3 \quad (5)$$
$$Y_4^* = \alpha_4 + X_i\,\beta_{i4} + \varepsilon_4 \quad (6)$$
$$Y_5^* = \alpha_5 + X_i\,\beta_{i5} + \varepsilon_5 \quad (7)$$

In the above-mentioned equations 3 to 7, related to five latent variables $Y_1^*$, $Y_2^*, Y_3^*, Y_4^*\ and\ Y_5^*$ underlying each of the adaptation strategies about decisions of adaptations. In adoption decisions of every adaptation strategy with latent five variables as indicated from equation 3 to equation 7 reporting as the $y_j = 1$ as $y^*_j>0$ or otherwise 0. Ponds structures, terraces with spillways, planting dates changing, tillage soil conservation and harvesting of on-farm rainfall were some significant adaptation measures considered as dependent variables in the model as applied in the study area. All such variables were binary considering non-adaptation as 0 while adaptation such strategies as 1. Climate change farmers' understanding applied as binary variable 0 for no application and 1 for application, rainfall variation about farmers perception estimated by 5 Likert scales as 5 very high and 1 very low while status about landholding ownership as a binary variable with 1 owner of land and 0 otherwise so these variables were also considered as independent variables in this research work as signified in Table 1.

**Table 1: Descriptive Analysis of the Variables**

| Study variables | Maximum | Minimum | Percentage | Mean value | Standard deviation | Ranked level |
|---|---|---|---|---|---|---|
| **Dependent Variables** | | | | | | |
| Harvesting of rainwater | 1 | 0 | 89 | ------- | ------- | 1 |
| Planting dates changing | 1 | 0 | 74 | ------- | ------- | 2 |
| Conservation of soil | 1 | 0 | 67 | ------- | ------- | 3 |
| Ponds | 1 | 0 | 64 | ------- | ------- | 4 |
| Spillways terraces | 1 | 0 | 57 | ------- | ------- | 5 |
| **Independent Variables** | | | | | | |
| Respondent age (in years) | 84 | 23 | ------- | 48.21 | 16.19 | ------- |
| Schooling of respondents (in years) | 18 | 0 | ------- | 5.29 | 5.98 | ------- |
| Farming experience (in years) | 63 | 4 | ------- | 24.87 | 13.76 | ------- |
| Family members' dependency (in numbers) | 8 | 2 | ------- | ------- | ------- | ------- |
| Monthly income overall in PKRs | 123,587 | 7481 | ------- | 33,856.71 | 16,974.46 | ------- |
| Ownership of land | 1 | 0 | 79 | ------- | ------- | ------- |
| Size of landholding (in acres) | 21.7 | 0.37 | ------- | 3.98 | 2.81 | ------- |
| Erratic rains | 6 | 1 | ------- | 4.16 | 1.53 | ------- |
| Climate change information | 1 | 0 | 83 | ------- | 0.47 | ------- |

## 3. Results and Discussion

The study variables précis figures illustrated in Table 1, elaborated the most relevant adaptation measures applied to coping severe effects of drought hazards. In this research area, the mainly prevalent strategy is 89% harvesting of rainwater for coping with the severe effects of drought hazards while planting dates changing 74% considered the second most applied strategy as illustrated in the results of the study.

In Table 2, related to multivariate probit model correlation coefficients are illustrated as indicating the five-adaptation strategies equation pairwise correlation in error terms. Estimates elaborated the overall significant and positive correlation coefficients signifying as a single strategy adaptation application endorses further adaptation strategies. In this study, the Multivariate probit model was applied for empirical estimates with the appropriate justification of significant likelihood ratio, Wald chi test and correlation coefficient having significance. Furthermore, the absence of multicollinearity was detected as all computed having values of variance inflation factors (VIF) less than 5.

**Table 2: Multivariate Probit Model Correlation Coefficients**

| Respondents adaptation strategies | Coefficient Correlation |
|---|---|
| Rho21= Harvesting rainwater and conservation of soil | 0.129***<br>(0.136) |
| Rho31= Harvesting rainwater and dates of crop planting | 0.284***<br>(0.152) |
| Rho41= Harvesting rainwater and ponds | 0.113**<br>(0.139) |

| | |
|---|---|
| Rho51= Harvesting rainwater and spillways with terrace | 0.117*** (0.128) |
| Rho32= Conservation of soil and planting crops | 0.371*** (0.144) |
| Rho42= Soil conservation and ponds | 0.497** (0.123) |
| Rho52=Soil conservation and spillways with terrace | 0.189*** (0.131) |
| Rho43= Dates of planting crops and ponds | 0.398** (0.119) |
| Rho53= Dates of planting crops and spillways with terrace | 0.417*** (0.135) |
| Rho54= Ponds and spillways with terrace | 0.381** (0.126) |
| Wald test $chi^2$ | 69.57 |
| p-value $chi^2$ | 0.000 |
| Observations numbers | 398 |

