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Identifying obstacles encountered at different stages of the disaster management cycle (DMC) and its implications for rural flooding in Pakistan

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The world has seen a number of natural hazards, but among them, floods are perhaps the most frequent devastating natural hazard, resulting in more human casualties and financial losses. Rural inundation has become an issue of concern in various parts of the world, including Pakistan. Over the past few decades, it has been hard for local institutions and rural populations to recover from the trauma inflicted by these events. The disaster risk management cycle is a well-known tool for coping with disasters and their consequences. Yet, the DRM cycle efficacy has been questioned in various rural settings. Thus, this paper applied a programmatic strategy to understand the challenges disaster management authorities and communities face in managing flood risks through the conventional disaster management cycle in Khyber Pakhtunkhwa province, Pakistan. The study objective was accomplished by using both qualitative and exploratory research designs. Four communities (namely, Peshawar, Charsadda, Nowshera, and Dera Ismail Khan) with a historical record of flooding were chosen for focus group discussion (32 in total) using a purposive sampling method. Additionally, 31 key informant interviews were undertaken from pertinent local disaster risk management institutions. We employed a thematic analysis to classify responses and obstacles into the various stages of the disaster management cycle. The findings of this study from interviews and focus groups provided some new insight into the conventional DRM cycle. The issues and challenges encountered by institutions and the community members were divided into four stages: 1-mitigation, 2-preparedness, 3-rescue and relief (R&R), and 4-rehabilitation and recovery (R&R). Based on the findings, it seems that local disaster management institutions still rely on reactive strategies and deal with flood hazards on an *ad hoc* basis. Poor governance and a lack of responses for present development trajectories were also highlighted as reasons why flood risk management is still challenging. There is an urgent need to perform susceptibility

and risk assessments for multiple hazards and develop specialized plans that follow disaster risk reduction principles and adaptation to climate change. This study recommends incorporating resilience and adaptation to climate change into the current disaster management cycle to prevent or reduce future hazards and risks in rural areas.

KEYWORDS

natural hazards, local institutions, rural communities, conventional disaster management cycle, Pakistan

1 Introduction

Disasters have a growing influence on human use systems worldwide (Wijkman and Timberlake, 2021). Every year, significant disasters (such as floods) kill and injure thousands of people, costing billions of dollars in economic losses (Alrehailli, 2021). Disasters can have varying impacts across countries depending upon the physical and socio-economic resilience of the local people. The economic setbacks resulting from extreme phenomena in affluent countries are more significant than in developing countries. However, the situation reversed for human fatality estimations (Agrawal, 2018). Developing nations are the epicenter of disasters because disasters pose a significant threat to the poor and can wipe out years of progress and accumulated wealth. The EM-CRED 2018 report estimates that the average number of catastrophes per decade rose from 100 to over 2,080 between 1990–2000 (Rana et al., 2021). In the midst of all of these disasters, the frequency of hydro-meteorological disasters has increased significantly (McGlade et al., 2019). Asia was perhaps the hardest-hit continent, with an estimated 88 percent death rate from all sorts of catastrophic events, compared to a decadal average of 62 percent. Among different climate-induced hazards, floods are the leading cause of human deaths, responsible for 43 percent of all fatalities owing to climate change aggravations (Ruidas et al., 2022a, 2022b). In disaster literature, riverine flooding and its consequences (infrastructure losses and people displacements) have been well-documented in Asian countries. Yet, despite the rapid rise of urbanization, flooding continues to occur frequently in rural areas (Shah et al., 2017).

In disaster risk reduction, “vulnerability” and “community resilience” are now extensively utilized. Thus, flood risk assessment and management must identify high-risk areas in modern rural settings. Risk management encompasses assessing and comprehending a system hazard and susceptibility (including exposed elements) before devising risk mitigation strategies (Plate, 2002; Shah et al., 2020e). In various stages of a flood disaster, a comprehensive review of these aspects informs the implementation of appropriate risk management methods (Madruga de Brito, 2018). The level of effort put forth in these stages of flood management is determined by the economic position of the local inhabitants and the capacity of the institutions functioning in these regions. As a result, the issues that local institutions and rural communities encounter at various stages of flood management are dynamic and require more attention. A study by Neal (Neal, 1997) argues that the theory of disaster risk management and its implications could be improved by re-examining and exploring different stages of catastrophes.

Due to its climatic and geographical features, Pakistan is highly susceptible to climate-induced disasters (Rahman and Khan, 2013; Ullah et al., 2020). Floods are one of Pakistan’s most deadly and frequent natural hazards. Spilling levees from the Indus River basin have caused extensive devastation to human life, crops, agricultural land, and infrastructures (Khan et al., 2011). Pakistan has been plagued by flood disasters regularly. The country has seen the deadliest floods in the last 20 years (2000–2020). In 2010, the country was hit by the biggest flood in its history (till now), which affected 24 million people, destroyed over 2 million hectares of standing crops, and cost the economy a total of \$10 billion (Shah et al., 2020c; 2021, 2022c; 2022b). However, this was disproven by the flood disasters in 2022¹. Since 14 June 2022, 1,717 persons have died due to floods in Pakistan² which caused \$40 billion in damages³. Flooding in Pakistan is mainly caused by the monsoon rain pattern in the lower Indus River basin or the glaciers that have melted in the higher, upstream mountain regions that flow into the Indus (Shah et al., 2018). Studies indicate that catastrophic floods will become more common due to the increased frequency and severity of extreme precipitation incidents (Shah et al., 2020d). In the last decade, local institutions and rural communities had difficulty dealing with and recuperating from such catastrophes. Thus, understanding the issues encountered by local institutions is critical to lowering the risk of flooding in rural settings. This article uses the conventional disaster risk management cycle to comprehend better the difficulties local disaster management agencies and rural communities encounter in managing flood risks.

The research paper is organized into five sections. Section two provides an extensive literature review. Section three explicitly highlights the research methodology, which outlines the methods used to gather data and conduct the study, such as surveys and interviews with experts in the field. The findings and discussion section (fourth section) presents the research results, including any patterns or trends that emerged from the data analysis. The fifth and last section provides a conclusion and course of action for efficient flood risk reduction.

1 <https://thediplomaticinsight.com/wwf-reports-differences-between-2010-and-2022-floods/#>.

2 <https://reliefweb.int/report/pakistan/pakistan-monsoon-floods-2022-islamic-relief-pakistan-12-october-2022>.

3 <https://dailymirror.com.pk/998913/flood-death-toll-reaches-1545/amp/>.

2 Literature review

In earlier times, most civilizations considered natural hazards an act of God, with the resulting injuries and property damage seen as divine retribution for human sins (Lutzer, 2011). As a result of this philosophy, the natural mechanisms that drive global environmental change were overlooked. Afterward, even though people learned more about physical earthworks, they started to think of disasters/catastrophes as natural hazards (McEntire, 2021). As societies advanced economically and educationally, individuals began to view the world through a more logical, empirical lens. Governments started behaving more reasonably and effectively in the face of catastrophes (Sylves, 2019). The existing knowledge/information indicates that hazards are not unusual since they are confined and recur in specific locations (Alexander, 2002; 2015). This sparked a more profound philosophical discussion about what makes a disaster “unnatural.” Such natural hazards become a disaster when individuals fail to take the appropriate preventative and preparatory measures to mitigate adverse consequences. This school of thought apprehended those catastrophic events resulting from complex interactions between humans and their environments (McGlade et al., 2019). This is particularly apparent in the case of floods in rural areas, where inefficient development planning, outdated drainage systems, and a lack of attention to flood risk management have led to tragic human losses and costly property damage. Multiple primitive civilizations left hints of their flood-prevention strategies. In retrospect, ancient cultures like Romans and Egyptians grew up alongside major rivers. However, they ensured that citadels and other important buildings were situated on higher ground to avoid flooding. They also set up flood-warning systems in areas prone to flooding (Sayers et al., 2015). Yet, in the current framework for managing flood risk, it has become an increasingly difficult task in heterogeneous rural parts of the country.

