JOURNAL FOR SOCIAL SCIENCE STUDIES
An International Peer-Reviewed Open Access Journal

ISSN (Online): 3006-2071 | ISSN (Print): 3006-2063
Volume 4 • Issue 6 • October 2026

CLIMATE RESILIENCE AND POVERTY DYNAMICS IN AGRARIAN BALOCHISTAN: A SOCIO-ECONOMIC ANALYSIS OF SMALLHOLDER FARMERS UNDER SDG FRAMEWORKS

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DOI: https://doi.org/10.5281/zenodo.23311241

Keywords
Climate Change; Poverty; Resilience; Farming Communities; SDGs

Article History
Received: *25 June 2026*
Accepted: *16 September 2026*
Published: *12 October 2026*

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Abstract

Climate change poses severe threats to agrarian communities, particularly in vulnerable regions like Balochistan, Pakistan. This study examines the socio-economic resilience of smallholder farmers in the climate-affected Pishin-Lora Basin, focusing on the interlinkages between poverty dynamics, climate-induced vulnerabilities, and Sustainable Development Goals (SDGs) 1 (No Poverty), 2 (Zero Hunger), and 13 (Climate Action). Using a mixed-methods approach, data were collected from 264 farming households across Pishin and Mastung districts through surveys, key informant interviews, and focus group discussions. Findings reveal low levels of economic resilience, with limited income diversification, poor access to credit, low savings, and high dependency on rain-fed agriculture. Nearly 50% of households have shifted from farming to non-agricultural livelihoods due to climate shocks. Educational attainment correlates positively with climate awareness and adaptive capacity, whereas low-income levels exacerbate vulnerability. The study concludes that enhancing resilience requires integrated interventions aligned with SDGs, focusing on livelihood diversification, access to finance, climate-smart agriculture, and institutional support to mitigate poverty and build adaptive capacity in Balochistan's agrarian communities.

1. INTRODUCTION:

Climate change is one of the most significant challenges faced by the world due to its impacts on different biophysical and social systems causing disturbance for the major food and water sources through temperature surges, droughts, and varying patterns of rainfall (Yamba et al., 2019; Bendell, 2018; Berg & Lidskog, 2018; USGCRP, 2017). It has the most detrimental impacts on poverty and inequality (Ulrichs & Slater, 2016) which has the potential to intensify the already adverse situation of people living in less developed regions (Speranza, 2010). The combination of shocks related to climate change, political instability, and

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global financial crises are understood to be major threats to any advancements made for poverty reduction (Hallegatte et al., 2016; Bastagli, 2014). There is a significant inter-relationship between addressing climate change, and achieving Sustainable Development Goals (SDGs) and focus on pathways towards social, economic and environmental sustainability (LEAD-Pakistan, 2017). For instance, both the Paris Agreement and SDGs establish the inter-relationship between SDGs and climate actions. Besides, an exclusive goal of SDGs 1 and 13 (on poverty and climate change respectively) almost 50 out of 169 targets focus to address climate change and its negative effects, especially on poverty, water, food, economic development, and energy. Therefore, climate change and the achievement of SDGs cannot be addressed separately because they are essentially connected and need to be acted upon via an integrated strategy (Hallegatte et al., 2016) on improving the resilience of communities to cope with risks and disasters. The sustainability of agriculture is focused on two main concepts i.e. resilience and persistence. Resilience establishes the capacity of a system to buffer the stresses and shocks while persistence is the capacity of the system to continue over a long period. Both aspects of sustainable agriculture produce several wider socio-economic and environmental results (Pretty, 2008).

Climate change adversely impact the socio-economic conditions of people who are directly dependent on natural resources for their livelihoods such as agriculture, livestock, and forestry. The socio-economic impacts of climate change are the results of close relations between society and climate and how they affect in turn both the managed and natural environments. Pakistan's vulnerability to the impacts of climate change is acknowledged and documented by many well-reputed organizations and institutes (GoP, 2012). As per the Global Climate Risk Index (GCRI) Report 2019, Pakistan—with a CRI score of 31.50, has been ranked in the top ten countries that are heavily affected by climate change and extreme weather events (Eckstein et al., 2018). The country faced a loss of approximately 3989 million US dollars and suffer up to 141 extreme weather events (EWEs) during a period of 20 years (1994-2013) (Kreft et al., 2015).

