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ENVIRONMENTAL RISK COMMUNICATION: ANALYSING COMMUNICATION STRATEGIES OF PAKISTAN DISASTER MANAGEMENT AUTHORITY (PDMA) IN RESPONSE TO NATURAL DISASTERS AND ENVIRONMENTAL HAZARDS

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ABSTRACT

To make Pakistan ready to face the disasters and their consequences, the understanding of the perspectives and enhancement of the environmental risk communication strategies are vital. It is critical that general public receive adequate information and knowledge as well as necessary tools to prevent and respond to environmental threats and natural disasters as this country remained at high risk of experiencing such events in years. A sample size of 200 was chosen to ensure generalizability, and data will be analyzed using descriptive statistics. The study targets communities affected by environmental hazards, with key stakeholders such as PDMA officials, local leaders, and community members selected via purposive sampling for interviews. The findings indicate that while PDMA's social media strategies have made significant strides in raising public awareness of environmental hazards, further improvements are necessary. By continuously evaluating and adapting its social media plans and integrating community feedback, PDMA can further improve disaster preparedness and response efforts, minimizing the impact of environmental disasters and enhancing resilience in Pakistan.

Key words: Environmental Risk Communication, Natural Disasters, Environmental Hazards, Pakistan Disaster Management Authority (PDMA).

INTRODUCTION

Environmental risk communication is essential in Pakistan's ongoing struggle against environmentally threatening risks and the disasters that threaten lives all the time. Pakistan is located in a physically diverse environment and faces threats of frequent earthquakes, floods and many other factors from nature; it can be said that it is a constant struggle to minimize these threats and safeguard its citizens. PDMA, that was established in 2007, through the National Disaster Management Ordinance (NDMA, 2020) in Pakistan, is currently spearheading this effort. The formation of the PDMA was a landmark event for Pakistan Disaster management planning because it was established with the mission of preventing and managing disasters, coordinating preparation, response, and rendition at the national level (Adnan et al., 2024).

The PDMA has endeavored to employ such a primary communication strategy throughout its existence for the purposes of disseminating critical information; building community support and capacity; and enhancing catastrophe readiness (Shahid, 2023).

The PDMA has made an effort to establish a broad reaching strategy for helping to increase the level of environmental management competencies across the population; to date, the PDMA has attempted to use as many channels as possible, including social media, traditional media (Ramzan et al., 2020), community outreach programs, and educational projects (Akram et al., 2021a). In all provinces of Pakistan, the PDMA aims at not only creating awareness but also changing the mind set of the population, as well as government and non-government organizations by practicing openness, sharing of information and working together (Seyfert & Ahmad, 2020).

According to (Anjum & Fraser, 2021) Many environmental challenges have been observed in Pakistan over the last several decades and this concurs with the notion that Pakistan is prone to different natural disasters and enduring environmental problems. These issues have posed immense threats to the nation's infrastructure and population as well as the objectives on sustainable development. Highlight the areas that are most exposed to a number of nihilistic phenomena including flood, earthquake, and drought that occurs due to its geographic location which is influence by its nearness to seismic faults, monsoon and reliance on river systems for irrigation and food production. Numerous individuals have been displaced throughout Pakistan primarily by, and millions of individuals have suffered, alongside facing major economic casualties, due to the frequent and deadly floods in the country. The geophysical factors have immense impact on the nation's river systems, especially the Indus River which can have flash floods that are boosted by monsoon winds and glacial melt in the Himalayas (Mani et al., 2023). The 2010 floods are considered to be among the worst floods in the history of Pakistan; the floods affected millions of people, led to a partial destruction of infrastructure, and caused the loss of many people's lives and their means for existence. Like most countries in the region, it is located along the intersection of the Indian and Eurasian tectonic plates, and thus, naturade from earthquakes in that country is real. Another fatal earthquake took place in same year 2005 mostly in Khyber Pakhtunkhwa and Azad Kashmir and it had greatly affected the people and there were houses destroyed. The Pakistan Disaster Management Authority which was established in 2007 is also involved in risk reduction strategies as well as disaster management (Rana et al., 2021).

