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INVESTIGATING THE COPING STRATEGIES AND COMMUNITY PREPAREDNESS FOR FLOOD MITIGATION IN TEHSIL DARA ADAM KHEL

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ABSTRACT

This quantitative study, "A Sociological Analysis of the Knowledge-Based Coping Strategies and Community Preparedness for Flood Risks Mitigation in Tehsil Dara Adam Khel," examines how indigenous knowledge supports flood resilience in southern Khyber Pakhtunkhwa. Data from 382 respondents across five local sub-sections, Bazi Khel, Zarghan Khel, Akhorwal, Bosti Khel, and Tor Chipper; were analyzed using SPSS, with a reliability score of 0.647. Results showed that 52% of participants agreed that flood knowledge is passed across generations, while 54% disagreed that early warnings are effectively received via community networks. About 43% were neutral on local climate change programs, and 40% on adopting new farming methods indicating weak institutional outreach. Chi-square tests confirmed strong associations between knowledge-based strategies and preparedness ($p < 0.001$; Tau-C range 0.35–0.49). The findings highlight both strengths in traditional awareness and weaknesses in modern coordination systems. The study concludes that combining indigenous experience, early warning technologies, and community training is vital for sustainable flood management and policy integration.

Keywords: *Flood Risk Mitigation, Indigenous Knowledge, Community Preparedness, Climate Change, Dara Adam Khel, Chi-square, Coping Strategies, Resilience.*

INTRODUCTION

Like many other socio-economic and political challenges and their coping strategies, coping with environmental and climate problems like floods and preparedness in mitigation is also of prime importance, especially in regions that are more prone to frequent disasters (Clarke, 1992). Flood management relating to Traditional measures to focus on reducing negative impacts has shifted towards a more holistic and integrated approach recently. The floods integrated concepts should identify the four key elements to ensure and presents floods emergency is manage the integrated water resources within the greater context of management (Moeeni, 2019). The water cycle includes the elements that are managed and ensured, the linkage thus recognizing between flood water and groundwater, the land integration used in water management planning, the best mix strategies of the adoption, both structural and non-structural, characteristics depending on the regions and river system (Carter, 2008). According to Glago (2019), in such areas, people living devised their own methods and their livelihoods for protecting themselves inevitably. Their own skills and experience are based on these methods and on their resources. Flooding has been identified as a

cause of unplanned living. A traditional reaction approach towards a proactive approach to the management of floods is rapidly gaining recognition among flood managers. Engineering problems or an emergency, as the proactive approach does not treat the flood issues only as economic, environmental, institutional, legal, but also as the social aspects.

Significance of the Study

This study will assess indigenous coping strategies for flood mitigation in Dara Adam Khel, focusing on social networks, local knowledge, and preparedness. By documenting and evaluating these practices, it will offer evidence to integrate them into formal disaster policies. The findings aim to guide policymakers and communities to develop more inclusive and sustainable flood management strategies for Dara Adam Khel and similar regions in KP.

Objectives of the Study

1- To know about the knowledge base copying strategies and community preparedness for flood risks mitigation in the tehsil Dara Adam Khel.

2- To measure the association between knowledge base copying strategies and flood risk mitigation in the tehsil Dara Adam Khel

METHODOLOGY

Nature of the Study, Research Design, and Universe of The Study

The nature of the study was quantitative, where a cross-sectional study design was applied during the study. Further, the current study was conducted in the tehsil Dara Adam Khel, southern Pakhtunkhwa, Pakistan. Further, it is in the centre of Peshawar and District Kohat, whereas Peshawar city is located at 36 kilometres, while Kohat is located at 25 kilometres. Moreover, the universe has been divided into five subsections (Quom), namely Bazi Khel, Zarghan Khel, Akhorwal, Bosti Khel, and Tor Chipper locally. The reliability of the data was measured as 0.647, sufficient for further statistical procedures (Ghazali, 2008).

Data Analysis, Results, and Discussion

After the completion of all primary information, the data was entered into SPSS, and it was coded and analyzed at Univariate with frequency and percentage as well as at Bi-Variate through chi-square application, with (Tao-C) directional test as well. All the results were discussed with appropriate explanation and relevant literature of the study.