Balochistan is the largest province of Pakistan—located in the southwestern region of the country. It has a unique geo-political position having a total area of 347,200 square kilometers. Most of the parts of the province are comprised of mountain ranges (53%) (Ashraf & Sheikh, 2017). In terms of area, the province is the largest in the country (44%), while the smallest in terms of population (only 6% of the total population of the country) (GoP, 2017). The rapid increase in the population and influx migration of refugees from Afghanistan in the last four decades resulted in high demand for water and food in the province (Majeed & Qureshi, 2000). The province is highly vulnerable to water scarcity and hydrological hazards because of its arid climatic conditions (Jamro et al., 2019). Ashraf et al. (2014) claim that 85% population of the province has agriculture as its primary source of income. Groundwater and flood water are the only sources of water available for agriculture, domestic and industrial use. However, due to regular and intensive spells of drought and extreme temperature, the groundwater resource is being over-exploited which has resulted in a rapid decline in the water table, drying of springs, *karezes* and abolishing fruit orchards (Ashraf & Sheikh, 2017). Water scarcity conditions for more than two decades destroyed almost 80% of the fruit production and orchards in all over the province (Ashraf & Routray, 2015). It caused shrank for all types of crops in general and rain-fed crops in particular in the province, in addition to, killing around two million animals (Jairath, 2008). Heat waves caused by climate change resulted in a deteriorating situation in the region, putting the life of farming communities at high risk (Zahid & Rasul, 2012). The province is already suffering from water scarcity, further; climate change will worsen the situation in the future. Due to the rise in temperature, the agriculture sector will be in

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need of more water during summer (Report No. ACS2258 v2, 2013).

2. The Concept of Resilience

Resilience has emerged as a unifying concept in a number of disciplines associated with the sustainable development sciences (Curtin & Parker, 2014). The focus on resilience goes beyond ecological studies and natural resource management in areas like health, disaster management, community planning, food security, and international development (Xu et al., 2015). Efforts to apply resilience in various domains have spurred interest in assessing and measuring resilience that has extended into many approaches including quantitative and qualitative methods, statistical analyses, participatory investigations, and development of models and metrics. *"Resilience is not a single number or a result"* states Walter & Salt (2012) rather; this is an emerging property that is related in a variety of ways and across different domains to the overall system (Quinlan et al., 2016).

2.1 Multiplicity in Resilience Definitions – the Resilience of What and to What?

The concept of resilience has been defined and practiced in different ways and more particularly, in the recent past, it has been conceptualized in proliferated definitions The literature on ecology has developed three major definitions including ecological, engineering, and social-ecological definitions of resilience. Carpenter et al., (2001) extend the definition of social-ecological resilience from ecology and include three components: i) the quantity of disruption a system can absorb and still continues to remain as part of the attraction; ii) the ability of a system to learn and adjust accordingly; and iii) the degree of a system to have the capacity to self-organize. According to the three major definitions, resilience emerges from a complex system. The more recent differences arise from the specific application of resilience. For instance, development resilience refers to the ability of a person/household or any other unit to prevent poverty for a time period due to different shocks and stressors such as drought, flood, climatic events, or shortage of food (Barrett & Constas, 2014).

Some researches on resilience determine other components of resilience with a major focus on people such as social resilience, community resilience, and psychological resilience (Berkes & Ross, 2013; Norris et al., 2008; Adger, 2000). Though emerged from similar disciplines, a common basis exists among these fields of research that offer prospects of possible integration among them (Berkes & Ross 2013). Social resilience refers to the capacity of groups/communities to deal with external disturbances and stressors due to socio-political and environmental changes (Adger, 2000). A related concept is community resilience which is defined as a process connecting a series of adaptive capacities to a positive track for practical adaptive measures following a shock/stressor (Norris et al., 2008). A dynamic area of research is psychological resilience which is defined as the capacity of an individual to recover from difficulty and eventually inform and improve the resilience of the community (Berkes & Ross, 2013; Tugade et al., 2004).

Due to a variety in the definitions of resilience, it determines several practical measures with specific backgrounds. Therefore, it is significant to know and understand "*the resilience of what and to what?*" and how it is defined. This context will largely guide how to assess or measure resilience (Alinovi et al., 2022; Carpenter et al., 2001).