Findings by (Ishtiaq, 2023) The communication of the PDMA is therefore centralized through different forms of communication such as social-media, traditional media, community engagement technology, and education (Akram et al., 2021b). By adopting these forms of communication, the PDMA wants to engage major target groups including policy makers in government, civil society organizations, communities, and the public. However, challenges still remain in effectively communicating environmental risks and in engaging stakeholders in risk management projects. Cultural barriers (Ramzan et al., 2023a), illiteracy, lack of information access, and language barriers may hinder proper communication (Ramzan et al., 2023b) and exclude communities from involvement in disaster-preparedness and disaster interventions. Under these circumstances, it becomes pertinent to conduct a critique of the communication strategies adopted by the PDMA to transmit its messages regarding environmental threats and natural calamities in Pakistan. As a result understanding these tactics and their potential benefits, downsides, feasibility and risks would help to identify lacunae and provide recommendations for enhancing the communication effectiveness.

It is evident that the PDMA and other stakeholders have not done much to inform the general public on the communication strategies practiced in Pakistan for environmental issues. It is thus important that an evaluation be conducted as soon as possible of the communication strategies employed by the PDMA in handling the environmental threats and natural disasters. By identifying these areas, appropriate recommendations can be made, which will improve the effectiveness of communication strategies and build the resilience of communities and institutions against environmental risks. Lack of coordination and cohesion in communication undertakings among many stakeholders also present major challenges to risk communication in Pakistan (Shah et al., 2023).

Many more governmental departments and non governmental, civil society and community based organisations are involved in risk communication though PDMA is the coordination and lead coordinating agency. However, in most cases, their

operations lack coordination and collaboration, thus leading to duplication of efforts, inconsistent messages, and gaps in coverage. Therefore, it ensures cogent and consistent messages throughout emergencies as it emphasizes integration of business processes, designation of clear contact points and fosters more cooperation from all the stakeholders. In as much as this may be the case, communication tactics need to be geared towards the capacity and needs of the different community types in order to have the highest impact. This needs appropriate language and means of communication that will not cause any form of offence to the culture of their employers (Cheema, 2021).

Hence, following research question and hypotheses formulated for this research.

RQ: Which communication techniques does the PDMA employ to inform the public about environmental risks?

H_1: In Pakistan, greater public knowledge and readiness for environmental hazards is positively correlated with the PDMA's efficient use of social media platforms.

H_2: Local communities in Pakistan that face environmental threats have increased resilience and adaptive ability as a result of community engagement programs carried out by the PDMA.

Literature Review

Environmental Risk Communication Overview

According to (Shaffer, 2021) Environmental risk communication is, therefore a multifaceted and crucial component of disaster management. This involves dissemination of information across various sector, empowerment of community and preparing for Environmental hazards and Natural disasters. People and poor communities have to first know about the risks and impacts of the environment, be prepared for them, and then ready to manage them effectively, so the way we communicate is vital. Such communication techniques are necessary in Pakistan – a country, which is at disclose risk concerning the environmental issues including the pollutions, earthquakes and floods.

The Importance of effective Communication Strategies

This research established that Pakistan faces a diverse threat posed by natural disasters and environmental elements; therefore, communication methods should be carefully considered if environmental issues in the country are to be addressed. Some natural disasters and calamities that occur on the regular basis include earthquakes, landslides, droughts, cyclones and floods which bring threats to individual and communal existence. Moreover, these hazards aggravate adverse effects of deterioration of environment like soil erosion, water pollution and deforestation. This means that the efforts and the actions of communicating need to be proactive and as well coordinated as possible (Hussain et al., 2020).

The Role of the Pakistan Disaster Management Authority (PDMA)

An organization of authority known as the Pakistan Disaster Management Authority is exemplary of the institutions that deal with environmental risk communication in Pakistan (PDMA). The National Disaster Management Ordinance that was signed in 2007 led to the creation of the PDMA which was given the responsibility of management and coordination of efforts regarding preparedness, response and recovery processes regarding disasters. It employs a decentralized system of organization and various departments at the provincial and district levels of disaster management agencies are responsible for implementing the policies and actions on the ground. Hence, the Pakistan Disaster Management Authority plays a significant role in defining and shaping the country's disaster management and the communication of risk, as it leverages partnerships, assets, and, particularly, expertise to enhance the protection of structures and populations. The PDMA is involved in coordinating emergency activities and arrangements and conducting risk analysis in its various departments and agencies in an effort to mitigate the impact of environmental hazards and natural disasters (Malik & Cruickshank, 2016).

