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REVIEW ON THE IMPORTANCE OF CAPACITY BUILDING FOR ENHANCING DISASTER RESILIENCE THROUGH THE EFFECTIVE UTILISATION OF RESOURCES

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ABSTRACT

Considering the increase in catastrophic events, resilience is now a widely accepted concept. Building resilience among the physical structures, infrastructure, and communities has become a necessity to improve the capacity to face future disasters. Effective utilisation of resources is one of the possible ways of building capacity within communities with the perception of enhancing resilience to future disasters. Therefore, identifying the correlation between resilience, capacity building, and resource utilisation is highly important to face future calamities. The resources required for enhancing disaster resilience vary depending on the type of disaster and the area affected by the disaster. Hence, resource constraints have been acknowledged as a factor in the ongoing failure of numerous recovery efforts. As such, capacity must be developed by utilising the resources effectively to address the deficiencies in resilience levels. Thus, a narrative literature review was carried out to establish the resource requirement in terms of capacity building to form disaster resilience. As the outcome of this comprehensive review, a conceptual framework was developed to support future decision-making processes with regard to disaster resilience. As per the findings, resource requirements exist in different forms such as infrastructure, institutional, economic, social, and environmental, and addressing them collectively, one after the other will enhance the resilience to future disasters in a considerable manner.

Keywords: *Capacity Build-Up; Disaster Resilience; Resource Utilisation.*

1. INTRODUCTION

A disaster is a phenomenon that can cause damage not only to life and property, but also can destroy the economic, social, and cultural well-being of a community (Perera, 2018). Disasters are widely defined as sudden events that cause significant damage to society with major losses of human beings, properties, economy, industry, and the environment that exceed the capacity of the affected society to cope with its resources (Ayataç, 2021;

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Keraminiyage & Piyatadsananon, 2013; Wang et al., 2020). According to data from the CRED International Disasters Database (EM-DAT), in the year 2021, the number of disaster events and extensive economic losses increased worldwide by recording 432 disastrous events related to natural hazards worldwide, 10,492 deaths, affected 101.8 million people and caused approximately USD 252.1 billion of economic losses. When a disaster occurs, the environment changes drastically, which increases physical and mental stress to people (Tamura & Rafliana, 2018). Some individuals may suffer from post-traumatic stress disorder, anxiety, depression, and other mental health conditions in the long term due to the adverse conditions of a disaster (Gil-Rivas & Kilmer, 2016). While disaster risks can hardly be eliminated, it is possible to mitigate risks by minimising the adverse impacts they bring (Tay et al., 2022).

Thus, to mitigate the risks from disasters, the resilience of the communities needs to be improved (Deng et al., 2022). The widely accepted definition of "resilience" is resistance to an external shock and the ability to recover quickly (Lu et al., 2020). Nowadays the term 'Resilience' is widely used by disaster researchers, which can be identified as capacities that need to be improved to deal with adversities (Tanvir et al., 2022). Identification of those capacities and mitigating the existing gaps are extremely essential for the resilience enhancement of both communities and infrastructure (Mukherjee & Hastak, 2016). Even though there are more empirical research has been conducted related to capacity building in disaster mitigation and recovery, less attention has been paid to developing capacities in terms of resources with the perspective of enhancing resilience to an expected level. In case of a disaster, communities combine existing resources to cope with an emergency event (Odiase et al., 2020). Further, resilient communities often demonstrate a greater reliance on their resources to recover from a disaster (Albright & Crow, 2021). However, as highlighted by Deria et al. (2020a) the lack of required resources has become one of the prominent issues for the failures in disaster mitigation and recovery efforts. Further, Freeman (2004) shows that the success of the post-disaster environment will depend on how efficiently and adequately government can allocate resources for disaster recovery. This study, therefore, provides an answer to the question, "How the disaster resilience can be improved through resource utilisation as a mode of capacity building?"

2. METHODOLOGY

This paper is based on a narrative literature review to give an illustration of capacities and capacity gaps in the built environment concerning disaster mitigation and reconstruction and to define different forms of resources required to improve resilience in disaster-prone areas. Possible means for bridging the identified capacity gaps are also examined in the paper through various sources of literature. Accordingly, books, journal publications, conference proceedings, and electronic articles were referred, to extract information and to familiarise with the definitions, concepts, and other principles.