3. The Link among SDGs and Climate Resilience

Sustainable Development Goals were framed in January 2016 with the purpose to guide United Nations policies and funding in the coming fifteen years. It has 17 goals and 169 targets. The focus of all 17 goals and 169 targets is on three major components of sustainable development: i) social; ii) economic; and iii) environmental. The broader aim of SDGs is to reduce poverty and enhance development. The momentum for SDGs was provided by Millennium Development Goals.

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MDGs aimed for action in developing countries while SDGs focus on both developing and developed countries. All goals of SDGs are interrelated to each other in various dimensions of poverty, education, health, gender equality, economic welfare, energy, access to water and sanitation, access to justice, environment and climate change, and resilience to disasters and shocks (UNO, 2015). Climate action has been recognized as an important element of sustainable development. There is a significant inter-relationship between achieving Sustainable Development Goals (SDGs); addressing climate change and focusing on pathways toward social, economic, and environmental sustainability (LEAD-Pakistan, 2017).

The following agenda of Sustainable Goals Development are directly and indirectly connected with climate change, climate variability, climatic extreme events, and water scarcity.

3.1 SDG 13 – Climate Action

Goal -13 of SDGs directly strives for the effective implementation of the Sendai Framework on Disaster Risk Reduction (SFDRR) and the Paris Agreement under the UNFCCC. The objective of SDG-13 is to decrease the emission of GHG and promote renewable energy by addressing the factors of climate change. It emphasizes taking urgent action to address the impacts of climate change. The goal has five targets and five indicators.

Climate change has resulted in an increase in the average temperature of Earth. The findings of the WMO (World Meteorological Organization) present that the average 5-year (2013-2017) temperature of the Earth was at maximum on records. 2017 proved to be one of the three warmest years which was exceeding 1.1°C the pre-industrial period (WMO, 2018). Climate-related disasters cause hundreds of billions of economic dollars in losses each year. This does not engulf the losses of humans due to geo-physical disasters. During a period of 20 years (1998-2017), climate-induced disasters have caused 1.3 million deaths and 4.4 billion injuries to humans (UNDP, 2021). The climate change goal of SDGs is of integrated nature due to which it can assist as a suitable instrument to carry out climate actions at local and provincial levels with more focus on the grass-root level (UNO. 2016).

3.2 SDG 1 – No Poverty

This is the prime and first goal of SDGs which aims to "end poverty in all its forms everywhere." Under goal one of SDGs, it is stated to enhance the resilience of poor population and especially those in marginalized conditions. This goal of SDGs can be effectively achieved when the vulnerability and exposure of the poor to extreme climatic events and disasters is reduced. Otherwise, it is evident that when such stresses and shocks combine with the vulnerabilities of the poor, it shows significant hurdles in achieving economic growth and development progress. Statistics from United Nations Organization show that in 2017, there were over $300 billion in economic losses due to disasters (UNO, 2018). Climate change is a serious threat to the poor people of the world which will push over 100 million more people into poverty by 2030 (World Bank, 2016). Sub-Saharan Africa and South Asia being extremely poor regions are predicted to be influenced the worst.

3.3 SDG 2 – Zero Hunger

Global goal 2 of zero hunger aims to "end hunger, achieve food security and improved nutrition and promote sustainable agriculture." SDG-2 is closely interlinked with poverty, climate change and disasters. The key factors for the rise in world hunger are climate change-associated disasters, drought, and conflicts. Food and Agriculture Organization reported that in the year 2020, 720-811 million people globally suffered from hunger. By taking the average of the figure (768 million), almost 118 million people additional people suffered from hunger in 2020 as compared to 2019. By taking the upper limit of the range of the

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reported figures, approximately 161 million people exceed the figure for hunger (FAO, 2021).

3.4 SDG 8 – Decent Work and Economic Growth

Goal 8 of SDGs aims to "promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all." However, this goal cannot be effectively achieved by 2030, unless actions regarding poverty reduction, climate shocks are taken in parallel. Climatic shocks in many parts of the world have caused unemployment, cheap and unskilled labor, and urbanization. A research study estimates that if bold and timely climate actions are taken, it could produce about 65 million job opportunities by 2030 which is equivalent to the current human resource of Egypt and the United Kingdom (The Global Commission on the Economy and Climate, 2018).