Opportunities and Challenges

In view of (Khan et al., 2016) Pakistan still faces several challenges which hinder efficient planning, response, and recovery operations in the communication of environmental risks. The effectiveness of promoting communication efforts is also constrained by the accessibility of information and communication technologies (ICTs), particularly in the remote areas. While the role of ICT in society and education is pivotal, as it bridges gaps in knowledge (Akram et al., 2021c; 2022), fosters global connections (Al-Adwan et al., 2022), and enhances learning opportunities (Abdelrady & Akram, 2022; Ramzan et al., 2023c). In education, ICT empowers both teachers and students by providing access to vast amounts of information, interactive learning platforms (Akram & Li, 2024), and digital tools that enhance teaching methodologies (Akram & Abdelrady, 2023). It enables personalized learning experiences, making education more inclusive and adaptable to individual needs (Ma et al., 2021). At the same time, health communication faces challenges such as illiteracy, language barriers, and cultural barriers (Akram et al., 2020) that require unique interventions to reach a diverse population. Moreover, probabilities of disasters are high, and current risks are aggravated by developing urbanization, uncontrolled growth, and weakened environments. The situation is worse because the nation struggles with weak institutional capability, inadequacy of resources, and conflicting goals when responding to environmental hazards. However, they are also opportunities for creativity and progress at the same time. Technological features and ICT include social media platforms, smart phones, the internet which offer new conduits where dispersed and marginalized people can access the right information at the right time. Some of the approaches used in community engagement that allow communities to drive the resilience building process themselves include the participatory risk assessments, community mapping exercises. Moreover, by adapting modern tools to the context of local communities, engaging with traditional technology systems, aboriginal norms, and cultural beliefs enhances the effectiveness and sustainability of the communication.

Studies on the Communication Strategies of PDMA

Several studies have been done with regard to the communication tactics of the Pakistan Disaster Management Authority (PDMA) in response to the environment threats and natural disasters in Pakistan. These studies outlined here also point to avenues for future research by providing valuable knowledge about the challenges and successes of the PDMA in risk communication.

(Shajahan & Reja, 2011) looked into the details of the communication strategies adopted by PDMA during the calamitous 2010 floods which shook the entire nation and marred the lives of millions along with eradicating the villages completely. The study again noted that despite the PDMA using various communication methods including use of social media platforms, SMS alerts and radio broadcasting, it was a challenge to make do with the isolated and marginalized groups hence there was sporicidal provision and relaying of services and information. They pointed towards the direction that different needs and preferences of different groups have to be considered when communicating risks

In addition, (Shaw, 2015) conducted research based on the role of PDMA in the face of the 2015 earthquake in Pakistan, which was a disastrous disaster in northern Pakistan that resulted in a large number of casualties. The interpersonal communication of their study showed the effectiveness of involving the PDMA and the citizens to listen to each other and build trust.

(Ullah & Zaidi, 2023) study involved a qualitative assessment of the Pakistani communities comprehension of environmental risks and the PDMA's communication strategies. Nevertheless, the study highlighted that there were some discrepancies in the ways in which the PDMA designed and implemented its communication strategies focusing on the needs and interests of particular communities, findings underlined the need for communication processes that engage a community in decisions and response measures. The involvement of the community in the risk communication programmers enhances the programmers' effectiveness, the authority they possess, and their significance.

Information Overload

During disasters human beings are likely to be flooded with information overload hence fail to make good decisions. Public may become bewildered, apprehensive, or skeptical due to mixed messages, information voids, and information overload. The authorities ought to distinguish between the most pertinent messages, establish the criteria for identifying reliable information sources, and demarginalize the communication process in order to address this challenge. One of the solutions mentioned was centralised hubs or platform that serves as credible source of information. These hubs can also aggregate and disseminate essential emergency alerts, authenticated updates, and recommendations from relevant government and expert agencies (Anson & Edwards, 2021). Risk communication initiatives can be made more coherent and clear by authorities through integrating information through reliable channels and thus reducing the delivery of conflicting messages.