3. LITERATURE REVIEW

3.1 DISASTER RESILIENCE

With the increase in occurrences of high-impact disasters, the concept of risk reduction and resilience is widely recognised (Tanvir et al., 2022). In the disaster context, the word resilience can simply be explained as the ability of people to recover within the shortest possible time with minimal or no assistance (Malalgoda et al., 2014). Disaster resilience will be defined as the capacity of a city to be able to absorb, bounce back and recover from the stress and shock it received (Sulaiman et al., 2019). Moreover, UNISDR (2012) defined resilience as the "ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including the preservation and restoration of its essential basic structures and functions".

Disaster resilience is further defined as "the capacity to adapt existing resources and skills to new situations and operating conditions" (Lee, 2020; Tanvir et al., 2022). Improving resilience includes building capacities, redundancies, robustness (pre-disaster), and rapid recovery of systems (post-disaster) (Mukherjee & Hastak, 2016). According to Tanvir et al. (2022), typical properties of resilience are as follows:

- **Robustness**: strength or the ability to withstand stress or demand without loss of function
- **Redundancy**: availability of alternative elements, systems, or units that can fulfil the same functional requirements in case of a disruption, degradation, or loss of functionality of the primary unit.
- **Resourcefulness**: the capacity to identify problems, prioritise tasks, and effectively utilise available resources to mitigate potential disruptions to a system or unit of analysis. Resourcefulness can be further conceptualised as consisting of the ability to apply material (i.e., monetary, physical, technological, and informational) and human resources to meet established priorities and achieve goals; and
- **Rapidity**: the capacity to meet priorities and achieve goals promptly to minimise losses and avoid future disruption.

3.2 CAPACITY BUILDING

Capacity building is one of the important pillars of resilience enhancement (Mukherjee & Hastak, 2016). According to UNISDR (2009) capacity is the combination of all the strengths, attributes and resources available within a community, society or an organisation that can be used to achieve agreed goals and they can exist in the forms of infrastructure and physical means, institutions, societal coping abilities, human knowledge, skills, and collective attributes such as social relationships, leadership and management. Further, Capacity is the ability to absorb any type of disruption and it also includes a margin of ability to resist, absorb or recover rapidly from disruptions that are more severe than anticipated (Mukherjee & Hastak, 2021). Therefore, Ginige et al. (2010) highlighted that identifying capacity gaps in the built environment and enhancing the necessary capacities are essential to reduce vulnerability to the impact of disasters. According to Ginige et al. (2010) capacities exist in different forms in the world such as knowledge, skills, technology, and resources. Disaster coping capacity reflects the ability of people, organisations, and systems, to manage adverse conditions, risks, or disasters using available skills and resources (Wang et al., 2021).

3.3 NEED OF CAPACITY BUILDING FOR RESILIENCE ENHANCEMENT

United Nations International Strategy for Disaster Reduction (UNISDR, 2012) defines major challenges forming disaster resilience. Those are increased density which put pressure on land and services, settlements in hazard-prone areas, lack of capacities and unclear mandates for DRR at local levels, weak local governance, inadequate water resource management, the decline of ecosystems, decaying infrastructure, and unsafe building stocks, uncoordinated emergency services and adverse effects of climate change. According to Malalgoda et al. (2014), most of the drainage systems and protective and servicing infrastructure are not sufficient to serve the increasing population, and many dwelling houses and other buildings are built without adequate consideration of disaster risks and vulnerabilities. Hence, it is apparent that the importance of resilience and capacity building is well-established to enhance the security of communities, infrastructure, and associated critical facilities in face of such extreme events (Mukherjee & Hastak, 2016). As elaborated by Dharmasena et al. (2020), disasters cannot be avoided and what we can do is mitigate disasters and build resilience in the community. Therefore, the assessment of resiliency is not only crucial for planning and decision-making, but it also helps to identify the vulnerable population in the society that is usually most affected when a disaster strikes (Deria et al., 2020b).

Moreover, past events have proven that obtaining adequate funding, and high-quality physical and technical assistance is a primary issue for achieving a resilient post-disaster built environment (Malalgoda & Amaratunga, 2015). The repeated failure of many projects can be attributed to the shortage and unavailability of resources required for reconstruction (Chang et al., 2010). Problems in the regulatory structure, deficiencies in necessary laws and regulations including problems in their implementation, and lack of required resources and skills are prominent issues to improve disaster resilience (Ginige et al., 2010). According to Malalgoda et al. (2016), local government in Sri Lanka faces several constraints such as a lack of proper legal framework, lack of adequate tools, techniques, & guidelines, human resource constraints, funding constraints, weaknesses in the internal systems and processes, weaknesses in the external systems, and lack of community engagement, which results in disrupting resilience to future disasters. This implies the need of capacity building in terms of utilising resources effectively when improving resilience level to future disasters.