4. Hydro-climatic Hazards in Balochistan

The location, geology and topography of Balochistan determine that the province is at severe risk of hazards due to climatic changes that has the potential to cause a variety of disaster emergencies and large migrations and displacement of people (LEAD-Pakistan, 2017). The climate-caused natural extreme events and risks are further intensified by deforestation, environmental degradation, and soil erosion. There has been a shape increase in disastrous flash floods due to variations in rainfall patterns, especially in the monsoon season. The August 2022 floods in the province and most of the other parts of the country are primarily due to climate change impacts (P-Lama & Tatu, 2022; Shahid et al. 2022).

The impacts of climate change are more obvious to the poor and marginalized people of the province. Different parts of the province are differently affected by climate change such as increase in temperature, seasonal shifts, unpredictable rainfall/snowfall, and sea level rise. Some regions of the province are suffering from the impacts of intensive drought spells due to insufficient and erratic rainfall while other regions are more often hit by flash floods due to varying climate patterns as a result of the increase in mean temperature. Climate change impacts on water-food-energy nexus have worsened the insecurity of the three sectors, resulting in high vulnerabilities in the life of people in Balochistan.

Heat waves due to climate change result in deteriorating situations in the region putting the life of farming communities at high risk (Zahid & Rasul, 2012). Climatic changes may have considerable effects on the hydrological cycle in the province. It has probably disrupted the typical seasons resulting in longer and more intense summers and shorter winters (IPCC, 2014a). Shortage of water due to climate variability and extreme weather events in the region led to significant water table declines in many parts of the province (Shahid et al., 2004). The province is already suffering from water scarcity, further; climate change will worsen the situation in the future. Due to the rise in temperature, the agriculture sector will be in need of more water during the summers (Report No. ACS2258 v2, 2013).

5. Methodology

On the basis of the nature of the study, this research is explanatory while on the basis of data source, the study is a mix of quantitative and qualitative methods. The study was conducted in the Pishin-Lora Basin – the most severely climate affected basin of the Balochistan province. For data collection, two districts of the PLB were selected, namely Pishin and Mastung. Both selected districts are dominated by agriculture as the main sources of income. A total of 264 small-holder farmers were selected by employing Arkin and Colten (1963) from 24 Union Councils via disproportional allocation of sample size. For the purpose of quantitative data, a structured questionnaire was formulated while qualitative data was mustered through KIIs and FGDs. Data analysis was computed via descriptive and

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inferential statistical tests especially mean, range, standard deviation, and correlation coefficient. To gauge the resilience of community, a component/variable resilience index (CRI & VRI) was developed.

6. Results and Discussion

6.1 Socio-economic Profile of small-scale farming communities in selected districts

Table 1 Descriptive Statistics of Study Variables (The Social Component)

	Variable	N	Range	Mean	Std. Deviation
1.	Age of respondent (years)	264	33-65	48.18	7.20
2.	Family size (Nos.)		6-18	10.59	2.80
3.	Total number of literate members in family (above age of 10 years)	264	0-10	2.03	1.68
4.	Farm size (acres)	264	2-5	4.36	.83
5.	Experience in agriculture (years)	264	8-35	19.30	5.31
6.	Distance of health centre from HH (km)	264	1-20	6.50	4.48

Source: Field survey

The average age of smallholder farmers in the study area was 48 years with a range of 33 to 65 years. The mean family size was 10.59 with a standard deviation of 0.83 and the range was 6 to 18 members per family. On average 2.03 family members were literate with a range of 0-10 and a standard deviation of 1.68. The average number of senior citizens (above 60 years of age) per household was 0.83 (range 0-3). Since, the target population of the study was smallholder farmers (having < 5 acres of farmland, according to World Bank, (2008), the mean farm size was 4.36 acres per household, with a range of 2-5 acres and the standard deviation is 0-83. Statistics show that number of smallholder farmers in Pishin is higher as compared to the Mastung district. The average experience in farming is 19.30 years with a range of 8-35 years and a standard deviation of 4.48. On average, the facility of the health center is 6.5-kilo meters distant from farming households with a range of 1 to 20 kilometers.