Additionally, through technology and structured data processing, materials can be redeveloped to fit particular individuals. Application of recommendation engines and intelligent algorithms can also sort through details and feed users with updates according to their current location, areas of interest or any previous interacted (Lachlan et al. , 2016). This method might reduce overloaded information since only the most necessary information will be given to the consumers, making risk communication even better. Moreover, the general public should be enlightened in order to be in a position to sift through all the information provided to them be it formally, informally, factually or falsely or a mere a rumor. Knowledge-based interventions such as micro- workshops and education can assist individuals in knowing how to approach information critically, evaluate sources, and know what to look out for as pertains to biased or wrong information Education on media critically helps authorities to strengthen the population ‘s ‘vaccine’ against fake news, as well as help people receive the necessary knowledge and skills to make the right decisions in an emergency (Reynolds et al. , 2019).

Language and Cultural Barriers

Particularly in the multinational and multilingual context of business, language and culture may become an obstacle to communication (Ramzan et al., 2023d). To address the multilingualism and diverse literacy level of the population, (Squires, 2020) stress the need for providing information in multiple languages and using different modes of communicating this information (Ramzan et al., 2023e). It is also critical to grasp how culture affects risk perception, communication styles and decision making when developing communications strategies. Government officials need to pay special attention to ensuring multilingual communication and proper translation to break language barriers that limit effective dissemination of information to all the sections of society (Chen & Ramzan, 2024). Official announcements, emergency messages and other pieces of information need to be translated into more popular languages and dialects in the community.

Cultural competence training is also required for communicators and emergency responders as Bosher et al (2019) noted in order to avoid feelings of discomfort around those of different cultures. This training should include strategies for building trust and addressing other cultural differences, such as norms, values, communication styles, and other do’s and don’ts. Authorities can ensure that risk messages are understandable, culturally appropriate, and has a positive appeal to different culture through cultural relevance.

Furthermore, another important factor highlighted by Fernandez et al. (2016) is the need to engage with trusted intermediates, cultural brokers, and community leaders to overcome barriers and encourage more community members to participate.

Crisis and emergency risk communication (CERC) model

In regard to communication, the CERC model provides support for its primary idea of the high level of pre-crisis planning elaboration. It entails identifying with the different stakeholders involved, creating procedures on how such information is handed over and acting as a means of raising preparedness through practice. In the same perspective earlier on in the crisis, the provision of timely dissemination of appropriate

and accurate data to the affected members of the public is necessary for the communication process to happen. Particularly, in the CERC model it pointed out the importance of action and information at the right time to alert and maintain the community concerned. When it comes to the sharing of information and communication during an event like this, there are two issues that must be upheld: credibility, and confidence. When it comes to the key principles of the CERC approach, there is a need to focus on the needs, concerns, and perspectives of the target audience. The fundamental purpose of crisis communication includes informing people and communities with the requisite knowledge so as to enable them prevent their own exposure as well as that of other people to harm.

Methodology

The study utilizes a quantitative approach, incorporating descriptive analysis to explore the complexities of communication strategies within PDMA concerning environmental disasters. A cross-sectional approach is used to gather data at a specific point in time, allowing for the assessment of PDMA's current communication strategies. The study targets communities affected by environmental hazards, with key stakeholders such as PDMA officials, local leaders, and community members selected via purposive, while questionnaires are distributed to a broader population, including university students. A sample size of 200 is chosen to ensure generalizability, and data is analyzed using descriptive statistics.