Note: ***,**,* indicated the 1 percent, 5 percent and 10 percent level of significance, Figures related to parenthesis illustrated the standard errors

### 3.1 Factors to Determine Rainwater Harvesting Adaptation

In Table 3, empirical estimates indicated a farming schooling coefficient value of 0.0024 and $p < 0.01$ significant and positively related to rainwater harvesting indicating as a rise in farming schooling possibility increases the adaptation of rainwater harvesting. Farmer's schooling rises human capital regarding their capability and awareness of climate change which motivates the farmers to have accepted coping mechanisms for climate change hazards as such outcomes are in line with the research work of (Adhikari et al., 2018; Ashraf Vaghefi, Mousavi, Abbaspour, Srinivasan, & Yang, 2014; Deressa, Hassan, & Ringler, 2011).

A farmer’s monthly income is significantly and positively associated with the adoption of rainwater harvesting strategies indicating as a farmer's rise in monthly income motivates farmers to more adoption of rainwater harvesting strategies to coping the severe effects of drought hazards. Income is considered the significant risk mitigation source to contest drought risk which induces farmers to purchase and use more risk-coping technologies for harvesting rainwater strategy as such empirical outcomes are alike to the research work of (Adhikari et al., 2018; Rehima, Belay, Dawit, & Rashid, 2013; Salmoral et al., 2020). Positive and significant estimates of land ownership indicated as farmers having their land more willing to adopt of rainwater harvesting strategy as the coping measure of drought risk rather than tenant farmers as such findings are consistent with the research work of (M. K. Khan, Trinh, Khan, & Ullah, 2022; Kukkonen & Pott, 2019).

### 3.2 Significant Factors to Determine Soil Conservation Adaptation

In farming practices in the aspect of conservation of tillage and fallow soil conservation strategies are mostly applied which rise 5% to 30% soil moisture and cover 30% of soil with crop residue (Blum, 2005). From a global perspective, a more feasible and applied strategy considered by farmers is soil conservation (Akinnagbe & Irohibe, 2014). Climate and environmental dynamics have particularly promoted environmental schooling and more focus on agricultural adaptation. Estimates of the factors that affect soil conservation in the research area were highlighted in Table 3 elaborated as significant and positive coefficient 0.027 with $p<1$ of farmers schooling indicated considerable function in climate change adaptation approach where inadequate schooling causes insufficient application of in hand resources. Well, literate farmers more focus on climate-induced adaptation strategies as such findings are alike to the research work of O’Neill et al. (2020).

**Table 3: Estimated Results of the Multivariate Probit Model**

| Independent Variables | Harvesting Rainwater | Conservation of Soil | Planting Dates Changes | Ponds | Terrace with Spillways |
|---|---|---|---|---|---|
| Respondent age | 0.0081 (0.0149) | 0.004 (0.021) | 0.031** (0.019) | 0.028*** (0.001) | 0.037*** (0.001) |

| | | | | | |
|---|---|---|---|---|---|
| Schooling of respondents | 0.024*** | 0.027** | 0.002 | 0.013 | 0.029 |
| | (0.001) | (0.011) | (0.024) | (0.021) | (0.016) |
| Farming experience | -0.031 | 0.009 | 0.043** | -0.006 | 0.026** |
| | (0.016) | (0.016) | (0.021) | (0.018) | (0.013) |
| Family members dependency | 0.0514 | 0.183*** | 0.031** | -0.081 | -0.076 |
| | (0.089) | (0.067) | (0.079) | (0.037) | (0.064) |
| Monthly income overall in PKRs | 3.97X10$^{-6*}$ | 7.04X10$^{-5*}$ | 5.23X10$^{-6**}$ | 1.76X10$^{-6}$ | 6.73X10$^{-7}$ |
| | (6.99X10$^{-6}$) | (3.06X10$^{-5}$) | (6.21X10$^{-6}$) | (4.82X10$^{-6}$) | (5.34X10$^{-7}$) |
| Ownership of land | 0.286*** | 0.436*** | 0.398** | 0.147*** | 0.034 |
| | (0.117) | (0.038) | (0.174) | (0.051) | (0.027) |
| Size of landholding | -0.003 | -0.018 | 0.002 | 0.029*** | 0.048** |
| | (0.029) | (0.026) | (0.036) | (0.012) | (0.023) |
| Erratic rains | 0.678** | 0.379** | 0.427* | 0.897 | 0.273 |
| | (0.499) | (0.298) | (0.28) | (0.264) | (0.298) |
| Climate Change Information | 0.496* | 0.514** | 0.794** | 0.199 | 0.513*** |
| | (0.297) | (0.267) | (0.297) | (0.237) | (0.247) |
| Constant | 1.24 | 0.697 | 0.197 | 1.87** | 0.489 |
| | (0.681) | (0.511) | (0.598) | (0.63) | (0.591) |
| Log-likelihood | | | -598.73 | | |
| Wald test chi$^2$ | | | 78.94 | | |
| p-value chi$^2$ | | | 0.001 | | |
| Observation | | | 398 | | |

