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RESEARCH ARTICLE

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Managing knowledge and sustainability in resource constrained disaster environments

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Abstract

Organizations use both tangible and intangible resources for their existence to achieve sustainable development goals. Organizational knowledge mainly comprises of tacit knowledge held by employees. It becomes more critical when the situations are unpredictable, for example in rescue/disaster projects involving human lives at risk. Tacit knowledge utilization has been understudied particularly in such environments bounded by resource constraint and sustainability issues. This qualitative research attempts to fill this gap by collecting data from the knowledge workers in a large public sector non-profit rescue organization. The study reveals various individual level, group level, organizational level, community level, and situational level factors, which impact the tacit knowledge utilization of rescue workers to properly execute emergency life threatening rescue operations and sustainability issues.

KEYWORDS

disaster environment, environmental management, green issues, knowledge management, sustainability, sustainable development

1 | INTRODUCTION

Organizations face fierce competition in the modern world's ever-changing environment, specifically in the wake of the knowledge economy (Ardito et al., 2022; Centobelli et al., 2016; Huan & Zhu, 2023; Kherazi et al., 2024; Pham-Truffert et al., 2020; Ratinen et al., 2023; Ross et al., 2024; Selseng & Gjertsen, 2024; Zheng et al., 2024). They need to continuously capitalize on external and internal knowledge for improved performance (Ahmed et al., 2021; Bjorvatn & Wald, 2018; Centobelli et al., 2019; Tang et al., 2023; Wu & Zhai, 2023; Yasir & Majid, 2017). The organizational knowledge comprises of tacit and explicit knowledge (Hallinger, 2020; Kong et al., 2020; Sumbal et al., 2021) where explicit knowledge is in documented form and the tacit knowledge resides with the employees (Biswas & Miller, 2022; Cockburn, 2022; Kruijf et al., 2022; Nurhas et al., 2022; Tang et al., 2023). The tacit knowledge of employees is of vital importance to enhance organizational performance (Müller et al., 2013). Tacit knowledge utilization has been studied mostly in commercial organizations and stable environments (Diehr & Gueldenberg, 2017). However, tacit knowledge utilization in non-profit and turbulent organizations managing disasters has been understudied (Cheuk et al., 2017; Ji et al., 2020).

In turbulent environments, such as military, firefighting, and rescue operations, the pace and magnitude of change are unpredictable, leading to high operational uncertainty (Jones & Mahon, 2012;

Payne & Shepardon, 2015; Yasir & Majid, 2017). Organizations working in such environments need to possess dynamic capabilities to handle risky operations and contain the disasters (Kaltenbrunner & Reichel, 2018). Dynamic capabilities are linked to employee experience, knowledge, and other resources (for example: IT infrastructure) of the organization. In disaster environments, organizations put greater effort into managing knowledge among stakeholders for survival, yet knowledge sharing is challenging due to the uncertainty of incidents, worker knowledge heterogeneity, and time and resource constraints (Jones & Mahon, 2012).

Despite the importance of tacit knowledge, there is lack of understanding regarding its role in disaster environment projects (Sanford et al., 2020) such as emergency rescue operations. The previous research largely focuses on the contextual factors of explicit knowledge utilization (Cheuk et al., 2017; Zimmerman, 2008) stating that factors such as purpose, relevance, accessibility, and time pressure affect explicit knowledge utilization. Although researchers have explored the outcomes of tacit knowledge, such as firm success, organizational creativity, and competitiveness, there is a lack of research on the contextual factors that influence its effective utilization in achieving these outcomes (Cheuk et al., 2017). The role of tacit knowledge utilization is more relevant in disaster environments and scenarios where there is lack of infrastructures and technologies, shortage of time (Borges et al., 2019). In this vein, this study aims to address above mentioned research gap with the following research questions:

RQ1. *How does employee's knowledge play a critical role in resource constrained disaster environments?*

RQ2. *What are the various contextual factors, which influence tacit knowledge utilization in projects carried out in disaster environments?*

A large non-profit rescue organization has been selected for data collection and to answer the research question. The analysis is based on 2 months' observations along with interviews. Based on our findings, we have proposed a framework, and certain testable propositions related to internal and external organizational factors which contribute towards tacit knowledge utilization. This research has significant importance in the context of emerging countries, where resource constraints, infrastructural limitations, and the absence of advanced technologies are more prevalent. With these constraints, emerging countries are more vulnerable and the effective use of tacit knowledge by rescue workers can play a pivotal role in mitigating the impact of disasters. Moreover, tacit knowledge of employees can also play a role in dealing with unforeseen challenges, which are likely to arise in a disaster situation.

The rest of the article is structured as follows. Section 2 covers literature review followed by sections on methodology, results, discussion, and finally the conclusion section summarizes the study along with limitations and future research directions.

2 | LITERATURE REVIEW

2.1 | Critical role of tacit knowledge in organizations

Effective knowledge management plays a crucial role in the existence and development of an organization in dynamic environments (Anshari & Hamdan, 2022). Knowledge management enables organizations to adapt to the dynamic environment by relying on organizational memory (Ahmed et al., 2021; Sumbal et al., 2024). This organizational memory largely comprises of the expertise or tacit knowledge of employees as most of the times, organizations working in disaster environments are unable to acquire, store, and reuse the knowledge gathered during emergency incidents, however, the experience and knowledge gained from the incident gets accumulated in the worker's mind that is tacit knowledge (Nisula et al., 2022). They reiterated that when the existing knowledge cannot be used; for example, in rescue operations, and new knowledge needs to be created based on the actual scenario, the tacit knowledge of employees and their past experience is highly relevant (Sumbal et al., 2021). The context of the environment, thus, mattes a lot (Irfan et al., 2022). Tacit knowledge is highly critical in disaster environments where cooperation and knowledge exchange among employees is crucial as the tasks or projects they encounter are bounded by time and resource constraints involving life threating risky situations (Nissen et al., 2022). The knowledge creation theory by Nonaka (1994) explains the conversion of knowledge in four stages namely: socialization, externalization, combination, and internalization. This is called the SECI model according to which knowledge creation is an ongoing process and knowledge can be converted from one form to the other. In socialization, tacit to tacit knowledge sharing occurs through observation, imitation, and apprenticeship. In this process, direct interaction occurs among the people. Externalization is a process where tacit knowledge becomes external knowledge. It can be expressed in the form of pictures and documents and so forth. In combination process explicit to explicit knowledge conversion occurs. In this process, knowledge is acquired within and outside the organization and then combined and processed to form new knowledge. In the internalization process, conversion of explicit to tacit knowledge occurs. Individuals process the external knowledge source and then internalize and modify the user's existing knowledge. Our current study context deals with socialization and internalization perspective in relation to tacit knowledge.