Results and Findings

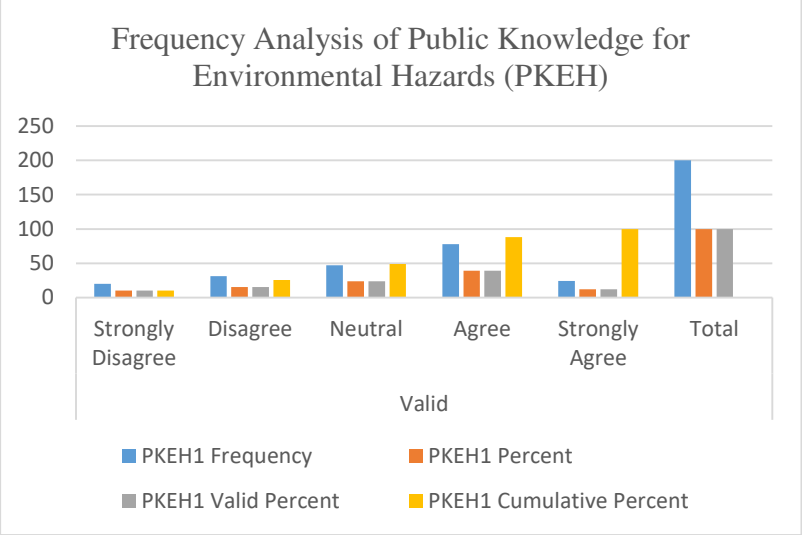


Figure 1: Frequency Analysis of Public Knowledge for Environmental Hazards (PKEH)

The Figure1 shows the responses of participants on the study item. Most of the participants agreed (39%), followed by a neutral response (23.5%), disagree response (15.5%), strongly agree response (12%) and strongly disagree response (10%).

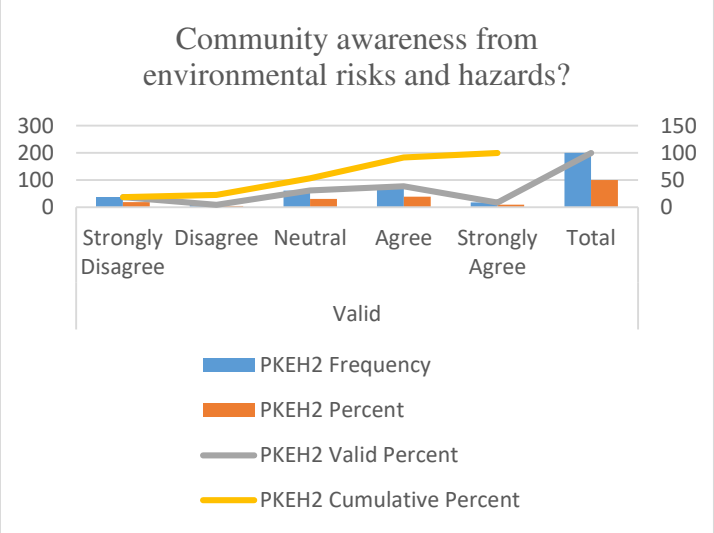


Figure 2: Community awareness from environmental risks and hazards?

The figure 2 shows the responses of participants on the study item. Most of the participants agreed (38.5%), followed by a neutral response (30.5%), strongly disagree response (18.5%), strongly agree response (8.5%) and disagree response (4%).

Table 1: Frequency Analysis of PDMA's Use of Social Media Platforms (PUSMP)

	PSMP1			
	Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Strongly Disagree	37	18.5	18.5	18.5
Disagree	39	19.5	19.5	38.0
Neutral	26	13.0	13.0	51.0
Agree	60	30.0	30.0	81.0
Strongly Agree	38	19.0	19.0	100.0
Total	200	100.0	100.0	

The table 1 shows the responses of participants on the study item. Most of the participants agreed (30%), followed by disagree response (19.5%), strongly disagree response (18.5%), strongly agree response (19%) and neutral response (13%).