This reflects that smallholder farmers have very less trend towards obtaining formal education and thus face difficulty in obtaining scientific knowledge and updates regarding climatic shocks and adaptation of modern climate resilient methods of farming. Additionally, lack of education and illiteracy has become a hurdle in accepting change and adaptation to climate change impacts.

6.1.1 Economic Profile of Smallholder Farmers

The study aims to assess the economic conditions, trends, and economic resilience of small-scale farmers. Table 2, elaborates on the descriptive statistics of the economic conditions of farming households in the selected districts. The variables include family employment, family income, per capita income, and family saving.

As reported in Table 2, the average number of family members (>/= 18 years of age) engaged in economic activities is 2.06 per family with a range of 1- 6 members. Family income of smallholder farmers per year ranges between Rs. 400,000/- to Rs. 2,000,000/- with a mean income of almost Rs. 935,000/- and a standard deviation of almost Rs. 304000/-. Per capita income per day {(@ Rs. 154/ 1 USD); (15 year+ Population)} among small-scale farming communities range between Rs. 166 to 1343 with a mean of Rs. 458 and standard deviation of 172.45. Out of 264 respondents, only 39 farmers (14.77%) had annual savings. The annual saving of these families ranged from Rs. 100,000/- to 400,000/- with an average of Rs. 215,385/-.

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Table 2 Descriptive Statistics of Study Variables (Economic Capital)

Variable	*N*	Range	Mean	Std. Deviation
1. Total No. of family members employed (>/= 18 years of age)	264	1-6	2.06	1.11
2. Family income p/anaum	264	400000-2000000	934090.91	303798.40
3. Per capita income /day	264	166.38-1343	457.54	172.45
4. Total annual saving	39	100000-400000	215384.62	92589.82

Note: Income and saving is reported in PKR (Pakistani Rupee)

Source: Field survey

The data reflects poor economic conditions of small-scale farmers, the employment ratio is low, and annual income and per capita income are far less than standards. Very few farming communities have saving plans. Due to such deteriorating economic conditions of small-scale farming communities, their resilience to climate change impacts is very poor.

6.1.2 Source of Income for Small-scale Farmers

More farming households in Pishin have diverse/multiple sources of income (47%) as compared to farmers in the Mastung district (34%). Diverse/multiple sources of income help families assist in situations of crop failure and reduce the risk of severe impacts. It also helps in enhanced resilience after a community is faced with disasters/stressors (Ainuddin & Routray, 2012a)

The primary source of income for households is agriculture (77% in Mastung and 61% in Pishin). It was found during discussions during FGDs and KIIs, that families in Pishin are also engaged in other employment sources due to which their reliability on agriculture is lesser as compared to farming communities in Mastung. Another, prevalent major source of income is agricultural labour among the study population. 20% of respondents in Pishin and 15% in Mastung rely on agricultural labour. Non-agriculture labour is a primary source of income for 14% of respondents in Pishin while only 2% in Mastung. Other sources of income such as self-employment, commercial livestock, foreign remittances, services/pensions etc. are rarely depended on among farming families in the study area.

6.1.3 Forced Change in Economic Activities due to Climatic Hazards

It was sought during discussions with key informants and duty bearers that small-scale farming households are changing their economic activities from agriculture to non-agriculture fields due to climatic hazards. To validate this information, small-scale farmers were inquired if their family members have changed economic activities due to climate risks in the past 10 years. As reflected from field survey, 54% HHs in Pishin and 46% in Mastung have opted for a change of livelihood sources from agriculture to Non-agriculture due to past bad experiences, income losses, and future risks. Most of such population has moved to bigger cities within and outside the province in search of employment.

Survey data shows that overall almost 50 percent of smallholder farming households have opted for a change in economic activities from agriculture to non-agriculture due to climatic shocks in the last ten years.