Note: ***,**,* indicated the 1 percent, 5 percent and 10 percent level of significance, Figures related to parenthesis illustrated the standard errors

### 3.3 Significant Factors for Considering Crop Planting Dates Change as an Adaptation Strategy

Crops planting date changes mean farmers about their experience with past climate change vary the growing and planting dates which play a significant role in the productivity of crops and more feasible to cope with climate severity (J. Abbas, Aman, Nurunnabi, & Bano, 2019). Factors affecting the plating dates of crops which are mostly practiced by the farming community elaborated on in Table 3. In empirical estimation, the relationship in crop plating dates changes in the model six variables out of nine variables was estimated as significant. Age variable estimated the positive and significant coefficient value 0.031 with p<1illustraing as aged farmers are more willing to use the livelihood adaptation to climate-induced strategies such as changing planting dates rather than young ones as these findings are alike with research work of R. Ullah and Shivakoti (2014); W. Ullah et al. (2019) while in not similar to the study of (Ali, 2017; Eckstein et al., 2019).

### 3.4 Significant Factors to Determine Ponds Adaptation

In the procedure of climate-induced adaptation strategies, pond construction is considered one of the more significant and feasible adaptation measures in climate mitigation strategies. In drought aspect when no rain or dry weather stored water in ponds major source for farming practices and provides farming livelihood while in erratic rain and flood season stores extra water and is a suitable strategy for coping with flood destruction (Ahmad, Afzal, & Rauf, 2019). The positive and significant coefficient of 0.028 with p<0.01of age with ponds construction as a coping strategy illustrated as aged farmers as compared to young farmers more motivated to adopt pond strategy for maintaining farming and mitigating severe effects in drought season as these outcomes are alike with the research work of Ahmad and Afzal (2019, 2021); R. Ullah and Shivakoti (2014).

### 3.5 Significant Factors Determine Spillways Terrace Adaptation

Spillways terrace is considered a significant drought-based adaptation strategy which includes the Drip Bucket Irrigation System (DBIS) as indicated for potentially yielding a more efficient and simple strategy for watering the yards. Seasonal crops and vegetables required more water than other normal crops the DBIS strategy is more feasible and economical from such a perspective. In the adoption procedure of this method, the field is divided into longitude segments and every segment starts with a bucket afterward such water pipeline is connected to a bucket and water is filled in the bucket through a line pipeline routed where the crop is planted in the field. In climate change, the context resilience of soil can be increased through such water management procedures (Kosmowski, Piesik, Piesik, & Śliwiński, 2022). The study estimates in Table 3, indicated the significant and positive coefficient of 0.037 with $p<0.05$ of age with spillways terraces elaborated as aged farmers in contrast to young ones more likelihood of usage adaptation measures such as spillways terraces. Spillways terraces strategy adoption required more technical expertise which is mostly generated with experience so aged farmers have more skills in the adoption of this strategy related to climate-induced disasters such as droughts as such results alike with the research work of (Abid et al., 2021; Alisha A Shah et al., 2021).

## 4. Conclusion and Suggestions

From a global perspective, current scenario climate-induced disasters are more severe destroying human societies in multiple aspects while agricultural productivity is notably affected. More particularly in drought-affected areas because of such climate disasters farming communities engage themselves in numerous risk management strategies as mitigation measures. In climate threat duration farmers' decisions are related to more feasible, appropriate and readily available strategies where a more effective and economical combination of such strategies is chosen. This research work focused on those areas having mostly rain-fed aspects and consecutively facing severe drought disasters. Informative climate-induced adaptation strategies, such as information about climate change, erratic rain risk perception, land ownership, land holding size, farmers' age, family member dependency, farming experience and schooling.

In multiple climates induced adaptation strategies most feasible, appropriate and dominating five adaptation strategies spillways terrace, construction of pond, planting date changes, conservation of soil and harvesting rainwater were investigated. In providing support to the drought-affected farming community in such disasters and formulating policies these findings will be more helpful. In drought-prone areas, it is more appropriate for farmers having up to date climatic variations information through print media, social media, internet, to interact with climate-related authorities to the adoption of timely suitable mitigation measures. Water storages and ponds need to construct by farmers through suitable assistance from the government. Provision of financial benefits and technical assistance for the availability of water in drought season and storing water during the erratic rain season in drought-prone areas by the concerned authorities.

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