2.2 | Tacit knowledge utilization and turbulent environments

The role of organizational memory is more critical when dealing in turbulent environments to address emergency projects through knowledge creation/sharing to handle the situation (Pellegrini et al., 2020). The ineffective management of knowledge sources may pose significant challenges for the emergency response organization engaged in life saving and disaster prevention operations. This issue could be

addressed by integrating knowledge source and leveraging the social capital within the organization (Mikovic et al., 2020). The quality and quantity of knowledge is also crucial in this regard specifically if new solutions need to be developed (Stock et al., 2021) which is common in rescue and lifesaving operations where situations are unique and not encountered before. It may involve both knowledge exploration (creating new knowledge) and exploitation (using existing knowledge). Many studies have investigated knowledge processes that mediate the complexity—performance relationship in NPD projects (New Product Development) such as information and knowledge sharing (Park & Lee, 2014; Um & Kim, 2018); knowledge exploration (Eriksson et al., 2017); and knowledge-based absorptive capacity (i.e., assimilation, transformation, and exploitation) (Bjorvatn & Wald, 2018). Focusing on tacit knowledge aspects, van der Hoorn and Whitty (2019) argued that project members use their tacit knowledge through various modes of comportment such as; To see (to understand what has and is happening); to share (what should happen or is happening); To think (what might happen and should happen) highlighting the importance of tacit knowledge in (disaster management/rescue) projects to accomplish the tasks. Using their experience and past knowledge, they decide on the strategy and equipment to be used for completing the operations. Similarly, there could be various control mechanisms that could be exercised depending on the uncertainties in the operations (Lin et al., 2019). These uncertainties might include computational complexity, technological complexity, novelty, or ambiguities and so forth in the tasks at hand. Under such circumstances, behavior control or self-control mechanisms help in knowledge integration to successfully handle the operations, and these behaviors are largely linked to human abilities or experience.

As the tasks in turbulent situations are normally temporary sometime requiring quick response, both formal and informal knowledge transfer practices play their part (Mahura & Birollo, 2021). Research has identified several processes for tacit knowledge utilization (TKU). Coordination is an important process for TKU as employees possess heterogeneous knowledge. They need coordination in order to align their knowledge according to the tasks at hand (Moon, 2011). Coordination is an important factor because it is not possible to have all the required knowledge by an individual or by an organization. In turbulent environments, employees look beyond the boundaries to create new knowledge by coordination and handle emergency situations. This involves interplay of various contextual factors according to the environment. Past studies mention factors of tacit knowledge utilization while covering different aspects of knowledge management discipline, however, the purpose of these studies was not to highlight the contextual factors of tacit knowledge utilization (Consoli & Elche-Hortelano, 2010; Marques et al., 2019). For instance, tacit knowledge utilization is a critical factor for solving customer's problem and the problem-solving capacity of organization depends upon interaction of organization with its customer (Consoli & Elche-Hortelano, 2010). Here, interaction is the key factor for tacit knowledge utilization. Similarly, employee's emotional attachment is another factor that is the employees having an emotional attachment with the organization are more willing to transfer and utilize their tacit knowledge (Marques et al., 2019).

The ability of an organization to absorb the knowledge and ability to innovate from existing knowledge assets (Chen et al., 2010; Hung et al., 2015) is another factor for knowledge utilization. The absorptive capacity of employees is necessary for the integration of external knowledge (Spithoven & Teirlinck, 2010). The absorptive capacity of the organization is the ability of an organization to combine the existing internal knowledge with external new knowledge to improve performance or to create solutions (Teigland & Wasko, 2003). Koskinen (2003) identified four factors of tacit knowledge utilization in the existing literature. This was the only exhaustive work that had studied the factors of tacit knowledge utilization. He divided factors of tacit knowledge utilization into internal factors and external factors. Internal factors are related to an individual's personality while external factors are not under the control of individuals. The categories of internal factors were memory, communication, and motivation. Memory system contains experience, mental models, and intuition. Interaction, language, and proximity are grouped under the communication system. Commitment and trust have been combined under a motivation system. The study revealed external factors as situational factors, which are leadership style and organizational culture. In simple words, external factors define a situation where tacit knowledge needs to be utilized. The study stated that these factors were generic but helpful for organizations to evaluate tacit knowledge utilization. Keeping in view the previous work carried out in relation to tacit knowledge utilization in turbulent project environments, the studies are still scarce, and it is important to understand that how the contextual factors trigger tacit knowledge utilization in turbulent situations bounded by time and resource limitations. The study, thus, contributes towards this research gap in relation to tacit knowledge.

3 | RESEARCH DESIGN

3.1 | Research context: A public sector rescue organization

Based on the nature of the research question, we adopted a qualitative and interpretive research approach through a case study design. A case study approach is useful in qualitative research (Ghauri, 2004; Miles & Huberman, 1994), to address "how", "why", and "what" questions to explore the phenomena within a real setting and develop new theoretical insights (Yin, 2009). For this purpose, we adopted a single embedded case design. We employed the purposive sampling (Patton, 2002) and selected a most suitable case firm (here named as Rescue 777) within the rescue organizations. The aim of purposive sampling was to focus on the specific characteristic of the sample which can be helpful to answer the research questions (Etikan et al., 2016).