Several studies have advocated for a shift from traditional disaster management techniques to disaster risk management approaches (i.e., a proactive strategy for broader cross-sectoral risk management). The 1990s were designated as the “International Decade for Natural Disaster Reduction” by the General Assembly of the United Nations (UNGA) in 1987. These steps were taken to better prepare for and recover from natural catastrophes and provide helpful recommendations. In 1994, the UN Yokohama Strategy and Roadmap for Measures for a Safe World underlined the significance of sustainable development for disaster mitigation and prevention (Coppola, 2006). In 2005, the Hyogo Framework for Action (HFA) urged countries and communities to strengthen their ability to withstand and recover from natural catastrophes. The HFA proposed a multi-hazard approach to minimizing fatalities by addressing community engagement, building capacity, and early warning. The Sendai Framework for Disaster Risk Reduction (2015–2030) was adopted during the third meeting of the UN on disaster risk reduction. This paradigm required a paradigmatic shift from disaster management to risk management (Rana et al., 2021).

The DMC has played an essential role in managing natural catastrophes. It was developed to help government agencies decrease disaster-related losses (Coetzee and van Niekerk, 2012). Previous studies suggest that the terminologies for different stages of disaster

management could be traced back to 1930. Several practitioners used certain definitions to better comprehend and enhance the humanitarian aid system (Neal, 1997). Experts in various fields and scientific disciplines are needed for disaster risk management. As a result, the ideas that fall under the DMC have been interpreted and operationally defined differently (Coetzee and van Niekerk, 2012). The DRM cycle provides a framework for understanding the various stages of disaster management. The DRM cycle argues that successive stages of disaster management require connected actions (Carter, 2008). Such actions can be divided into three categories: 1) pre-disaster-encompass disaster prevention followed by disaster mitigation and disaster preparedness, 2) during the disaster (rescue and relief), and 3) post-disaster-included activities related to disaster recovery and development. These actions work together to make a disaster more manageable and less likely to cause harm to people and property. This holistic approach ensures that disaster management efforts are comprehensive and integrated, leading to better outcomes and reduced impacts of disasters.

On the other hand, Alexander (Alexander, 2002) divided the DRM cycle into two stages: 1) pre-disaster-encompass disaster preparedness and mitigation, and 2) post-disaster-focused on disaster response and recovery. Yet, the DRM cycle has both advantages and disadvantages. Furthermore, the continuous circular pattern of disaster management has been questioned. Consequently, practitioners and academics have differing opinions on the usefulness of the DMC (Coetzee and van Niekerk, 2012; Sawalha, 2020).

Amendments to the DRM cycle are still being discussed to better balance resources, time, choices, capabilities, and institutional transformation. It is widely accepted that climate change is a major contributor to extreme weather catastrophes (Trenberth et al., 2015). However, the current DRM cycle does not permit it. The current research study has focused on incorporating DRR and climate change adaptation (CCA) (Rana, 2020). It has been postulated that there are various ways to describe how to cope with a catastrophe. Despite this, the DMC is still in use due to its convenience and robustness (Alexander, 2018).

Flooding in rural areas is triggered by hydro-meteorological risks and human-induced activities (Shah et al., 2017). Furthermore, flood hazards in rural regions have been exacerbated by insufficient sewerage infrastructure (Morita, 2014), poor land planning (Lu and Ran, 2011), disparities (Rana et al., 2020), and the lack of ecological services (Farrugia et al., 2013). In rural areas, flood risk management tries to lessen fatalities and property damage (Shah et al., 2017). Risks have increased due to a lack of concern for future risk reduction and investment in corrective actions for ongoing advancement. (Jha et al., 2012). claimed that an integrated flood risk management plan employs structural and non-structural techniques to address flood risk holistically. A complete and well-rounded approach to flood risk management is crucial for rural areas in Pakistan, as they are often particularly vulnerable to the impacts of flooding. This approach should involve the integration of both non-structural measures with structural measures, such. The combination of these measures will help to increase community resilience and reduce the impact of floods on rural populations.

Additionally, a participatory approach involving local communities in planning and implementing flood risk

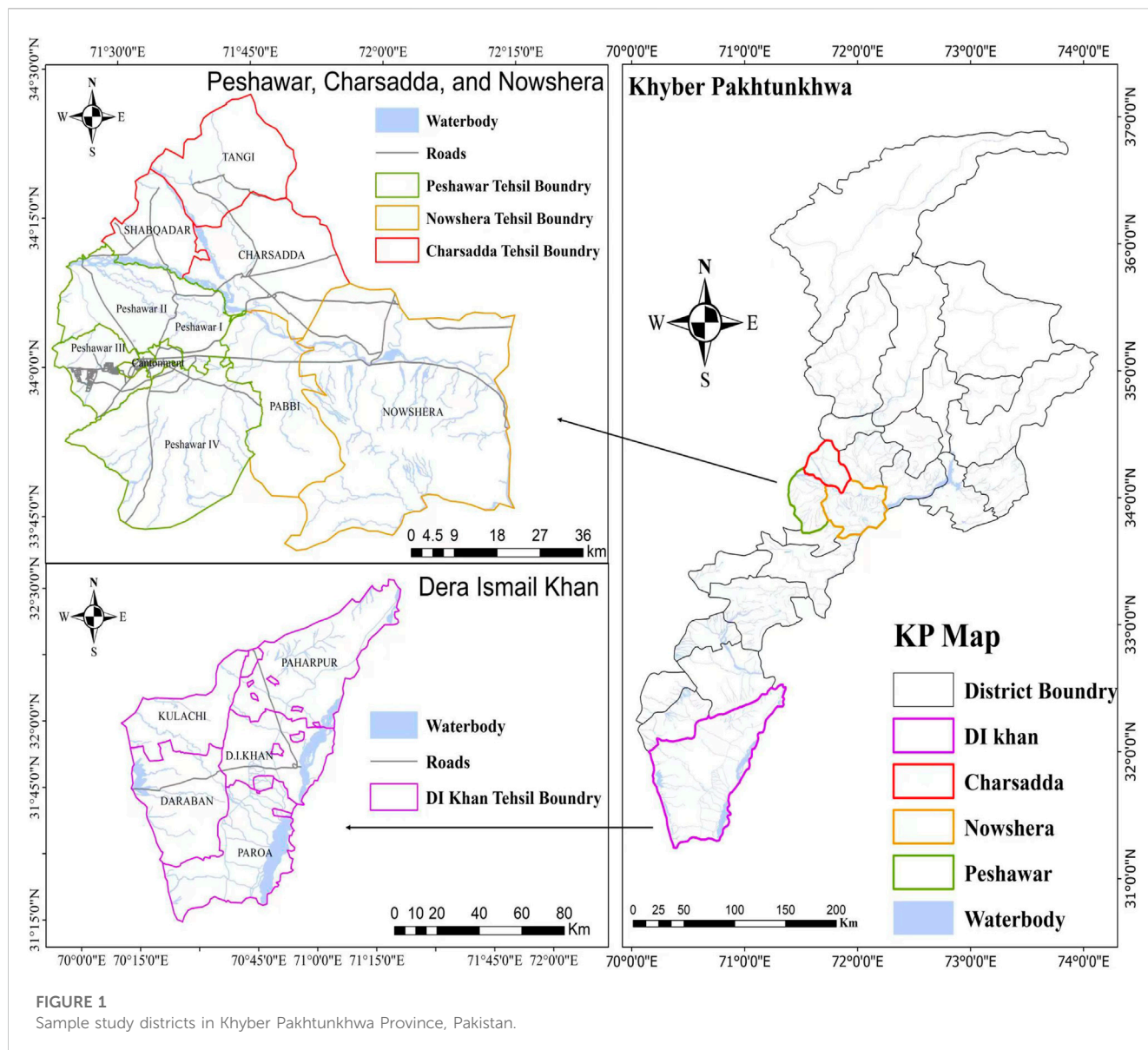


FIGURE 1
Sample study districts in Khyber Pakhtunkhwa Province, Pakistan.