Table 3 Nonparametric Correlations of Study Variables (Spearmen's Correlation) (n = 264)

Variables	1	2	3	4	5	6	7	8	9	10	11	12
1. Education Level	—											

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2.	Religious belief of CC	.13*	—								
3.	Awareness of CC	0.08	0.06	—							
4.	Level of concerned about CC	.23***	-.21**	.14*	—						
5.	Personal contribution to mitigate CC	0.02	0.05	0.00	.51***	—					
6.	Ability to forecast EWEs	.29***	0.12	.15*	.26***	0	—				
7.	Social networking	0.03	0.05	-0.06	0.09	-0.03	0.05	—			
8.	Gender balance in domestic decision making	0.04	0.12	-0.08	0.10	0.02	.121*	.45***	—		
9.	Family income	0.11	0.01	-0.01	0.04	-0.07	0.02	-0.03	0.02	—	
10.	Affordability of modern irrigation facilities	0.07	0.03	0.00	0.10	0.10	0.10	-0.05	0.03	.31***	—
11.	Affordability of public transport	0.11	0.08	-.15*	-0.03	0.01	0.08	-0.03	0.03	.25***	.37***
12.	Access to safe drinking water	.13*	0.04	-0.02	0.08	-0.04	0.05	0.01	0.00	.17**	.19**

*p<.05. **p<.01. ***p<.001.

Table 3 explains the correlation between variables of farmers' knowledge of climate change and variables of different components of resilience. The data type is categorical, thus Spearmen's correlation test was applied to check the level of relationship between and among variables.

Data reveals that the education level of smallholder farmers has a strong positive association with the level of farmers' concentration on climate change (r = .23, p<.001), farmers' ability to forecast EWEs (r = .29, p<.001); religious belief about climate change (r = .13, p<.01); and access to safe drinking water (r = .13, p<.01).

Farmers' religious belief in CC has a strong negative correlation with the level farmers are concerned about CC (r =-.21, p<.001).

The awareness level of farmers regarding CC is positively correlated to farmers' concentration of CC (r = .14, p<.05); and ability to forecast EWEs (r = .15, p<.05); while negatively correlated to farmers' ability to afford public transportation (r = -.15, p<.05).

Farmers' level of concern has a strong positive correlation with farmers' personal contribution to contribute to CC mitigation (r = .51, p<.001); and their ability to forecast EWEs (r = .26, p<.001).

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Social networking of farmers has a strong positive association with gender balance in domestic decision-making (r = .45, p<.001).

Family income is strongly and positively correlated with the affordability of modern irrigation facilities (r = .31, p<.001); affordability of public transportation (r = .25, p<.001); and access to safe drinking water (r = .17, p<.01).

A strong positive correlation is also explained between the affordability of modern irrigation techniques with the affordability of public transportation (r = .37, p<.001); and access to safe drinking water (r = .19, p<.00). Similarly, the ability of farmers to afford public transportation has a strong positive correlation with access to safe drinking water (r = .30, p<.001).

Table 4 Score of Economic Component/Variables Resilience Index

	Component and Indicator	District Pishin		District Mastung		Over all study area		Optimum weightage		Impact on resilience
		% Value	VRI	% Value	VRI	% Value	VRI	% Value	RI	
2	*Economic Resilience*									
2.1	Percent of economically active members in family	26.5	0.66	18.7	0.47	22.6	0.57	40	1	+
2.2	HH income above poverty line (Middle Income Class Poverty Line @ 3.20 USD)	35.6	0.45	28	0.35	31.8	0.40	80	1	+
2.3	Multiple or diverse sources of income	47	0.72	34.1	0.52	40.55	0.62	65	1	+
2.4	Saving scheme of family	19.7	0.25	9.8	0.12	14.75	0.18	80	1	+
2.5	Access to credit/loan facility	19.9	0.25	15.2	0.19	17.55	0.22	80	1	+
2.6	Investment other than agriculture	28.8	0.41	16.7	0.24	22.75	0.33	70	1	+
2.7	Remittances/pension	9.1	0.23	3	0.08	6.05	0.15	40	1	+
2.8	Capacity of affordability	20.2	0.22	15.9	0.18	18.05	0.20	90	1	+
2.9	Social funds/grants	21.2	0.28	12.9	0.17	17.05	0.23	75	1	+
	ERI (Economic Resilience Index)		**0.39**		**0.26**		**0.32**		**1**	