We have chosen Rescue 777 as a case study to explore the phenomenon of tacit knowledge. This organization is based in the Northern part of Pakistan and established in 2006. The main function of

this organization was to provide timely emergency care, prevention of emergencies, creating awareness, training for volunteers for emergency preparedness, response, and prevention. The organization deals with various emergencies such as firefighting (fire related emergencies), water emergencies (flood and drowning), animal emergencies and medical emergencies such as road traffic accidents (RTA). It has strict hierarchies, but field employees can choose the course of action according to the situation. The employees go through a rigorous 6-month training course after their selection, to get the basic knowledge and understanding to deal with emergencies. Afterwards, field training is carried out. We selected this organization because of the following reasons:

1. Knowledge utilization and transfer are challenging in emergency situations because of the uncertainty and uniqueness attached with incidents.
2. Rescue teams need to deal with emergencies in limited time, as a result employees have to deal with the situation in real time with the available resources at hand and through sharing of ideas/brainstorming.
3. Tacit knowledge is context specific (Baškarada & Koronios, 2013) and the rescue projects with unique situations and scenarios provide this rich context for employees' tacit knowledge utilization.
4. In line with the other researchers who adopted single case study design (e.g. Durst and Bruns (2016)), this case provided an opportunity to study the contextual factors in do or die rescue projects providing a real time perspective rather than a retrospective one thus making it a suitable choice.
5. Finally, the extant literature supports single case study design to get fine-grained detail about the phenomenon not studied previously by selecting a unique and relevant case with in-depth insights and rich data (Dubois & Gadde, 2002). Moreover, a single case study is advantageous for studying complex social processes (Patton, 2002). Tacit knowledge utilization contains this social process, especially in the rescue teams where they need to collectively handle various incidents or emergency situations involving interactions with the people.

3.2 | Data collection

To elicit information, semi-structured interviews were conducted along with field observations of real time emergency incidents to get in-depth information. Interview questions were kept open-ended providing flexibility to respondents in sharing their experiences. We used semi-structured interviews because they offer more flexibility, which is crucial when investigating employees' tacit knowledge—especially in a resource-constrained disaster environment with limited resources (Shakil et al., 2024). Semi-structured interviews, with their open-ended approach, helped us record details of individual thoughts and observations that might not have come out in more organized formats such as focus groups or Delphi panels. On the other hand, semi-structured interviews provide the room for reflection and customized questioning that implicit knowledge frequently needs.

Eighteen interviews were conducted along with field observations of 10 real time emergency incidents. We observed how the employee's identified problems, shared their views, and tackled the emergency. Observations helped us to gain an in-depth understanding of the tacit knowledge utilization in real time emergency situations and to triangulate the findings of the research along with interviews. For interviews, we chose the knowledgeable respondents that is, the field workers and rescuers who were involved in handling the emergencies and utilized their personal knowledge gained through training and experience over time. Field employees (Dread rescue/firefighters, divers, and road traffic accidents staff) were chosen as respondents to explore the employee's tacit knowledge and their utilization to address the turbulent situation (Table 1). Dread rescuers deal with natural calamities such as earthquakes, landslides and so forth. Medical staff deal with emergencies related to road accidents, while divers deal with water emergency situations such as floods, drowning and so forth.

We approached the participants with the consent of the organizational echelon and personal contacts. All interviews were conducted in the local language (Shina) to get the respondents insights and expressions in a natural way and recorded with workers' consent. The interviews were then translated into English with the help of an English literature professor who had expertise in both Shina and English languages. Moreover, one of the researcher's mother tongues is the aforementioned local language, which made it easy to understand the concepts between the lines.

3.3 | Data analysis

We analyzed the data to generate codes through line-by-line examination of the transcriptions using ATLAS.ti software. Initially, we followed an initial coding scheme by performing line by line coding based on the indigenous terms used by the respondents (also referred to as "native categories"), which is then followed by focused coding (Friese, 2019). In focused coding, we constantly compared the transcribed data with one another to find similarities and differences to create categories. Unique codes and themes, which emerged from the data, were recorded and similar codes were grouped into various categories. ATLAS.ti software assisted us to organize the data, which makes it easy to make codes and families. Through this software, we built networks by establishing a relationship between the codes in the same category as well as relationship with other categories. Main codes, themes and interview quotes are mentioned in Table 2.

4 | RESULTS

This section delineates the main findings of the study retrieved from the case data. We identified different themes that emerged from the data on the phenomenon of contextual factors of TKU. The

TABLE 1 Respondent details.

Interviewees	Years of experience	Age	Gender	Expertise
1	12	35	M	Fire fighter
2	07	29	M	Dread rescuer (DR)
3	07	30	M	Dread rescuer
4	08	33	M	Road traffic accident (RTA)/medical staff
5	06	29	M	Dread rescuer/firefighter
6	08	30	M	Dread rescuer
7	12	41	M	Dread rescuer
8	11	38	M	Road traffic accident (RTA)/medical staff
9	07	31	M	Diver
10	03	26	M	Dread rescuer
11	07	29	M	Dread rescuer/firefighter
12	08	34	M	Dread rescuer/firefighter
13	03	27	M	Diver
14	03	28	M	Dread rescuer/firefighter
15	09	36	M	Diver
16	10	40	M	Diver
17	15	45	M	Road traffic accident (RTA)/medical staff
18	12	37	M	Road traffic accident (RTA)/medical staff

contextual factors include individual level, group level, organizational level, communal level, and situational level factors. The details of families/themes with relevant codes related to each family, and sample quotes have been shown in Table 2.