management strategies can help to ensure the sustainability and effectiveness of these measures (Shah et al., 2017). The fundamental problem in DRM is finding the appropriate proportion involving structural (keeping floodwaters out of the way of people) and non-structural countermeasures (keeping people out of the floodwaters) (Jha et al., 2012). Proximity to rivers has been an important issue throughout human civilization that has resulted in increased flood hazards (Tucci, 2008). For this reason, it is necessary to use mostly structural solutions to mitigate flood risks all along the coastline and in riverbeds.

Flood risk management is used in Pakistan to lessen the severity of floods. Flooding is a complex problem that necessitates sophisticated scientific knowledge from policymakers. Due to varying physiographic, climatic, demographic, and socioeconomic conditions, the flooding phenomena's intensity varies from place to place (Ahmed, 2013). Pakistan's unique physical and geographical geography leaves it vulnerable to a wide range of disasters triggered by natural hazards. Overall, the government strives to supply

essential services like clean drinking water, sanitary facilities, appropriate food, and access to healthcare and education for its citizens. As a backdrop, disaster management and adaptation to climate change are rarely high on the country development agendas (Rana and Routray, 2016; Shah et al., 2017). Rural people have been subjected to devastating catastrophes due to rapid urbanization that paid scant consideration to spatial planning and building standards (Ahmed, 2013). Despite this, the government yet lacks thorough risk assessments and mitigation strategies. Numerous humanitarian bodies have aided in developing disaster risk management programs at the local level. However, these are limited to a few high-risk areas (Khan, 2007).

This is worrisome since Pakistan stands seventh among the world's most susceptible countries based on the climate risk index (CRI) (Kreft et al., 2016). Numerous studies have shown that local governments have failed to develop effective plans and policies for reducing disaster risk and have criticized their reactive response (Shah et al., 2019). Consequently, climate-induced extreme events,

including floods, had a negative impact. Research evidence on floods in Pakistan has concentrated on risk governance, mitigation, and preparedness approaches (Shah et al., 2017), risk assessment (Khan et al., 2011), comprehensive susceptibility assessment (Khan and Shaw, 2015), and resilience (Shah et al., 2018). But past research has not yet put enough emphasis on identifying problems using the conventional DMC. Therefore, this study adds to the body of knowledge by examining the challenges faced by rural communities and relevant institutions in distinct stages of disaster management.

3 Research methodology

3.1 Study area description

Pakistan has a population of around 210 million people, between 23.35 and 37.50 in north latitude and 60.50 and 77.50 in east longitude. Its total size is approximately 881,913 square kilometres (Figure 1). The population of Pakistan is made up of numerous different ethnic and racial groups. A country cultural and geographic diversity is a blessing, but it also increases its vulnerability to disasters triggered by natural hazards due to the apparent variety of coping skills (Rahman and Shaw, 2015). Recent years have seen several large-scale flooding incidents affecting vulnerable people in all four provinces of Pakistan. Sixteen major floods have hit Pakistan since its independence in 1947, and Rs 386 billion in economic damages have been recorded (Rahman and Khan, 2011; Rahman and Khan, 2013). Aside from “human influence on rivers and continuing shrinking of Himalaya and Siachen glaciers owing to rising temperatures, rapid unplanned development, and deforestation,” rainfall was a significant contributor to the country flood disaster.

3.2 Sampling plan of the study

The current research study was performed between March 2021 and June 2021. The province of Khyber Pakhtunkhwa is purposively selected because of its population (over 15 million people living in the KP province) and size (which occupies a total land of 10.17 mh). In the past 2 decades, eight devastating floods have occurred. This province was hit hard by a flood in 2010 that devastated 24 of the 25 districts (Shah et al., 2020a, 2020b; 2022a). After selecting Khyber Pakhtunkhwa as a study province, we deliberately chose four districts (particularly Nowshera, Charsadda, Peshawar, and Dera Ismail Khan), which were listed as the most susceptible districts to the 2010 flood disaster. The stakeholder consultation was carried out, and information was collected through key informant interviews (31 in total), focus group discussions (FGDs) with men and women (eight FGDs per district, including four male FGDs and four Female FGDs; 32 in total), informal discussions as well as telephone conversations. The main idea behind qualitative key informant in-depth interviews is that the interviewee is free to express their thoughts and feelings about the situation. For example, interviews are time-consuming and necessitate appropriate periods for conducting, transcribing, and analyzing.

Additionally, there is a possibility of recalling distortions, which may entail the collection of further details from a specific respondent than others. Interview guides (Doody and Noonan, 2013) supported an efficient way to collect the essential data from each sample respondent but also allowed the freedom to pursue the interviewee’s discourse wherever it led them. The semi-structured style interviews lasted somewhere around 30–60 min. While conducting interviews in a semi-structured manner, it is possible to get more in-depth and particular information by allowing participants to speak more freely and ask more challenging questions. Table 1 shows the key informants from different institutions consulted during the study.

3.3 Analysis

The researcher of this study used content and thematic analysis to classify issues, concepts, and recommendations into related categories at various phases (Mayer, 2015). This process begins with sorting and categorizing responses before developing a basic coding framework that incorporates developing themes and interpreting data. Data from the interviews were categorized using a process known as theme analysis. As a core qualitative research method, thematic analysis has the potential “to produce a comprehensive, rigorous yet complicated description of outcomes because of its flexibility and thematic freedoms (Braun and Clarke, 2006). Following the structure, we created an initial open code in which the information was organized to make it more familiar and understandable.

Furthermore, the retrieved codes were grouped to have a specific association. Eventually, the codes were grouped into a single theme. We sought recurrences of unexpected reactions to specific phrases and words. The identified themes were tested against existing literature to see if they had any semblance of validity. After forming the themes, we intended to explore any missing notions. One of the essential aspects of thematic data analysis is identifying the underlying meaning of respondents’ answers. There are various ways to identify the underlying purpose, including through gestures, metaphors, and body language. Figure 2 shows the four main themes (1: mitigation; 2: preparedness; 3: rescue and relief (R&R); and 4) rehabilitation and recovery (R&R)) that emerged from the data. In addition, the researcher employed the triangulation approach to eliminate biases in the acquired data, as triangulation of the data sources strengthens the study, provides a means to compare different points of view, and ensures that qualitative evidence is reliable and consistent (Zhang and Wildemuth, 2009). The final step of the analysis was to synthesize and evaluate the responses. The responses that fit into a certain coding category were reviewed using appropriate themes. Since thematic data analysis necessitates the inclusion of accurate answers from the survey participants, we used quotations from them whenever possible in our presentation of the results.