Results and Discussion

The frequency and percentage distribution of the respondents categorized their preferred type of analysis regarding the knowledge-based coping strategies in this statement: "Early warning messages are received through community networks." The process, where official warnings from meteorological or disaster management agencies are rapidly disseminated to the at-risk population through trusted local networks, which are pre-established, bridges between a formal alert and community action. It issues a flood, cyclone, or tsunami warning and is a highly effective component of the disaster warning system. Among the 382 participants, the majority, comprising 205 (54%) individuals, disagreed with this statement, representing approximately 92 (24%) who agreed with this assertion. Following this, 85 (22%) respondents indicated that they were neutral. This data provides insight into the distribution of the respondents who largely disagreed. In this statement, the early warning system received through community networks is a powerful strategy that leverages social capital to save lives, and it represents a shift from a top-down warning system to a participatory, people-centered model—often the difference between a disaster and a managed emergency. It relies on a network of volunteers who are responsible for informing their immediate neighbourhoods and local communities to ensure all residents are alerted.

"The community relies on local signs (clouds, river levels) for flood prediction." Among 382 participants examined and surveyed, the majority were neutral, comprising 162 (42%) individuals. Approximately 111 (29%) disagreed with this assertion, while 109 (29%) strongly agreed with this statement. This is a powerful example of indigenous local knowledge or traditional ecological knowledge passed down from generation to generation, where the community has learned their environment and how exactly they can indicate heavy rainfall and erosion happening upstream long before the flood peak arrives. The most resilient flood prediction strategy is to integrate local knowledge with modern technology

and science, which is more effective for on-the-ground information.

In this statement on the distribution of respondents, "Government or NGOs provide scientific early warnings about floods," the scientific forecasts, such as satellite imagery and weather models, provide ground truth to generate data on extreme weather patterns and provide immediate warnings through modern radar and satellite forecasts. Complex weather systems are analyzed through a globally recognized framework designed to issue timely alerts and enable communication to take lifesaving action (Zahoor, R., 2015). Among 382 respondents, the majority of participants disagreed with this equation, comprising 151 (40%) individuals. Following this, 126 (33%) participants agreed with this statement, while 105 (27%) individuals remained neutral. Hence, this initiative, which is UN-led, aims to ensure that every person on Earth is protected by an early warning system by 2027. The initiative coordinates globally and takes action around four pillars to close critical gaps, especially in vulnerable countries. NGO organizations play a bridging role in addressing non-technical social barriers. They tailor the situation to suit individual problems and community needs, raise awareness through campaigns, and facilitate communication between vulnerable populations and government authorities.

In this statement of knowledge-based coping strategies, "Flood risk maps are available and used in the community," the availability and use of flood risk maps in a community represent a critical step in moving from reactive disaster response to proactive risk reduction. In this equation, 138 (36%) participants were neutral and did not answer this assertion. Following this, 134 (35%) respondents disagreed with this statement, while 110 (29%) respondents agreed with the report. Hence, flood risk maps are basically visual tools combined with weather forecasts for community safety and resilience. Sometimes, maps are ignored due to development pressures, as labelling land as high-risk can decrease its value, leading to political resistance.

In this statement, "People are trained to read and interpret flood risk maps," flood risk maps are a powerful scientific tool. Their true value, however, is only realized when they are accurate, accessible, understood, and integrated into the daily decisions of the community and planners. This is crucial for using flood risk maps effectively. Training people to read and interpret these maps transforms static technical documents into life-saving tools. Using maps for evacuation planning, identifying safe routes and zones, prioritizing areas for rescue, and locating critical infrastructure assists the community in finding safer places. The respondents categorized that among 382 participants, 145 (38%) were neutral about this assertion. Following this, 140 (37%) respondents disagreed with this statement, while the remaining participants, comprising 97 (25%), agreed with this statement. Hence, training people to read flood risk maps is what turns information into power. It ensures that the investment in creating the maps pays off in the form of a more prepared, resilient, and safer community.

In this statement, "Climate change awareness programs are conducted locally," it is easier for people to engage their neighborhood in describing the concept of flood-prone areas and abstract global temperature rises, bringing people together around a shared cause, fostering a sense of collective responsibility, and empowering them to make the issue real. Among the 382 participants surveyed and examined, 166 (43%) individuals were neutral on this statement. Following this, 121 (32%) respondents disagreed with this assertion, while approximately 95 (23%) agreed with this statement. Hence, climate change awareness is the backbone of building a resilient and sustainable community. Arranging workshops on energy savings focused on environmental science, promoting green spaces, organizing group discussions to clean up rivers and beaches, and setting up informative displays with books and local data on climate impacts are essential (Forsyth, 2009).