4.1 | Individual-level factors for tacit knowledge utilization

Given the fact that tacit knowledge is sticky and resides in individual persons, individual level factors are extremely vital in utilization of individual specific knowledge in emergency situations. Multiple factors compelled the rescue workers to share, combine and utilize their tacit knowledge in the rescue operation. A number of codes emerged from the data, but the most frequent ones were common sense, experience, emotional stability, trust in one's ability and concern for others. The aforementioned factors are necessary to deal with extremely turbulent environments as employees need to look beyond the routine practices. Interviewee 9 described a situation where a rescue member used common sense to save a life in the following words:

> We got a call to rescue a boy who jumped into the river. If we had tried to locate the boy at the exact jumping place, we would not have been able to find him. We went at a distance from the place where he initially jumped. As soon as we saw him, one of the rescue workers jumped into the river carrying a rope with him and rescued the boy. It was our common sense that we searched for the boy at points far from the initial jumping point otherwise the guy would have drowned.

Interviewee 15 described another situation where they used their common sense as:

> We were unable to trace a dead body under water because we pushed down bamboo straight into the water at 90-degree angle. As this river has a high flow of water so, you need to put the bamboo a slight vertical to the surface of water so that it could reach down the ground. It took only 10 min to get the task done.

Concern for others is yet another important factor for the utilization of tacit knowledge by individual employees. It has been observed that employees have a personal level of connection and rapport with the local people and society. They also have passion to save people and their property. The interviewees agreed that they performed their job diligently because it is a matter of people's lives and property. It is their responsibility to help the people in times of disaster. Even when they are off duty and get to know about an emergency, they try to reach there to help people and make maximum use of their knowledge.

Emotional stability and control also turned out to be important to perform the rescue activity. It helps employees to make sense of the uncertain situation consciously. If a person gets perplexed, he cannot properly perform his task and thus can't use knowledge effectively. Interviewee 8 stated this as:

TABLE 2 Families, codes, and sample quotes.

Families	Codes	Interview quotes
Individual-level factors TKU	Common sense	In such crises time, we use common sense and take quick decisions to handle the situation. In short, common sense, experience, and collective decisions help us to control the situations.
	Concern for others	The emotions and the situation of relatives, wives, or children, and so forth. compel us to perform our job to the fullest.
	Experience	I still remember my first experience in rescue. I had my first experience in hospital. When I went there, I vomited while seeing blood and I was nervous. That day and now, I feel great differences in terms of handling the situations.
	Emotional stability	Now I feel quite confident, and relax while dealing with emergencies as compared with my first emergency.
	Trust	Trust is an important element. Trust in oneself and trust in teammates. If you do not trust your capabilities to deal with emergency, you will not be able to make sense of the situation.
	Commitment to job	If you are passionate and aggressive about the emergency matters, or you have an urge to save a human life then even if you are above 60 years of age the passion wont go away.
Group level Factors of TKU	Buddy system	Teamwork has vital importance in our job. In high accident cases, each second is important for the life of victims. That is why we do perform our job in teamwork.
	Mutual trust	Trust in the companion is important. In teamwork, trust is an important factor. We are dealing with a turbulent situation; therefore, we need to have trust in one another.
	Amiable employee attitude	During emergencies I do take care of myself as well as my buddy. In such times our passion for helping one another increases.
	Coordination among employees	The buddy system has been created for coordination purposes. In each emergency, we need coordination among teammates.
	Scene assessment	We assessed the situation and act accordingly. We utilize our resources according to the situation whether we needed foam, water, or mixture of both.
	Brainstorming	If confronted with complex situation, we do brainstorming. Ideas are shared between teams before taking a decision.
Organizational level factors of TKU	Job autonomy	For handling the situation, we are free to use whatever available resources. As every situation is different from other situations, so it is at our discretion to decide on the spot according to the situation.
	Lack of hierarchy	On the field, we do perform our job as a team. There is no discrimination between seniors or juniors. Whoever gives sensible advice, we are open to taking it up for decision-making.
	Resource availability	Vehicle contains everything to deal with fire situation like fire extinguishers etc. If we feel shortage of such material, we coordinate with control room.
Communal level factors of TKU	Coordination with community	We asked eyewitnesses where children got trapped and from where did their sound comes from last time. They specified the location.
	Social interaction	During the office hour, few of the employees were standing at the front gate and greetings the passersby because they know most of them (Observation)
	Emotion of the people	The emotions and the situation of relatives, wife or children and so forth compel us to perform out job to the fullest. Being a human being, we cannot leave them in lurch.
Situational level factors of TKU	Time constraint	In high accident cases, each second is important for the life of victims. We need to perform our tasks quickly.
	Resources constraints	There are certain situations where we face resource constraints and such moment of time, we rely on the resources around us in the emergency area. All this depend upon the nature of emergency.
	Nature of emergency	When we go to the place of incident, on ground things are quite different from what we had done, imagined or what has been informed to us.
	Vague information	Initial information was that vehicles (4 by 4) can go up to the top and we equipped the vehicle according to that information. Upon reaching there, it was discovered that the vehicle could not go up.

> To perform rescue task, one needs to have strong nerves. We deal with different emergencies where people's lives as well as our lives are at high risk. To sense the situation properly, one needs to be emotionally strong.

In contrast, the findings also identified certain instances where the individual factors hampered the tacit knowledge utilization of employees such as lack of self-trust and lack of experience. Employees who did not trust their skills and expertise were unable to perform their tasks well, which means that they were unable to utilize

their experience. However, this fear gets reduced as rescue workers gain experience and are accustomed to the turbulent environment. Interviewee 5 stated his first experience as:

> In my first field emergency of a car accident, I had to rescue a man stuck in his car (with blood all around) and my hands were shaking but now I deal with an emergency more confidently.

4.2 | Group level factors of tacit knowledge utilization

When the individual characteristics of rescue workers come in contact with the team, there is a need for certain antecedents to utilize their collective tacit knowledge and experiences. These antecedents were buddy system, amiable employee attitude, coordination among employees, scene assessment, brainstorming, and mutual trust. The rescue organization has created a buddy system for task performance. They perform their task in the form of groups and deal with emergencies as a team. When employees work in a team, they need coordination for sharing information and performing their job. These antecedents or factors assisted employees to utilize their knowledge in group capacity as rescue teams do not operate in silos. This buddy system engendered certain characteristics among employees. One such characteristic was coordination and cooperation. Interviewee 1stated:

> We deal with emergencies through teamwork. Emergencies cannot be handled individually and if there is no coordination and cooperation within the team then it might be possible that we fail to deal with the emergency.