4 Findings and discussion

The focus groups and key informant interviews with the local institution officials gained an insightful perspective on the

TABLE 1 Characteristics of local experts consulted for key informant interviews in Khyber Pakhtunkhwa, Pakistan.

S.No	Local institutions	Designation	KI
1	Provincial Disaster Management Authority (PDMA)	Deputy Director	02
2	District Disaster Management Authority (DDMA)	Deputy Director	02
3	Irrigation Department	Executive/sub-divisional Engineer	02
4	Provincial Revenue Department	Deputy Director	01
5	Planning & Development	Deputy Director	02
6	Social Welfare	Deputy Director	01
7	Public Health Engineering Department	Executive Engineer	02
8	Civil Defense	Deputy Director	02
9	Communications and Works Department	Deputy Director	02
10	Urban Policy Unit	Director	01
11	Rescue 1122	Instructor	03
12	Pakistan Meteorological Department	Asst. Director	02
13	Special Development Unit	Program officer	02
14	Local Government-WSSP	Manager	03
15	Peshawar Development Authority	Director	02
16	Town Municipal Administration	TMO ^a	02
Total			31

^aTehsil Municipal Officer.

conventional DRM cycle. A four-phased DRM cycle was used to organize and classify the issues and challenges the local institutions and communities faced, as illustrated in [Figure 2](#). The following section explores each issue potential causes and consequences.

4.1 Theme-1: Mitigation

Mitigation refers to preparing for and responding to potential disasters to reduce casualties and property damage ([Sena and Michael, 2006](#)). The use of structural measures can mitigate flooding and its consequences. In spite of their obvious crudeness, flood levees and embankments are often promoted as effective methods to reduce flood risks. Pakistan has considered taking a similar tack in the Khyber Pakhtunkhwa floodplains, where the relevant authorities have constructed embankments across the river and Nullah's (a waterway fed by rivers and streams coming down from higher elevations) to mitigate floods. This theme focuses on the structural (proper embankment construction and improper cleaning of drainage canals) and non-structural mitigation measures that include poor building control, intrusions into embankments, and imprecise responsibility and jurisdictions (see [Figure 3](#)). [Figure 3](#) displays the current study's results, revealing that municipal officials and community members believe that embankments should be raised or reinforced.

For instance, an executive engineer from the irrigation department stated:

“Embankments serve as a reservoir or a barrier for low-lying areas to protect them from flooding. There are different types of flood embankments. If they are exposed to fast-flowing water or waves, they might require further shielding from erosion. Thorough knowledge of the underlying soil capacity to enhance the required loads and the assurance of post-construction durability is necessary for embankment design and implementation. A thorough site assessment, sampling, testing of possible building material, and durability analyses before and during construction are typically required. Relevant local laws and regulations should follow such guidelines. He further added, “there are a lot of Earth materials that may be used to build flood embankments. Locally sourced resources must be used as much as feasible to save money and limit the ecological consequences. Compression, an important aspect of the construction phase, improves the durability of the materials needed to build the embankment. The needed strength is attained by layering the embankment and proportioning every layer using suitable mechanical equipment for the soil type. Density can improve by adding water to every layer due to the type of soil and its moisture condition. A geotechnical expert must be consulted to determine the proper layer thickness and the kind of compression machine needed”. He further added that “high clay soils should be discouraged since they break when they dry up and can extend to a meter into the embankment, weakening the bank's role as flood defense. Soils rich in sand and gravel could be used. However, a cutoff may be necessary to limit seepage during floods. Soil that has lost its topsoil layer has become less resistant to abrasion than one that has not. According to him, several fill options have been tested in Khyber Pakhtunkhwa

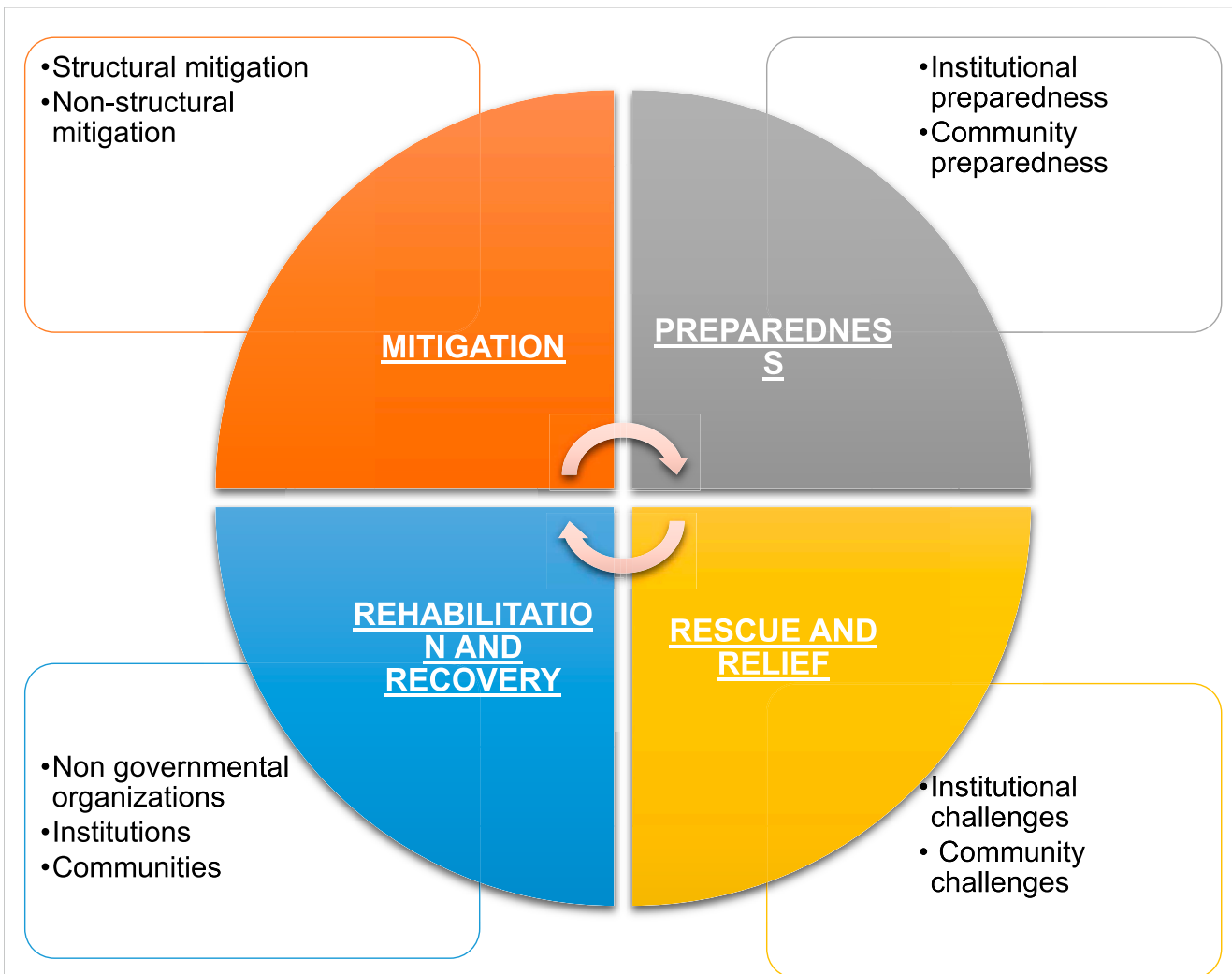


FIGURE 2
Summary of the themes and sub-themes used to unveil challenges in rural flood risk management.