Source: Field survey

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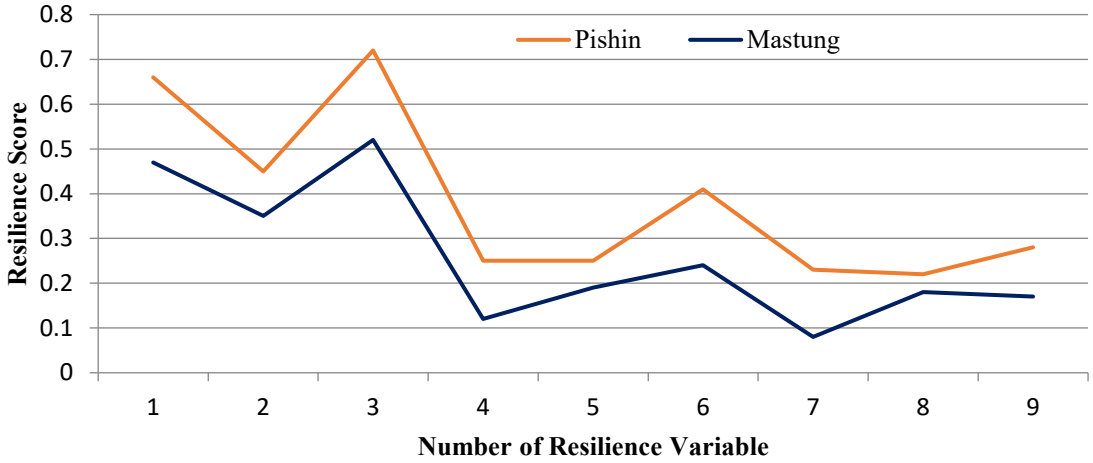


Figure 1 Comparative Analysis of the Indicators of Economic Resilience in Pishin & Mastung Districts of the PLB

Table 4 elaborates the economic resilience scores of both selected districts and the overall study area. The economic resilience index score of Pishin and Mastung is 0.39 and 0.26 respectively. While the overall economic resilience index score of the study area is 0.32. This denotes that the level of economic resilience of the small-scale farmers in PLB is low. Similar findings indicating a low level of resilience of the community to drought were reported in another study in Balochistan (Nasrullah et al., 2015).

The engagement of more *family members in economic activities* enhances the household's capacity to deal with climate risks and adapt accordingly. To analyze family employment, the percent of economically active family members was assessed which explains the VRI score for the family employment was 0.57 (medium level resilience). Smallholder farming families in Pishin (VRI=0.66) are more resilient than in Mastung (VRI=0.47). High levels of employment contribute to a healthy community economy, which supports community resilience. (Parson & Morley, 2017 – ANDRI; Perfrement & Lloyd, 2015 –TCRI; Cutter et al., 2014 – BRIC; Foster, 2014 – RCI; Cutter et al., 2010 – DROP; Sherrieb et al., 2010 - CRI2). Unemployed persons do not have employee benefit plans that provide income and health cost assistance in the event of unwanted incidents (Flanagan et al., 2011- SVI). Employment increases the economic capacity of the community. It also improves well-being in reducing poverty and vulnerability (Ainuddin & Routray, 2012b).

The score for *HH income above the poverty line* (Middle Income Class Poverty Line @ 3.20 USD) is 0.64 where Pishin is 0.45 and Mastung is 0.35. This shows that small-scale farmers have low resilience in terms of their income. Pishin district is placed in the extreme poverty zone and Mastung district is in the high poverty zone in the country (PPAF, 2020). Smallholder farming communities due to poor socio-economic conditions, lack of capacity and access to resources are less likely to deal with climatic shocks. Research has shown that there is a strong relationship between individuals' financial resources and their resilience to a disaster (Cutter et al., 2014 – BRIC; Peacock et al., 2010 - CDRI). Low-income households are at greater risk because they tend to live in housing situated in higher-risk areas, are less likely to have prepared for a disaster, and have fewer resources to support recovery (Peacock et al., 2010 - CDRI). Farming families below the poverty line may be impacted more than those above, especially in the recovery period from hydro-climatic hazards such as drought (Nasrullah et al., 2015; Cutter et al., 2012; Hewitt, 1997). The VRI score for

JOURNAL FOR SOCIAL SCIENCE STUDIES
An International Peer-Reviewed Open Access Journal