Coordination among employees is a prerequisite for performing the job in teamwork. Coordination comes from individual-level factors such as how committed an employee is towards his job and addressing a specific emergency situation. Interviewee 14 described the importance of coordination in the following way:

> Coordination is critical for us. Without it, we cannot plan and execute our tasks. Coordination is required to perform our job.

When employees work within a team, they socialize. Socialization occurs through brainstorming, sharing of ideas, openness, and scene assessments. Through socialization, employees discuss the alternatives and reach a certain conclusion. The level of socialization depends on how much employees are committed to the job and how much they trust one another. Openness and mutual trust are very important in a rescue job. For instance, a rescue worker needs to go down into a deep well while his buddy supports him holding the rope in his hand. Because of the trust, rescue worker goes down the well. Mutual trust among employees is established through organizational level factors such as sharing the same common room, informal conversation during office time (out of the field) and lack of hierarchies, and so forth. Interviewee 12 expressed about the mutual trust in the following words:

> We need a high level of trust in each other. As our job is a bit adventurous. Sometimes, we need to climb buildings to evacuate people with the help of a team… we go into the well because we trust the person who is holding the rope outside the well.

Scene assessment is yet another important factor at the group level. Through scene assessment rescue teams are able to find a solution. Scene assessment is assessing the whole situation and considering all the actors involved. After the scene assessment, rescue teams gather to decide the course of action through brainstorming and sharing of knowledge. Interviewee 5 described this as:

> The terrorists attacked oil tankers through bullet fire. We got a call and reached the destination. It was a huge fire. Security guards who were on duty were killed. We assessed the situation and planned accordingly. Five oil tankers had caught fire. Through mud and soil, we set up a barrier between these and other oil tankers so that fire could not spread any more. We saved 12 oil tankers after 12 hours of firefighting.

Interviewee 3 shared his thoughts on brainstorming as:

> We brainstorm when we think that situation needs more ideas. Whatever ideas come to mind based on the situations, these are shared by the team members. Sometime local people also get involved to share their viewpoint.

These group level factors are further supported by an observation of the researchers at one of the rescue operations as stated below:

Rescue team received a distressed call that fire broke out in nearby building, and it is spreading to other buildings. The team swiftly assembled and rushed to the scene within a few minutes. Upon reaching, the team assessed the situation. They discussed the building map and formulated a strategy to tackle fire and save people's belongings. They divided themselves into smaller teams and assigned tasks according to the situations. Few of them focused on extinguishing the fire while rest of them were busy saving people's property. During the emergency, they gave one another unwavering support and encouragement. They are confronted with certain challenges such as blocked passage and limited visibility. However, through their experience and shared ideas overcome obstacles swiftly. Teamwork played an important role during situation handling and exhibits a greater level of coordination.

4.3 | Organizational level factors of TKU

Organizational level factors of TKU contain codes related to organizational structure and culture, which directly or indirectly facilitate knowledge utilization of rescue workers. These codes were: lack of hierarchy, job autonomy, and resource availability, which helped employees to foster the utilization of their tacit knowledge in a collective manner to address turbulent situations. Rescue teams need specific resources to perform their job in real situations. These resources or tools helped them to utilize their tacit knowledge. Such resources were rescue vehicles, extinguishers, safety kits, and related equipment. The organization did provide these resources to the rescue employees. Interviewee 5 shared his views as:

> We carry important tools related to the rescue activity. Sometimes resources we moved may not be utilized because of the terrain or landscape of the situation. Sometimes we rely on the resources available around us.

Another factor for TKU was the lack of hierarchy in rescue teams. Lack of hierarchy, in turn, fosters group-level factors such as amiable employee attitude and informality among employees. Interviewee 16 described lack of hierarchy in the following words:

> On the field, we do perform our job as a team. There is no discrimination between seniors or juniors. Whoever gives sensible advice, we are open to taking it up for decision-making.

Rescue workers had to follow certain standard operating procedures such as wearing personal protective equipment (PPE). However, the job is performed by employees according to the situation. Rescue teams themselves chose the course of action to handle the situation. There are various reasons for having a lack of hierarchy in the organization. The organization does not have a proper service structure, which has been mentioned by many employees during an informal conversation. Another reason is every employee must go through 6 months of training irrespective of rank. So, workers during emergencies worked in a team irrespective of seniority. They appoint anybody as team leader to check whether they are following what they are intended to follow or what has been planned during brainstorming. Interviewee 7 stated about the lack of hierarchy and job autonomy in this way:

> We take opinions from staff irrespective of their ranks. As this job requires experience and lot of sense-making, so, everybody can provide a good and rational input.

The above factors helped the workers to utilize their knowledge during rescue activities. These factors augmented the group level factors for employee job performance. For instance, the lack of hierarchy helped employees to share and disseminate information and ideas during rescue activity. These organization level factors are further supported by an observation of the researchers at one of the rescue operations as stated below:

A boat sank in the lake and the rescue team had to recover a dead body from the lake. The rescuers got a call in the control room and rushed to the location. It was an emergency. Rescuers did not have buoyancy compensator, which helps to thrust the body of diver upward to the surface of water. One of the members of the rescue team went into the water with a rope to search for the dead bodies. When he reached the bottom of the lake and found the body, he slightly shook the rope, and the other end of the rope was in the hand of staff standing outside of water to take the rescue staff out of water. They planned earlier from where to start search and where to end the search. If the diver starts deviating from the path, the staff outside water holds back the rope. This holding back cue means that he needs to change direction. When he found the body in the water, the diver shook the rope for a few seconds. The staff understood that the diver got the body, and they started pulling him out of water carrying a dead body along with himself.