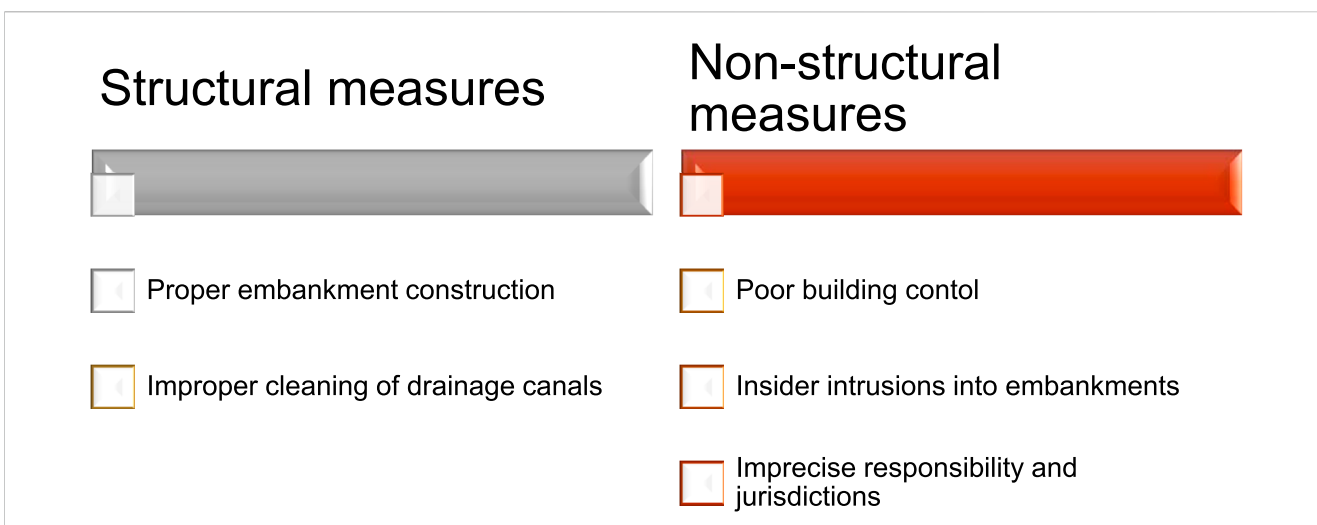


FIGURE 3
Theme-1: Mitigation.

province because of a lack of proper fill and the environmental effects of transporting significant volumes of fill from different parts of the country. These include using recycled tyres crushed into bales to build a flood embankment's center core. Before adopting these alternatives, they must be thoroughly investigated, with special attention paid to long-term resilience, stability, and total environmental consequences."

A 41-year-old male FGD group member stated:

"In rural areas, animals and agricultural machines have easy exposure to embankments. Both could inflict extensive damage to the riverbank crest when congregating or frequently breaching the barrier. Using fences to regulate livestock mobility and paved walkways to minimize the risk and extent of damage can be beneficial. Placing complementary strands of wire fences at the tops of fence posts can deter livestock from grazing on flood embankments. Sheep can cross underneath the lower strand since they do not harm embankment surfaces while they graze. Fencing impenetrable to livestock may be necessary at the boundaries of the fields. He added further that to ensure pedestrian movement, gates might also be needed".

Drainage canals with inconsistent widths, silt, and the need for regular cleaning were cited by representatives from various local institutions as a second major concern. This has led to congestion and poor water flow. The blockage is partly due to people and industries depositing solid waste into drainage systems.

Our conversation with the representative from the Local Government-WSSP office reported:

"Waste is dumped off or discharged into the drainage and river basins. Most of the local inhabitants in the four selected regions (especially Charsadda, Nowshera, and Peshawar districts) deposited waste into nearby rivers and streams. This has resulted in garbage piling along river channels and drainages, leading to water contamination, drainage clog, infrastructure deterioration, and the prevalence of water-borne diseases (e.g., typhoid, diarrhea, and cholera)."

An official from the local government-WSSP brought in to expedite the discussion further to find out what measures were in place to deal with the issue in each sampled region. He said:

"The government has been trying to solve the problem of waste disposal in the study region. This effort entails bolstering municipal committees with additional human resources, providing advanced technologies, and providing workers with capacity-building training".

However, findings from focus groups show that efficient garbage collection systems encourage locals to dispose of trash in eco-friendly ways. Most people who participated in focus groups in the four designated areas seemed to be concerned about the state of the waste management systems. Focus group participants brought up two issues with waste management in the survey: a lack of convenient collection locations and inconsistent garbage pickup. Every discussion group brought up the problem of having garbage collection points that were not permanently installed (100 percent). The local government in charge of the designated areas did not do anything to improve residents' access to designated areas where rubbish bins can be deposited. Participants in the focus groups voiced concerns that they could not find a convenient place to dispose of domestic waste due to a lack of community bins, improperly located collection points, or temporary collection points. Since each vehicle had to follow a specific path, they often fell short of the day's targets. The trashmen

were thus unable to keep to their regularly scheduled pickup schedule.

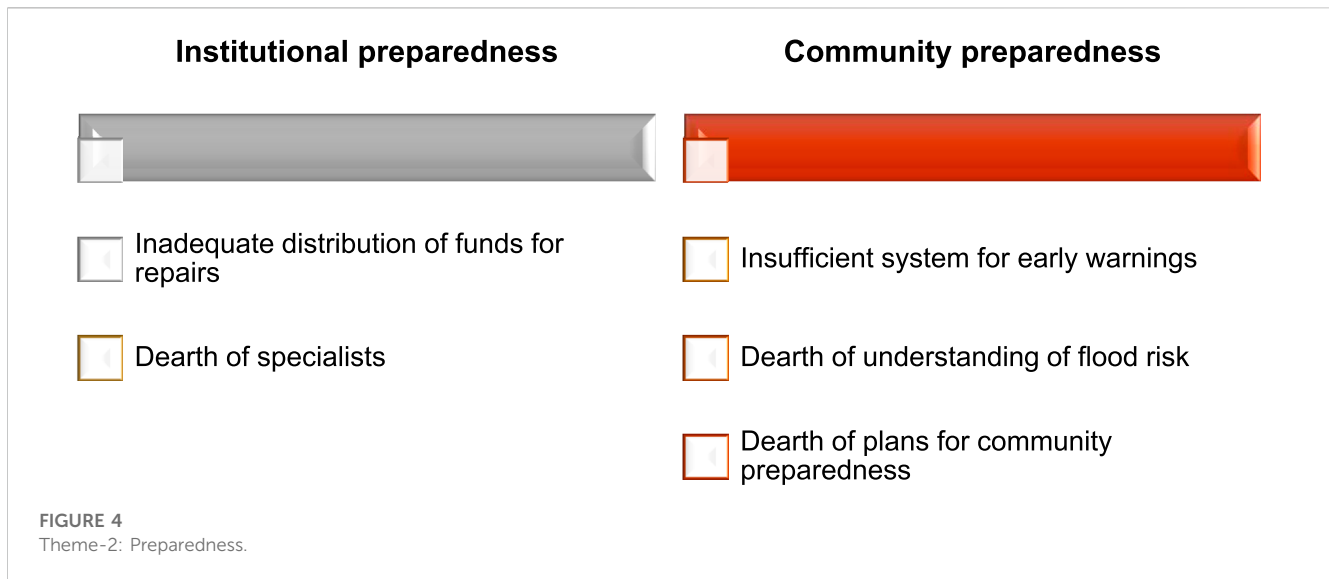
Figure 3 depicts how potential residual flood hazards in four different regions could be reduced using non-structural mitigating approaches. The most efficient method of decreasing disaster risk is through building control. There are regulations to restrict and guide construction away from obvious hazards. There was widespread agreement among government authorities and flood-prone area inhabitants that the local authority was not excellently regulating rural sprawl. When the latest floodwaters receded, new encroachments sprouted up within the riverbeds. However, the authorities' efforts to dismantle this lawless encampment were met with threats of legal action. Local governments are responsible for clearing up illegal structures and hazardous structures. However, they are powerless to remove illegal structures on land owned by the revenue or irrigation departments. The geographical scope of floods, which affects areas under the purview of different authorities, localized legislation is insufficient to control sprawl since the country lacks both regional and spatial legislation. Hence, non-structural flood risk mitigation can be achieved to a large extent through spatial planning laws and techniques. Furthermore, this has been backed up by the work of numerous scholars (Rahman and Shaw, 2015; Greiving et al., 2016; Shah et al., 2017).