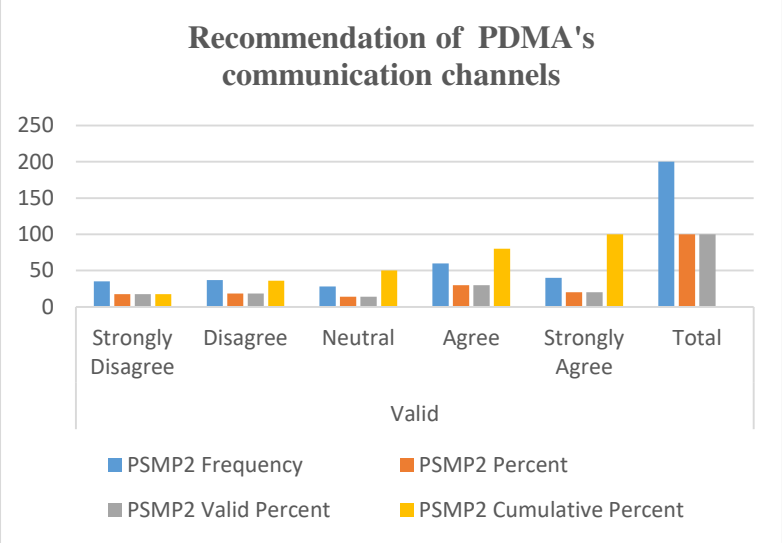


Figure 3: Recommendation of PDMA's communication channels

The figure (5.3) shows the responses of participants on the study item. Most of the participants agreed (30%), followed by a strongly agree response (20%), disagree response (18.5%), strongly disagree response (17.5%) and neutral response (14%).

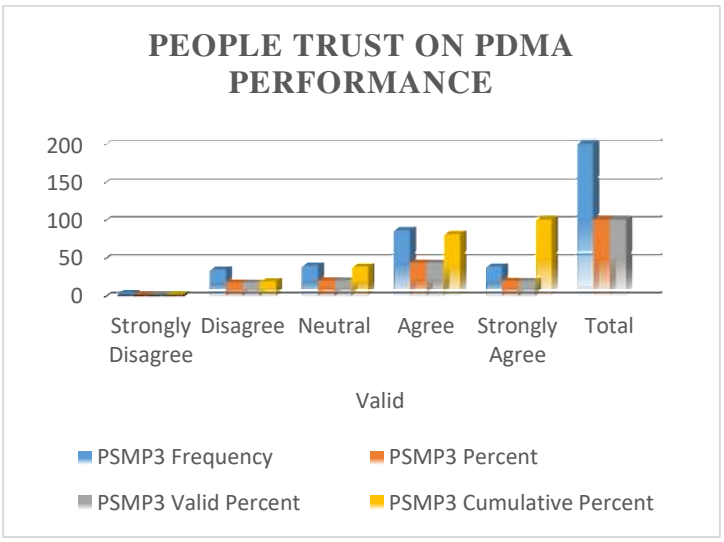


Figure 4: People's trust on PDMA performance

The figure 4 shows the responses of participants on the study item. Most of the participants agreed (43%), followed by a neutral response (19.5%), strongly agree response (19%), disagree response (17%) and strongly disagree response (1.5%).

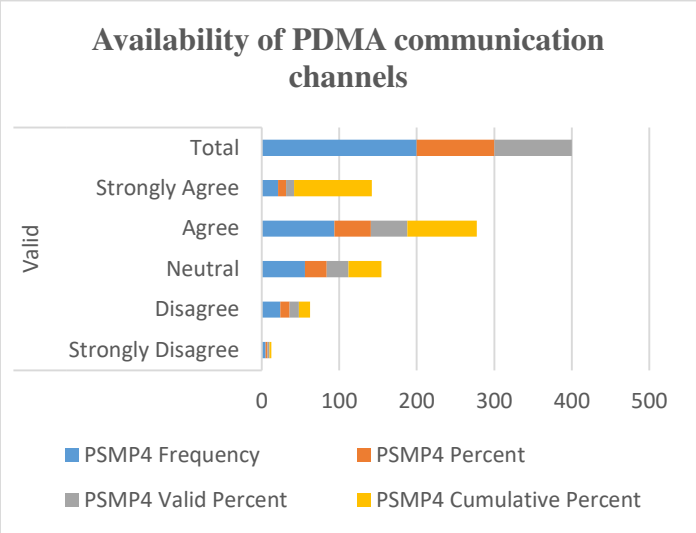


Figure 5: Availability of PDMA communication channels

The figure 5.5 shows the responses of participants on the study item. Most of the participants agreed (47%), followed by a neutral response (28%), disagree response (12%), strongly agree response (10.5%) and strongly disagree response (2.5%).