In this statement, the respondents highlighted that "Households adopt new farming methods to cope with climate change." Households around the world are indeed adopting new farming methods to cope with the impacts of climate change, though their choices are often shaped by local conditions and resources. While these adaptations are crucial, they only partially offset climate-related losses. Among the 382 participants surveyed and examined, 145 (38%) individuals disagreed with this assertion. Following this, 151 (40%) participants remained neutral, while 86 (22%) agreed with this statement. Hence, households face significant hurdles, despite their best efforts, which

limit the effectiveness of their adaptation (Habib, 2021). Many farmers lack adequate training, reliable climate information, and technical support, leaving them to rely on indigenous knowledge, which may be becoming less reliable.

Further, "People use mobile phones or radios to receive flood alerts," the use of radio or mobile phones to receive flood alerts is a widespread and crucial strategy for households to cope with climate change, specifically to reduce the risks from extreme weather events. Mobile technology has revolutionized early warning systems, especially in rural and remote areas. In this significant statement, among the 382 participants surveyed and examined, 140 (37%) individuals agreed with this statement, 123 (32%) disagreed, while 119 (31%) remained neutral or silent. Hence, radios can be powered by batteries, hand cranks, or solar panels, making them functional even when the electrical grid fails or during prolonged power outages. In some regions, flood warnings delivered via mobile phones include automated calls and messages in local languages, which is critical for those who are not literate (Alam, 2024).

"Training programs teach villagers how to act after a warning." While receiving a flood alert is the critical first step, knowing exactly what to do when that alert arrives is what ultimately saves lives and livelihoods. It is essential to teach villagers how to act after a warning to bridge the gap between knowing a threat is coming and being prepared to respond effectively. Among the 382 participants surveyed and examined, the majority, comprising 166 (43%) individuals, were neutral on this statement. Following this, approximately 132 (35%) respondents agreed with this assertion, while 84 (22%) participants disagreed. Hence, teaching villagers what the different alert levels mean (e.g., watch, warning, critical) and the specific actions tied to each level ensures people know which messages are official and which might be rumors.

Similarly, "Knowledge from past flood experiences is transmitted across generations," the intergenerational transmission of knowledge from past flood experiences is a foundational pillar of community resilience. This process, often called indigenous or local knowledge, is a living archive of strategies, memories, and wisdom that allows communities to survive and adapt to recurring environmental hazards. Among the 382 participants surveyed and examined, the majority, comprising 199 (52%) individuals, agreed with this statement. Approximately 79 (21%) disagreed, while 104 (27%) remained neutral. In this regard, the knowledge transmitted across generations is not a relic of the past but a dynamic and vital resource. It provides context, practical experience, and wisdom, a deeply rooted cultural imperative to prepare, making it an indispensable component of how households and communities cope with climate change and recurring floods.

Table-I: Frequency and Percentage Distribution of Independent Variable Knowledge-Based Coping Strategies

S.No	Statement	**Disagree**	**Neutral**	**Agree**	Total
1	Early warning messages are received through community networks.	205(54)	85(22)	92(24)	382 (100)
2	The community relies on local signs (clouds, river levels) for flood prediction.	111(29)	162(42)	109(29)	382 (100)
3	Government or NGOs provide scientific early warnings about floods.	151(40)	105(27)	126(33)	382 (100)
4	Flood risk maps are available and used in the community.	134(35)	138(36)	110(29)	382 (100)
5	People are trained to read and interpret flood risk maps.	140(37)	145(38)	97(25)	382 (100)
6	Climate change awareness programs are conducted locally.	121(32)	166(43)	95(25)	382 (100)
7	Households adopt new farming methods to cope with climate change.	145(38)	151(40)	86(22)	382 (100)
8	People use mobile phones or the radio to receive flood alerts.	123(32)	119(31)	140(37)	382 (100)

9	Training programs teach villagers how to act after warnings.	84(22)	166(43)	132(35)	382 (100)
10	Knowledge from past flood experiences is transmitted across generations.	79(21)	104(27)	199(52)	382 (100)

Bivariate Analysis

Association between Independent Variable "Knowledge-Based Coping Strategies" and Dependent Variable "Flood Mitigation"