4.2 Theme-2: Preparedness

Preparedness links the pre- and post-event phases of a catastrophic event. When a disaster hits, most people begin to consider what can be done to aid different scales of analysis in their response and recovery (this includes individuals, families, organizations, and communities). In the event of a disaster, preparedness initiatives also make an effort to ensure that the necessary resources are in place and that the people who would be called upon to use them have the required training (Tierney and Sutton, 2006). In this theme, we evaluated the issue of disaster preparedness from the perspective of both institutions and communities. The cornerstone of comprehensive crisis risk management is strong institutions. The results of this investigation show that representatives of different local institutions contend that financial and technical constraints are to blame for the lack of institutional preparedness. The local officials complained that they had to wait too long to receive their share of the funds for emergency preparations. For instance, the Provincial Disaster Management Authority (PDMA) Khyber Pakhtunkhwa owns logistics and machinery purchases to combat corruption, further procrastinating much-needed preemptive action. Institutions have blamed higher-ups for failing to recognize their urgent needs.

Representatives from the provincial and the district in charge of disaster management told us during our meeting:

"Disasters necessitate a wide range of commodities and services to deal with them. To be well-prepared, one must have these resources or systems in place to make them available quickly in an emergency. It is necessary to have a large stockpile of emergency supplies and vehicles to access the flood-affected areas and evacuate people or distribute relief goods. The devastating floods of 2010 in Pakistan exposed the



country many fault lines like no other single event in its history, endangering the lives and livelihoods of more than 20 million people. Unfortunately, we could not reach flood-affected regions, rescue people, or deliver relief materials due to a lack of appropriate vehicles and equipment.”

The findings in Figure 4 demonstrate that the Provincial Disaster Management Authority (PDMA) in Khyber Pakhtunkhwa lacked disaster risk reduction professionals with disaster management qualifications. The Deputy Director of PDMA Khyber Pakhtunkhwa stated that most experts work as consultants for non-governmental organizations. On top of that, workers who had previously dealt with flooding were regularly reassigned. As a result, institutional expertise is dwindling since employees who have just been recruited must understand flood risk management from scratch. A major barrier to the effective implementation of the flood risk management cycle was a lack of qualified human resources in local institutions. Our key informant interview officials highlighted that institutional readiness for flooding could be evaluated partly by how well their early warning system works. Most of our key informants highlighted that the current early warning system was ineffective and obsolete. The relevant agencies (such as the Pakistan Meteorological Department) require modernized methods to predict and issue flood warnings reliably.

A key informant from Pakistan Meteorological Department stated:

“Flood management begins with issuing a flood forecast or warning. The Pakistan Meteorological Department (PMD) has been assigned this role because the monsoon rains can best be predicted and handled by PMD. PMD employs satellite images of clouds and radar data to anticipate floods from quantified rainfall measurements to supplement standard weather forecasting resources. PMD is responsible for promptly communicating flood forecasts and warnings to avoid disasters like the floods of 2010, which devastated Pakistan even though PMD had issued a flood warning before the actual flood. However, in 2010 prior alerts were still ineffective in persuading inhabitants to flee their homes out of

the flooded area, resulting in significant losses of life and property. Most residents stayed in their homes as they were skeptical of the flood warnings.”

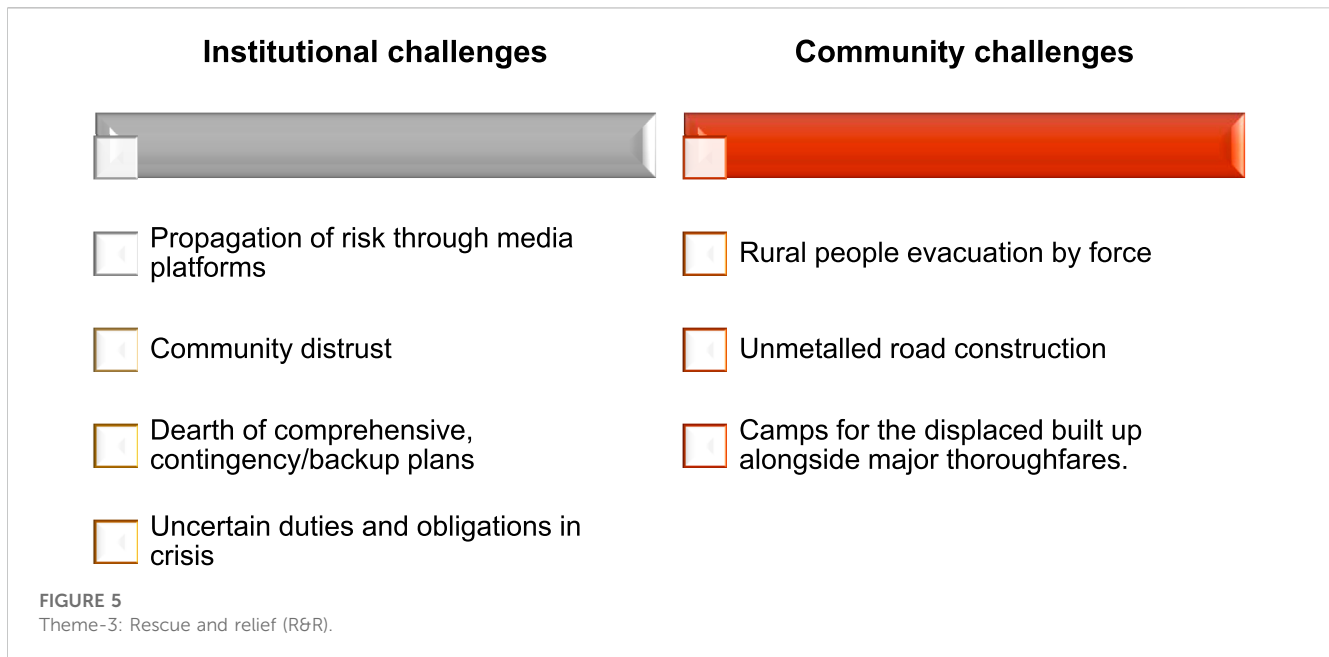
Preparedness for floods allows communities to respond more effectively during emergencies. Participant attitudes about risk were shown to be low during focus groups. During the focus groups, it became clear that the participants had an abysmal outlook on risk. None of the people who participated in the study knew that PDMA had classified their area as having a high risk of flooding.