4.4 | Communal level factors of TKU

Rescue organizations interacted with the community because the community was the final beneficiary of such organizations. Several factors affected employees' TKU. These factors were coordination with the community, social interaction, and the emotion of the people. In countries such as Pakistan with collective societies, the first responder in most situations is somebody from the community. As rescue teams reside in offices, when they get a call at the control room, they move to the emergency room. So, the callers/respondents are community that is why they are called first responders. The community calls the emergency center for help and conveys the information regarding the emergency. Based on their information, the rescue office sends teams according to the nature of the emergency. Most of the respondents stated that they take community's help during the turbulent situation. Interviewee 2 described his views on community involvement in the following way:

> On emergency sites, we always take help and seek community advice, where deemed necessary. For instance, in a fire emergency, we get information from the local community about the seat of the fire. These are the people who are familiar with the terrain and geography of the area.

One reason for taking community help was that it is not possible for them to first go to the emergency site and then mobilize resources according to the situation nor they have all the resources at their disposal during an emergency. The second reason was that being a member of a collectivist society, people themselves get involved in the rescue activities. Therefore, rescue teams take help from the

community. The role of local community involvement is critical in dealing with an emergency. Rescue organizations and employees interacted with the community in two ways both formally and informally. Formally, they engaged with the community through awareness sessions, imparting knowledge related to emergency skills such as first-hand training and intime information, and so forth. Informally they interacted with the community through the personal rapports of the employees. The organization has recruited employees who resided in the same districts. Being a member of the same society, employees got personnel level rapport with the community.

However, certain communal factors hindered employees' for utilizing tacit knowledge. These factors that have emerged from the data were unusual expectations from the community, criticism, and mob gathering. People display unique expectations and behavior from the rescue teams in collectivist societies. This is evident in rescue organizations, where people are highly involved in emergency situations with rescue teams. For instance, when an ambulance passes by, people promptly contact emergency rescue employees asking about rescue incidents as rescue ambulances use sirens during an emergency. Sometimes, people make false calls just to pass their time as dialing emergency numbers is free of cost. Moreover, people ask emergency employees for tasks beyond the organization's scope, such as cleaning the drainage system as such task comes under the scope of waste management. All these actions stem from personal relationships, lack of awareness and education. Unfortunately, such behavior from the community can hinder rescue work and impede employees' ability to utilize their time and skills efficiently.

4.5 | Situational level factors of TKU

Situational factors also affected the TKU of employees. Situational factors included the nature of the emergency and resource constraint. In rescue operations, every emergency is different and varies from a simpler one to a complex one. Resource constraints included both tangible and intangible resources. Tangible resources consisted of material resources while intangible resources were time constraints and vague information. Interviewee 7 described the nature of the emergency in the following words:

> Every emergency is unique in nature, which gives us new insight and new experiences. When we go to the place of incident, on ground things are quite different from what we had done previously, imagined or what has been informed to us.

Similar views were shared by interviewee 9 as:

> The informer of the emergency will not tell you the scenario. He/she will simply call to tell us that people are caught in trouble. It is a concise statement. They give you a vague and concise statement. Vague of information not only come from the first emergency respondent, but it can arise during complex situations where employees are unable to figure out what has happened.

Lack of resources during an emergency pushed employees to utilize their past knowledge and experience to deal with the situation at hand. They have looked for the available resources available around the emergency and they make different tools from the available resources in such a situation. Interviewee 3 stated about the lack of resources and how they handled the situation as:

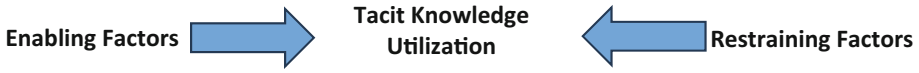
> Sometimes, we do not carry all the necessary equipment because of the nature of the emergency. In "C" Valley (a location in Gilgit Baltistan), a helicopter crashed, and it was raining heavily. We covered an hour's distance on foot as it was a hilly area, and there was no road to that place. We could not take the stretchers there. Also, it is impossible for a helicopter to land because of the nature of the landscape. To handle this situation, we got a few sticks from a nearby place, pulled off our shirts, and made an improvised stretcher. We placed dead bodies over them and carried the dead bodies to the hospitals.

Time constraints and vague information also pushed employees to utilize their knowledge to make sense of the situation. Rescue teams mostly performed their task under time constraints. Therefore, they must decide under a time constraint and that is the reason they use resources at hand. The organization lacks technology such as GPS, buoyancy compensator and other urban search and rescue (USAR) technology. Therefore, they hire local drivers, as they know every street in the area. They know which road to take during rush hours to avoid traffic and reach on time for tackling emergencies. In light of these findings, Figure 1 shows the overall enabling and restraining factors of tacit knowledge utilization in rescue teams. It provides a concise picture of the overall factors that foster and inhibit tacit knowledge utilization of the rescue workers.

5 | DISCUSSION

As induced from the result that employees needed certain characteristics for performing the riskier task such as emotional stability, common sense, and sense-making. Employees can achieve and improve these characteristics with the passage of time through learning by doing and experiential learning (Herron, 2018). Marques et al. (2019) stated that employees who have an emotional attachment to their job (Martingano et al., 2022) are more inclined to transfer and utilize their tacit knowledge. In rescue organization, employees were emotionally attached because they found their job as a greater cause that is, save lives, property of people and to serve the community (Dromi, 2022). It has been observed that employees based on their experience (tacit knowledge) make sense of the situation because they do not always

Enabling and restraining factors of Tacit Knowledge Utilization (TKU)



		FACTORS	
Individual Level	Employees who posses common sense, experience, emotional stability and self-trust utilize knowledge.	*Common sense, experience, emotional stability, self-trust*	Lack of common sense, fear and nervousness and lack of self trust are the cause of less experience which inhibit TKU.
Group Level	Teamwork, cooperation, mutual trust increase employees coordination that enhance TKU.	*Buddy system, amiable attitude, coordination and mutual trust*	Lack of trust, low level of cooperation leads towards weak coordination where employees cannot utilize knowledge efficiently.
Organizational Level	Lack of hierarchy, job autonomy and basic resource availability create group level enabling factor and hence, enhance TKU.	*Lack of hierarchy, job autonomy, and resource availability*	Strict hierarchies, strict roles inhibit employees from creative behaviors.
Communal Level	Collectivist societies assist rescue teams in tacit knowledge utilization.	*Coordination with community, social interaction, and emotions of the people*	Unusual expectations and mob gathering decrease employee tacit knowledge utilization.
Situational Level	Resource constraints both tangible and intangible push employee to rely on their tacit knowledge to handle the situation. Employees resort to improvisation in such a situation.	*Resource constraints, Lack of additional resources, time pressure and lack of technology*	The presence of resources, both tangible and intangible, does not foster creative behaviors such as improvisation