In bivariate analysis, the association between independent variables and dependent variables was measured through the Chi-Square statistic and Tau-C test. In this regard, the association between "Early warning messages are received through community networks" with flood mitigation was highly significant and positive in direction (P=0.000; Tau-C 0.397). Similarly, the association between "Community relies on local signs (clouds, river levels) for flood prediction" with flood mitigation was also highly significant and positive, with statistical values (P=0.000; Tau-C 0.416). Further, the analyzed data (P=0.001; Tau-C 0.398) indicate a simple significant relationship between the statement "Government or NGOs provide scientific early warnings about floods" with flood mitigation in the study population. While proceeding with bivariate analysis, the information further explains a highly significant and proportional relationship between the statement regarding knowledge-based coping strategies and flood mitigation in line with Chi-Square and Tau-C test results (P=0.000; Tau-C 0.492), also (P=0.000; Tau-C 0.479) for "People are trained to read and interpret flood risk maps" with flood mitigation, highly significant and positive (P=0.000; Tau-C 0.162) for climate change and awareness programs in the universe of the study. Moreover, the results were also highly significant for new indigenous methods for flood mitigation (P=0.000; Tau-C 0.477), for the statement "People use mobile phones or radio to receive flood alerts" with flood mitigation (P=0.000; Tau-C 0.349). A highly significant and positive association with the independent statement "Training programs teach villagers how to act after warnings" was also indicated by statistical test results (P=0.000; Tau-C 0.355).

Table-II: Association Between Independent Variable "Knowledge-Based Coping Strategies" and Dependent Variable "Flood Mitigation"

Statements	Attitude	Knowledge Base Strategies			Total	Chi square (χ2) P value
		High Level Social Strategies	Moderate Level Social Strategies	Low Level Social Strategies		
Early warning messages are received through community networks	Disagree	105	80	20	205	χ2=328.189 (P=0.000) Tau-C 0.397
	Neutral	35	26	24	85	
	Agree	40	30	22	92	
The community relies on local signs (clouds, river levels) for flood prediction	Disagree	40	41	30	111	χ2=352.104 (P=0.000) Tau-C 0.416
	Neutral	50	40	72	162	
	Agree	50	40	19	109	
Government or NGOs provide scientific early warnings about floods	Disagree	47	88	16	151	χ2= 302.130 (P=0.001) Tau-C 0.398
	Neutral	42	47	16	105	
	Agree	60	39	27	126	
Flood risk maps are available and used in the community	Disagree	34	49	51	134	χ2= 346.093 (P=0.000) Tau-C 0.492
	Neutral	78	67	7	138	
	Agree	50	40	20	110	
	Disagree	60	41	39	140	χ2= 387.677 (P=0.000)

People are trained to read and interpret flood risk maps	Neutral	59	40	46	145	Tau-C 0.479
	Agree	33	39	25	97	
Climate change awareness programs are conducted locally	Disagree	48	39	34	121	$\chi 2$= 279.176 (P=0.000) Tau-C 0.162
	Neutral	48	72	46	166	
	Agree	39	31	25	95	
Households adopt new farming methods to cope with climate change	Disagree	50	46	49	145	$\chi 2$= 273.302 (P=0.000) Tau-C.477
	Neutral	80	39	32	151	
	Agree	30	41	15	86	
People use mobile phones or radio to receive flood alerts	Disagree	76	36	11	123	$\chi 2$=290.133 (P=0.000) Tau-C.349
	Neutral	80	13	26	119	
	Agree	70	59	11	140	
Training programs teach villagers how to act after warnings.	Disagree	30	33	21	84	$\chi 2$=321.782 (P=0.000) Tau-C 0.355
	Neutral	101	29	36	166	
	Agree	69	40	23	132	

Conclusion

The study concludes that community knowledge and indigenous coping strategies play a vital role in flood risk mitigation in Tehsil Dara Adam Khel. Based on data from 382 respondents, results revealed that 52% of participants agreed that traditional knowledge is transmitted across generations, showing the strength of local wisdom in resilience. However, 54% disagreed that early warnings are effectively received through community networks, highlighting communication gaps. Similarly, 40% of respondents were neutral about adopting new farming methods, indicating limited adaptive practices. The chi-square analysis showed significant associations ($p < 0.001$) between knowledge-based strategies and social preparedness, confirming a positive relationship between awareness and mitigation behavior. Despite limited formal training—only 25% agreed people are trained to interpret flood maps—the study found that integrating scientific tools with indigenous knowledge can improve community resilience. Therefore, a hybrid approach combining local experience, education, and technological early warnings is essential for sustainable flood management. Overall, the research emphasizes strengthening local capacity and institutional collaboration to enhance disaster preparedness in vulnerable regions like Dara Adam Khel.

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