“In the event of disaster triggered by natural hazards, residents’ poor risk awareness and readiness could impede an appropriate response, making them important considerations for efficient emergency management and planning. Many believe that citizens’ lack of risk awareness is to blame for their unpreparedness, which leads to a poor response to catastrophes.”

There must be plans to deal with the immediate aftermath of a disaster and ensure that business operations continue uninterrupted. At the same time, the crisis is being managed, as well as to direct the rehabilitation and reconstruction process efficiently. Handling disasters is an inclusive social process that involves a diverse range of responders, technical specialists, and concerned people. Since recent catastrophes are becoming more complex and need a higher level of professionalism, emergency preparedness has become more formalized common sense than ever before. This is especially true now, as ICT plays an increasingly vital role in disaster relief efforts (Alexander, 2015). The conversation in the focus groups across the four selected regions also revealed that there were no plans for the community to prepare for an emergency.

A male member from the Nowshera district focus group reported that:

“Khyber Pakhtunkhwa (particularly Nowshera and Charsadda) was devastated by a flood in 2010. Crops, houses, and other infrastructure were all severely damaged during this historic flood, perhaps the worst in the country’s history. Due to a lack of preparedness, the actual emergency intervention was severely constrained. The following outcomes resulted from a lack of



effective emergency preparedness plans: 1) relief efforts were hampered because major roads and bridges were not properly maintained; 2) it took longer to respond to the disaster because local committees could not operate. In the absence of clearly specified roles and responsibilities, elected representatives and municipal authorities competed over who should assume the leadership role; 3) the administration could not prioritize the delivery of emergency supplies since there were no plans or criteria in place; 4) the bulk of the initial data on the impacted people had to be gathered after the catastrophe. The devastation of roads and bridges in the area severely hindered damage assessment following a natural catastrophe. There were hardly any established procedures for estimating the flood damages; 5) There was significant scarcity, stockpiling, and an increase in pricing due to a lack of essential food and fuel supplies (Wheat flour and other basic items prices went up by 300 percent overnight). The rural poor were disproportionately affected. The demolition of infrastructures exacerbated the supply situation; 6) After the catastrophe, it was necessary to build up response capability in logistics, telecommunications, and human resource management (including material and financial resources). Most of the essential critical equipment was brought from other provinces since it was unavailable in the local market, and even in some situations, it took several months for it to reach."

The provincial government only launches a few public education and awareness efforts. Local non-profit organizations carried out the majority of awareness programs. Communities reported that the military and local administration purposely breached embankments to protect vital infrastructures but did not inform surrounding populations before the breach. During the focus group discussion, skepticism about early warning systems was also raised. This made it difficult for individuals to take action in response to early warnings from authorities. Consequently, people in flood-prone areas were reluctant to leave their homes. Therefore, a skewed perspective of risk, lack of familiarity with and knowledge of emergency preparedness strategies, and institutional

distrust were identified as the most significant barriers to enhancing local flood preparedness.

4.3 Theme-3: Rescue and relief

Natural hazards cause emergencies along with physical and societal chaos. The rapid distribution of these life-sustaining resources (such as food, housing, security, and water) through a reliable communication system is crucial to provide for those in need during times of crisis. Steps in relief operations frequently include setting up communication networks, conducting rescue operations, and administering first aid (Narayanan and Ibe, 2015). As shown in Figure 5, this study assesses the Rescue and relief theme in light of the difficulties encountered by local organizations and residents across the four studied areas. Effective rescue and relief operations can save lives, aid victims, and lessen economic damages. Some research contradicts the idea that the media overstates and misrepresents risks. However, broadcast news generally meets the reasonable reader requirements, which allow for substantial stories without outright spreading misinformation (Klaidman, 1990). Institutions providing disaster relief were most concerned about media exaggeration of risk, which they said stoked public panic and pessimism. Thus, individuals affected by disasters, volunteers, and NGOs are hesitant to work with local authorities. During the crisis, there was an issue with ineffective cooperation among relevant agencies.

In our in-depth conversation with the provincial PDMA representative, he told us:

"The media distorts the facts and misrepresents risk data. Many people believe that the media, particularly newspapers, television, and radio, are to blame for the "irrational" swings in public opinion they have caused. Journalists are often described as "risk junkies," constantly on the lookout for new and inventive ways to gratify

and scare their readers. To paraphrase an adage, “good news is not news.”

The media can serve a crucial purpose in times of calamity and crisis. Many people have found fault with their approach to victims and their loved ones. A community woman from the Nowshera district who took part in a focus group discussion said:

“At the district government office in Nowshera, Khyber Pakhtunkhwa, local journalists waited for updates about those who had gone missing in the 2010 flood. When I saw them, I inquired as to what all the hoopla was about. Officials called out the names of those who had perished in the 2010 flood. She inquired about her five-year-old son, Mr Ahmad. He said, “Yes, he is on the list.” She fell to the ground and screamed, “Never, my baby.” The only thing I can recall is giving up control. I recall seeing lights everywhere. The media treated me like a criminal. Normally, I’m a lady who likes to be in command. That was probably the one time I felt completely unhinged in my life. Furthermore, I had the impression that the media had carefully selected that particular moment. Anger boiled up in my veins, and I started feeling humiliated. In addition, there had no one to defend me. I spotted something at my relative’s grocery store the next day (when purchasing some food). As soon as I noticed the newspaper headline, “Missing Person,” I asked the shopkeeper, “Can I view that newspaper?” I was shocked to see a photo of myself lying on the ground of the district government office on the main page. When I saw it, I could not imagine it!”

Another issue that plagued disaster management was ineffective coordination across institutions. There is further evidence for this conclusion in the work of Atta-ur-Rahman (Rahman, 2010). The results of the key informant interviews indicated that no thorough contingency plans were in place. Organizing relief activities after a catastrophe was more challenging without a well-developed plan. The Khyber Pakhtunkhwa Provincial Disaster Management Authority (PDMA) creates a new plan to combat flooding yearly. However, these plans were rarely communicated to the local institutions. On the front line, the police and rescue personnel were working under the direction of the local government to carry out the evacuations.

While speaking with the Tehsil Municipal officer Nowshera, he stated:

“No irrigation department representatives were on-site during the flood to explain any potential ad hoc measures to lessen flood consequences.”

Officials said forced evacuation is perhaps the most challenging aspect of rescue and relief efforts. The fear of being robbed kept people inside their homes. In addition, unmetalled road construction posed a significant barrier to the evacuees’ ability to get to safety (Jamshed et al., 2019). In order to better serve those in need, relief camps were put up along major thoroughfares and in close proximity to major cities. The residents, however, felt that the camps were primarily there for political purposes and public spectacle. Communities had wonderful experiences with medical services because it was primarily provided by the military or local NGOs. Generally, challenges at the institutional and community levels were identified to impede the smooth operation of the rescue and relief operation. A discussion with the male focus group member from the Nowshera district states:

“The local authority has already set up camps along the main highway to draw media attention. They serve no other purpose but to impress.”