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multiple/diverse sources of income is 0.62 with 0.72 in Pishin and 0.52 in Mastung. It is observed that people of Pishin district also opt for making their livelihood other than agriculture in other parts of the country, especially, in the hotel industry. Diversified sources of income provide alternatives and help better in community rehabilitation and recovery from extreme weather events (Ainuddin et al., 2015; Ainuddin & Routray, 2012a & 2012b; Norris et al., 2008) such as drought, heat waves and floods. Households with multiple sources of earned income are likely to be less impacted by climate change, and quick recover from disasters (UNDP-CoBRA, 2017). Changing trends in rainfall, raise in temperature, heat waves, flash floods, and other EWEs are forcing communities to make livelihoods from diverse sources and make *investments in fields other than agriculture*. Field survey data showed that such trends among small-scale farmers are not prevailing due to their incapability to save money, poor risk-taking behavior, and lack of opportunities in other business sectors. The VRI score for investing money in fields other than agriculture is low among small-scale farmers (0.33).

Another factor that significantly contributes to lower resilience of the farming communities is the lack of *access to credit facilities and loans*. Small-scale farmers have poor access to credit/loan facilities in PLB catchment areas (VRI=22) making it more difficult to adapt according to climate change impacts. Consequently, it decreases their *ability to afford* modern irrigation facilities, resilient varieties of seed/plants, and fertilizers for crops (VRI=0.20)

Saving schemes and *remittances/pension* for households of small-scale farmers are both very low with VRI scores of 0.18 and 0.15 respectively. Access to saving and credit facilities for farming households increases their capability to deal with socio-economic problems during disasters (UNDP-CoBRA, 2017) particularly when livelihood sources are tight. The saved amount helps households recover quickly from the impacts of extreme weather events. Remittances and pension are effective sources of livelihood for poor families. Improved sources of income have a positive association with recovery from natural disasters in developing countries (Nasrullah & Ainuddin, 2019; Sato et al., 2022).

The findings of ERI show that the economic resilience of small-scale farmers is not satisfactory. Only 23 percent of farmers have access to *social funds/grants*. The resilience variable score in Mastung (0.17) is lower than the Pishin (0.28) indicating low resilience of small-scale farmers in both districts.

Conclusion:

This study underscores the profound and interconnected challenges faced by smallholder farmers in Balochistan as they confront the escalating impacts of climate change. The findings reveal a community caught in a cycle of vulnerability, where climatic shocks—such as prolonged droughts, erratic rainfall, and extreme heat—directly undermine agricultural productivity, the primary source of livelihood. The resulting economic fragility is evident in low household incomes, minimal savings, limited access to credit, and a heavy reliance on single-income sources. Nearly half of the surveyed households have been forced to abandon farming in the past decade, migrating in search of alternative livelihoods—a clear indicator of systemic distress and eroding resilience.

The analysis demonstrates that resilience in this context is not merely a matter of survival but a multidimensional capacity shaped by education, economic stability, and social networks. Farmers with higher education levels showed greater climate awareness and adaptive potential, highlighting the critical role of knowledge in navigating environmental crises. Conversely, pervasive poverty and financial exclusion severely constrain the ability to invest in adaptive measures, such as modern irrigation or drought-resistant crops. The low scores on the Economic Resilience Index (0.32 overall) reflect a

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community ill-equipped to absorb, recover from, or adapt to ongoing and future climatic stresses.

From a policy perspective, the study aligns with the integrated aspirations of the Sustainable Development Goals, particularly SDG 1 (No Poverty), SDG 2 (Zero Hunger), and SDG 13 (Climate Action). Isolated interventions are insufficient. What is needed is a coherent strategy that combines climate adaptation with poverty alleviation. This includes promoting livelihood diversification through vocational training and support for non-farm enterprises, improving access to microfinance and insurance products tailored for smallholders, and investing in climate-resilient agricultural infrastructure. Furthermore, enhancing early warning systems and expanding social protection nets—such as cash transfers and grants—can provide immediate buffers against shocks.

Ultimately, building resilience in Balochistan requires a transformative approach that empowers farmers as active agents of change. Strengthening local institutions, fostering community-based adaptation plans, and ensuring inclusive participation in decision-making are essential steps. By bridging the gap between climate action and poverty reduction, stakeholders can foster a more sustainable and equitable pathway toward resilience, ensuring that the most vulnerable are not left behind in the face of a changing climate.

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