FIGURE 1 Enabling and restraining factors of tacit knowledge utilization (TKU).

get accurate and timely information. In such circumstances, they rely on their individual and team knowledge to respond to the situation (Muhren & Van de Walle, 2010). Another important characteristic is trust in one's capabilities. It is vital in critical situations as mentioned by the respondents. That is why naive employees feel nervous in the initial years of their job because the rescue tasks can pose risk to their own lives (Buvik & Tvedt, 2016). Therefore, lack of self-trust is one of the obstacles in utilizing their knowledge. According to Judge and Bono (2001), emotional stability is vital for the employees who are working in life saving organizations. Unstable emotions have repercussion and may be detrimental for the human lives. This has been confirmed in our study that rescue employee's emotional stability is prerequisite for performing their field operations. While developed countries provide guidance and counseling service to the employees to cope with unstable emotions, employees in resource constrained developing become emotionally stable with the passage of time and experience while dealing with emergency situations. Based on above discussion, we can propose that:

P1. *The more a rescue worker faces diverse emergency projects/situations, the more he becomes emotionally stable, makes sense of the situation, and trusts his instinct and vice versa leading to effective tacit knowledge utilization.*

P2. *Rescue operations projects in turbulent environments with unpredictable situations lead to higher tacit knowledge utilization as compared to normal and routine situations.*

Results showed that rescue workers performed their job through teamwork. The individual-level characteristics help employees to utilize their tacit knowledge in teamwork. Factors such as amiable employee attitude, buddy system to foster employee coordination, and idea generation through brainstorming are key in rescue operations. Analysis of these findings reveal that rescue operations have

dynamic situations and contain high stakes wherein finding solutions depends upon effective teamwork (Power, 2018). Past studies have identified the relationship between coordination and knowledge utilization in a team (Reagans et al., 2016; Sumbal et al., 2021). As team members possessed heterogeneous knowledge therefore, they needed coordination to create a shared mental model for the successful resolution of the problem (Moon, 2014). Well-developed coordination among employees enhanced knowledge utilization among team members (Reagans et al., 2016). According to existing studies, teams, which have higher coordination, perform better than those, which have a low level of coordination (Oktari et al., 2020). Propagating this to our study context and analysis, rescue teams coordinate with each other, right from receiving emergency calls till completion of the task at hand. Employees make sense of the situation through scene assessment where coordination is a prerequisite. During scene assessment, employees brainstorm to assess the current situation, make on spot decisions, and anticipate the future scenario in an agile manner. Past studies have shown that employees are unable to make sense of the situation when they have lack of coordination (Roux-Dufort & Vidaillet, 2003). The mutual trust among employees also plays an important role in this context as the operations might pose a higher risk to their lives as well. Therefore, trust is considered a critical factor for collaboration with team members (Einarsdóttir & Osia, 2020; Imam & Zaheer, 2021) which is also evident from the examples of different respondents and observations that where employee put their trust in each other and worked in a coordinated manner. Thus, based on this discussion, we propose that:

> **P3.** *In uncertain situations, coordination among teams fosters mutual trust and cooperation among team members which in turn increases the team's performance by collectively utilizing tacit knowledge to handle emergencies in rescue projects.*

Dul and Ceylan (2011) argued that employees do not show creative behaviors if the organization has tight hierarchical structures, routinized task, and strict rules and regulations. Reduced hierarchy gives employees an opportunity for open communication and interaction within the organization (Nonaka & Takeuchi, 1995). This also applied in turbulent resource constraint situations as reiterated by the respondents that they do not work under formal rules and regulations during field operations and as a result, they are able to communicate and share their opinion during emergency, which emanates from their experience. Therefore, we conclude that lack of hierarchy and job autonomy is part of the rescue organization's work environment. In such supportive work environment, employees generate new and valuable ideas through knowledge sharing (Llopis & Foss, 2016). Job autonomy enhances the utilization of the skills of employees in an organization (Prince & Piatak, 2022) while formalize structures have negative impact on knowledge utilization (Ho et al., 2014). This has been observed in our study that field employees do their job irrespective of their ranks. The field staff appoints anyone from them as team leader and work under his direction one's problem is identified, and solution is sorted out. On the basis of this, they easily communicate, coordinate and share their knowledge to perform their task. Research has shown a positive relationship among job autonomy, employee performance, and creativity. Both performance and creativity are the outcomes of knowledge utilization (Kuvaas et al., 2016; Langfred & Rockmann, 2016). The above analysis led us to present the fourth proposition:

> **P4.** *Organizational work environment and flat organizational structure engenders an amiable employee behavior, which helps in tacit knowledge utilization in turbulent environments.*

This study explores the tacit knowledge utilization in the Pakistani cultural context. Pakistan has collectivist culture pivoted around cohesion, harmony and societal oneness (Hofstede et al., 2010) where people like to socialize and help each other. As evident from the results that apart from internal sources of knowledge, rescue workers acquired and shared knowledge while interacting with the community members (Malinen & Mankkinen, 2018). Interaction and collaboration with the community enhanced community response and increased the directed efforts towards situation handling (Alaimo & Carman, 2022; Chaturvedi & Singh, 2021). Rescue teams utilize information from the communities and most of the time the communities or public act as a first respondent to the emergency tasks. Therefore, the communities can act as enabler for tacit knowledge utilization as they provide context and background information. Further, from the examples stated in result section, suggestions from the communities in the light of that context can also help in better knowledge utilization for the emergency teams to contain the situation. Based on this, it is proposed that:

> **P5.** *In a collectivist society, communities act as enablers for the employees to effectively utilize their tacit knowledge in turbulent environments.*

The existing literature highlights the role of technology in leveraging knowledge utilization (Väyrynen et al., 2023). However, rescue teams in developing countries face lack of technology as evident in the results section. In such a situation, rescue workers significantly rely on their tacit knowledge of past experiences to handle the situations. Various strategies used to combat the situation included: hiring local drivers to reach emergency situations who know about the location of different areas in the absence of GPS system used to track the location, building stretchers using wooden sticks and shirts, building a grappling hook from available material in the nearby under construction building, taking help from the community for identifying victims as well as seats of fire and so forth. While the developed countries have USAR technologies (Urban search and rescue) such as search cameras, audible call out and electronic listening devices for search and rescue operations (Statheropoulos et al., 2014), developing country employees lack these resources (Einarsdóttir & Osia, 2020) and thus focus more on tacit knowledge

utilization to use available resources in order to combat the situation. Thus, it is proposed that:

> **P6.** *Lack of technological solutions enhances dependence on tacit knowledge utilization to handle operations in turbulent environments.*

6 | CONCLUSION

The focus of this study was on the factors affecting tacit knowledge utilization in a turbulent environment faced by a non-profit rescue organization. Organizations achieve a competitive advantage and superior performance through the acquisition and application of a diverse combination of resources at a given point in time and context, if and only if, they are valuable, inimitable, rare, and non-substitutable. One such resource is the employees' expertise (tacit knowledge) that is difficult to imitate and contributes to organizational performance. We conducted qualitative research to explore the phenomenon of tacit knowledge utilization in turbulent environments in the context of a large rescue organization in a developing economy. Various individual level, group-level, organizational level, communal level, and situational level factors of tacit knowledge utilization were identified. The study further dwells into the role of these factors specifically to resource constrained context of developing economies as compared to the resourceful context of developed economies. Tacit knowledge plays a critical role in rescue operations because of various resource constraints. As rescue teams simultaneously get engaged with different stakeholders from organization to community, there are certain enablers which help in increasing their knowledge utilization during an emergency and certain inhibitor which may restrict tacit knowledge utilization. The collectivist culture, lack of technological infrastructure, hierarchical organizational structures, mutual trust and coordination, emotional stability and higher exposure /experience underscore the critical role of tacit knowledge in turbulent environments.

6.1 | Theoretical and practical implications

This study has contributed to expanding the body of existing literature by studying the various factors of tacit knowledge utilization and fills the gap by investigating the tacit knowledge utilization specifically focusing on turbulent environments in the context of a developing economy. This study reveals the various important factors to explain the mechanism of tacit knowledge utilization in uncertain and emergency situations when there is certain support from the organization as well as from colleagues. This furthers the understanding on underexplored area of tacit knowledge utilization in unstable environments. In such environments, the employee emotional stability and sense making as well as coordination and trust among team members enhance performance through knowledge utilization. Furthermore, these findings provide important new information for enhancing operational efficacy and efficiency in emerging countries that struggle with resource shortages, inadequate infrastructure, and outdated technologies. In these environments, tacit knowledge of the employees can play a pivotal role and can facilitate organizations to build on dynamic capabilities to provide improvised solutions to deal with uncertainty. Thus, employees such as rescue personnel's ability to effectively utilize tacit knowledge can be crucial in lessening the effects of disasters and add important knowledge to this domain of research. It is the organizational culture that fosters certain behaviors among employees. A supportive work environment inculcates creative behaviors by sharing and utilization of knowledge. Lack of hierarchies and job autonomy creates informality among employees which enhances openness, generates mutual trust among employees at the time of crisis. Project team's exploitation capacity, knowledge sharing, and knowledge utilization help project team members to minimize delays while achieving their tasks in complex projects. Joint decision for tasks interdependence may help project team members to coordinate changes promptly.

This study helps managers and executives to understand that in turbulent environments, organizations need to recruit employees who exhibit certain characteristics such as emotional stability, self-trust, having common sense, and cooperation to perform well in such an environment. Managers can create an environment of openness and foster a collaborative culture which is critical for nourishing project team members' mutual trust and creativity. Further, managers can foster a sense of meaningfulness and task significance of project team members' work as emergency workers by promoting continuous and fair feedback as well as communicating about objectives of the work. In addition, HR should provide training workshops to emergency workers to enhance their emotional knowledge in turbulent environments.

6.2 | Research limitation and future research directions

The current study has certain limitations, and care must be taken while interpreting and applying its results and findings. As this study is context specific focusing on a rescue organization in the developing country context (Pakistan), it may not reflect the realities outside this context. Also, the nature of emergencies and resources may have different effects on the employees to address and share, utilize their knowledge in different contexts. Furthermore, the study adopted a purposive sampling technique which may lead to certain biases. Future research can be conducted taking multiple case studies over an extended period to explore and identify the nuances in the process of tacit knowledge utilization. Also, quantitative studies can be performed using surveys and questionnaires based on propositions developed in this study to understand the tacit knowledge utilization in greater detail. Future studies can focus on other industries and organizations where the organizations are more dependent on the employee's expertise and tacit knowledge such as product development, R&D, and

technological sectors. Moreover, future research can be conducted in technologically advanced countries to compare the findings and have a holistic view of the tacit knowledge utilization in turbulent environments. Moreover, future research can focus on developing employee training programs that better prepare them for resource-constrained environments. An important avenue for exploration is the integration of digital technologies, such as AI and machine learning, to enhance employees' ability to respond effectively in situations where knowledge and resources are limited. These technologies can help with decision-making and maximize the utilization of resources, allowing employees to work more productively under stress. Examining the ways in which community, social, and cultural factors affect the dissemination and use of tacit knowledge in crisis response could be another area of research. Gaining an understanding of how informal networks, local customs, and trust influence knowledge sharing may help to improve disaster management procedures.

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