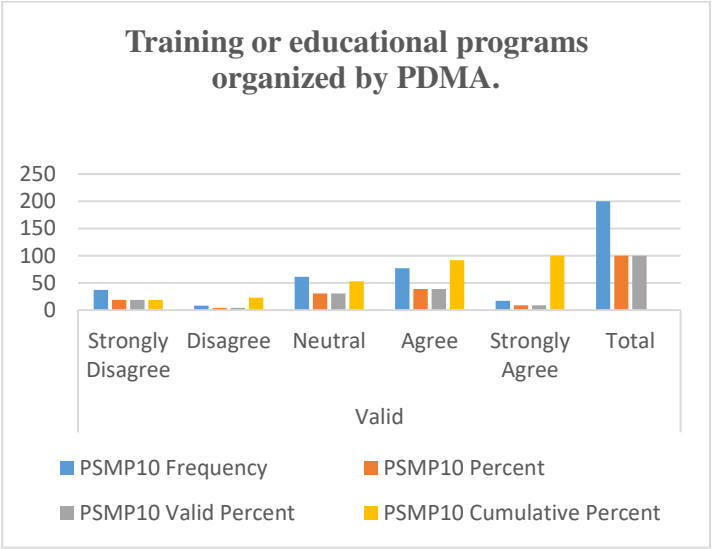


Figure 6: Training or educational programs organized by PDMA

The Figure 5.6 shows the responses of participants on the study item. Most of the participants agreed (38.5%), followed by a neutral response (30.5%), strongly disagree response (18.5%), strongly agree response (8.5%) and disagree response (4%).

Table 5.2 PDMA's risk communication tactics

	ERCT10			
	Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Strongly Disagree	35	17.5	17.5	17.5

Disagree	37	18.5	18.5	36.0
Neutral	28	14.0	14.0	50.0
Agree	60	30.0	30.0	80.0
Strongly Agree	40	20.0	20.0	100.0
Total	200	100.0	100.0	

The table 2 shows the responses of participants on the study item. Most of the participants agreed (30%), followed by a strongly agree response (20%), disagree response (18.5%), strongly disagree response (17.5%) and strongly agree response (14%).

Discussion

The study's examination of Public Knowledge for Environmental Hazards (PKEH) and PDMA's Social Media Platforms (PSMP) provides insights into how effectively social media is used to raise awareness about environmental hazards. Descriptive statistics reveal that while the public is generally aware of environmental risks, there are knowledge gaps in specific areas, such as understanding the signs of danger and prevention strategies. PDMA's use of social media has been largely effective, characterized by regular posting and diverse content, but there remains room for improvement, particularly in enhancing communication during emergencies (Shah et al., 2020).

The results suggests that social media is a powerful tool for public education and disaster response. However, to maximize its effectiveness, PDMA must adopt a multifaceted communication approach that integrates social media with traditional media. Engaging the public more actively through real-time responses to inquiries during emergencies can strengthen public trust and confidence (Saroj & Pal, 2020).

While social media platforms like Facebook, Twitter, and WhatsApp have been utilized for disaster alerts and public engagement, challenges remain. Issues such as misinformation, unequal access to communication tools, and limited digital literacy, especially in rural areas, affect the overall effectiveness of these strategies (Singla & Agrawal, 2024). PDMA should consider adopting additional communication channels like community radio, SMS alerts, and interactive voice systems to reach a broader audience

Moreover, involving local communities in the decision-making process and tailoring communication strategies to their cultural and linguistic needs can enhance the relevance and impact of PDMA's efforts. By incorporating diversity and inclusion, PDMA can foster social justice, strengthen community resilience, and improve society's ability to adapt to future challenges.

Conclusion

The findings indicate that while PDMA's social media strategies have made significant strides in raising public awareness of environmental hazards, further improvements are necessary. Enhancing the quality of posts, addressing public concerns in real-time, and employing a multi-channel communication strategy will help PDMA better serve its audience, particularly in rural and marginalized areas. By continuously evaluating and adapting its social media plans and integrating community feedback, PDMA can further improve disaster preparedness and response efforts, minimizing the impact of environmental disasters and enhancing resilience in Pakistan. Moreover, it is argued that engagement with potential communities located in disaster areas, enhancement of civic engagement, increasing human resources in the form of volunteers, students, citizen willing to provide assistance and support to affected communities, stakeholders and local leaders can potentially reduce the risks of environment disasters if communication is triggered before the environmental hazards.

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