4.4 Theme-4: Rehabilitation and recovery (R&R)

The process of disaster rehabilitation is an essential component of disaster management. Disasters can severely hamper the ability of a country to maintain long-term growth. In addition, disasters can persuade governments to make substantial changes in their socioeconomic priorities and programs. Disasters often have adverse psychological consequences, such as high-stress levels and dysfunction. It is, therefore a hard challenge to manage disasters effectively. The human toll and economic losses caused by natural disasters are high, and it might take years to restore normalcy. Disaster management necessitates a systematic approach and efficient resource allocation to positively impact catastrophe relief, disaster rehabilitation, and recovery (Dhameja, 2008). Disaster rehabilitation entails making systematic improvements in a disaster-affected area to ensure long-term recovery. Disaster rehabilitation is a stage in the recovery process that follows immediate relief. It consists of the steps undertaken in the aftermath of disasters to restore essential services, aid victims in self-help attempts to repair physical damage, resurrect economic activity, and give psychological and social assistance to survivors (Pinkowski, 2008). Owing to the complexity of disaster rehabilitation, it is difficult to assign a specific timeline to the various phases of the process. Long-term developmental aid (like reconstruction) can assist the impacted people in restoring their lives and addressing their current needs and future demands. Recovery should be long-term; however, this may not be possible unless specific guidelines are strictly followed during rehabilitation and reconstruction. An effective rehabilitation or long-term recovery plan must recognize the physical and non-physical needs of the most vulnerable areas (Pinkowski, 2008).

Institutions play an essential role in recovery and rehabilitation (Shah et al., 2019) and provide financial assistance, construction materials, and temporary employment in the local community. The findings in Figure 6 revealed some alarming results. First and foremost, in terms of determining the extent of the damage (to determine the approximate cost of rehabilitation and recovery as well as formulating appropriate plans), unfortunately, there was no set method to execute. Similarly, no measures were in place for effective rehabilitation operations (relocated or resettled) to ensure that people would not be affected by future floods. Consequently, individuals return to their houses in flood-prone locations when the water has gone. Although disaster victims received cash payments to aid their recovery efforts, they were criticized by the communities in which they lived for being based on partiality and nepotism. Arai (Arai, 2012) noted that these challenges similarly plague aid delivery in Pakistan. The institutions believed this mistrust and misunderstanding were caused by an ineffective system for disseminating resources or aid.

“In the provision of tents, foodstuffs, medical aid, and other commodities, certain flood-affected localities received special privileges over others in the same area. Skewed assistance distributions can be traced to the feudal system, whereby some landowners (many of whom were linked to or represented political



parties) favoured their respective political constituency over the wellbeing of their rivals. As a result of their intimate relationships with the provincial administrations and police, the systemic disparity in aid distribution was further strengthened. It is important to emphasize and highlight the examples of feudal landowners who responded to the demands of their people more rationally with compassion and agility."

The focus group discussion across the four regions found that the residents of a community work together to raise funds for its rehabilitation and recovery. On the other hand, the district government hired locals to restore their neighborhoods embankments. As a result, those afflicted by the floods have been able to get short-term jobs and recuperate their losses, as highlighted by the flood victims. A focus group discussion with the male focus group member from the Nowshera district states; "Some subcontractors rely on us to repair embankments or to rebuild other infrastructures. Although they compensate us very little, they helped us acquire essentials and recuperate some of our damages."

NGOs and disaster management institutions appeared to have the most acrimonious relationship. Owing to a worsening national security situation, non-governmental organizations could no longer receive funds directly from international bodies. Thus, NGOs capacity to assist the local population has been restricted as they await NDMA funding approval. In most cases, NDMA engaged with international NGOs, and the information they gathered or produced was not exchanged with provincial or local institutions. Nevertheless, several NGOs operating in flood-affected areas received money from local charitable sources. In a nutshell, rehabilitation and recovery attempts would be hindered by institutional constraints. To put it briefly, reconstruction and recovery initiatives are hampered by institutional constraints, yet, the local political economy plays a role in the unequal allocation of flood recovery resources.

5 Conclusion and course of action for efficient flood risk reduction

Human-environment interactions are the underlying cause of disasters. Despite the usefulness of the DMC, its process and elements remained subject to discussion. In the context of climate change and resilience discourses, phase definitions that

are too broad might lead to confusion and misunderstanding. Long-term disaster risk reduction has increasingly relied on climate change mitigation and adaptation. As a result, climate change adaptation must be integrated. It is also necessary to look at the multidimensional facets of rural risk to connect local institutions, rural communities, and other stakeholders for improved flood risk management. The widespread use of resilience across every development agenda prompts concern about how it would be integrated into the conventional disaster risk management cycle. Rural inundation is becoming more common, especially in impoverished countries, owing to global warming and climate change. Yet, rapid urbanization, the clustering of rural poor in unplanned communities (riverside) and susceptible areas, ineffective land use planning, and a lack of participation of important stakeholders in disaster risk management is also the other causes. The problems identified in the flood risk management system pointed to a reactionary approach to response and funds, a self-directed reconstruction phase, and poor governance. There is little thought given to the risks of new rural development or the need to invest in measures to mitigate such risks. The local institutions and rural communities have grown to consider a course of action for efficient flood risk reduction. Rural flooding in Pakistan has revealed difficulties in implementing the DMC. Rural flooding has become frequent in many rural parts of the country. In this situation, the government still lacks a comprehensive rural development framework at the federal and provincial levels. Every district has various developmental goals based on a single integrated system, but their execution varies greatly. This complicates catastrophe risk management since the government priorities differ from one region to the next.

As a consequence, flood risk management is now mainly performed in an *ad hoc* manner. Disaster management institutions in Pakistan are still establishing themselves. Thus, it will take some time for them to establish a solid foundation. Although the NDMA promises to use a preparedness-oriented strategy, the state disaster management structure is still based on a top-down approach. In practice, the focus has shifted from disaster assistance to seasonal preparation. The PDMA(s) are not constitutionally required to adhere to NDMA under the 18th constitutional amendment. As a consequence, the NDMA functions as a general policy-setting institution. Cooperation is essential to guarantee complete coverage. DDMA comprises local

officials from various government agencies, yet they are practically non-existent in action. This necessitates the formation of a designated DDMA that could open up opportunities for disaster risk reduction. Frequent institutional and technical capability assessments are also necessary for effective emergency readiness and response. The local institutions used in the current study could benefit from additional investigation to uncover any flaws in their systems. To strengthen flood risk reduction efforts, it is critical to enhance the reputation of local institutions in front of the community. There must be cooperation between local institutions and rural communities to maximize the benefits of the DMC and DRR measures.

To manage the risks of rural flooding in a context-sensitive approach, it is advised that structural and non-structural interventions be used in a suitable proportion. The capabilities of local governments to provide efficient design interventions to mitigate the risks of floods are compromised by insufficient financial resources in developing economies. This underlines the need to rely increasingly on non-structural solutions to alleviate the threats of Rural floods over the foreseeable future. The results of this study will help disaster management professionals, climate experts, and planners to address the issues of managing rural flood risk in similar geographical settings like Pakistan. To effectively deal with the distinctiveness of the many significant catastrophes, this research provides a modern perspective on the conventional cycle for disaster management. This viewpoint promotes greater individual and public participation in catastrophe management and stresses contemporary and creative aspects. This study is anticipated to have significant value for those looking to enhance institutional, interpersonal, and societal endurance as well as performance throughout different phases of the disaster response cycle. The conventional disaster risk management process is typically administrative; as a result, it needs to adopt innovative management concepts by focusing on all governance levels.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary Material. The data that has been used in the article can be obtained from the first author AS (shahaa@cau.edu.cn; ahmad.ashfaq1986@gmail.com) upon request.

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Ethics statements

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent from the participants was not required to participate in this study in accordance with the national legislation and the institutional requirements.

Author contributions

AS: Conceived and designed the study; Performed the field survey; Analyzed and interpreted the data; Wrote the paper. AU, NK, MS, RA, SH, MT, and CX reviewed the paper.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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