3.4 IDENTIFICATION OF DIFFERENT TYPES OF RESOURCES REQUIRED FOR RESILIENCE ENHANCEMENT

The resilience to disasters depends on the severity of the antecedent calamity, as well as the resources available for and the efficiency of the recovery process (Wickramaratne et al., 2012). Further, Dharmasena et al. (2020) highlighted that communities needed to have resources that extend beyond the very basics of life to make it resilient. According to Deria et al. (2020a) the poor suffer disproportionately from natural disasters because of their inability in terms of lack of resources in the response, recovery, and reconstruction phases that leads to more fatalities and psychological trauma among the lower-income groups. As Cutter et al. (2008) highlighted key assessment factors for disaster resilience are Social, Economic, Institutional, Infrastructure, Community competence (health, understanding risk, quality of life, etc.), and Environmental. Further, Ayataç (2021) defines four different ways of achieving urban disaster resilience such as infrastructure resilience, Institutional resilience, economic resilience, and social resilience.

3.4.1 Resources for Economic Resilience

According to Ayataç (2021), economic resilience illustrates the employment diversity in communities, and it refers to the capability to do work in the aftermath of a disaster. As per the empirical findings of Tanvir et al. (2022), socio-economic resilience indicators are education and knowledge about natural disaster health, food consumption, income, and use of savings. Moreover to Gil-Rivas and Kilmer (2016), stable employment, adequate income, housing, access to clean water and sanitation, availability and access to health and social services, and a strong and diverse financial system are the economic resources that are important for reducing vulnerability. According to Ekanayake et al. (2018) easy access to the livelihoods of disaster victims is critical for economic resilience.

3.4.2 Resources for Social Resilience

Human and social aspects of communities are also key resources in the face of disaster (Gil-Rivas & Kilmer, 2016). Social resilience indicates the demographic profile of communities, and it refers to the aspects of the social capital including age, gender, disability, and ethnic background (Tanvir et al., 2022). The utilisation of the human population as a resource is a very important concept for mitigating the threat of any disaster (Ranwella, 2021). Since reconstruction is about building back homes and infrastructure to become more resilient to the next disaster and fit for purpose for the community, local community participation is vital for the disaster reconstruction process (Mannakkara & Wilkinson, 2015). Complement to that Norris et al. (2019) stated that affected community members must be empowered to be part of the recovery and planning process. In this context, Knowledge and experience of a local community can input some important information for the construction process such as locations that are less vulnerable to potential disasters, locally available material that can be used for construction, and special community needs that are necessary to be integrated into reconstruction (Ginige et al., 2010). Also, according to El-Masri and Tipple (2010), the supportive role of international communities can be used to assist developing countries in disaster mitigation and reconstruction by applying their existing knowledge and resources. In this context, education and training are vital in developing necessary human resources (Ginige et al., 2010).

3.4.3 Resources for Institutional Resilience

As stated by Malalgoda and Amaratunga (2015) a well-structured institutional framework is a pre-requisite for a city's sound resilience initiatives. Institutional resilience refers to the capacity of those who are in charge of managing communities, such as governments and non-governmental bodies (Ayataç, 2021). Further institutional capacity encompasses the interdependent fiscal, technical, and human resource dimensions that enable proper functionality during disasters (Albright & Crow, 2021). When referring to the empirical findings of Malalgoda and Amaratunga (2015) institutional resources consist of sufficient funding, adequately qualified and skilled human resources, training and capacity-building programs for technical staff engaged in regulating a disaster-resilient built environment and leadership skills of councillors and administrators.

3.4.4 Resources for Infrastructure Resilience

As stated by Ayataç (2021) resilience of the infrastructure refers to eliminating the vulnerabilities of the built environment including buildings and transportation systems. It also indicates the housing capacity in cities, healthcare facilities, vulnerabilities of buildings to disasters, and the availability of evacuation routes and supply lines after disasters. Tanvir et al. (2022) define in their study the physical resilience indicators as electricity supply, water bodies, early warning systems, and housing patterns. According to Deria et al. (2020a) often delivering accurate information is difficult for communities living in rural areas as they may not possess telephone and internet services. Further, unequal access to transportation alternatives during natural disasters also increases the vulnerability of the exposed communities (Deria et al., 2020a). Ginige et al. (2010) emphasise that critical infrastructure systems should be restored in a manner that is consistent with such vulnerability reduction and resiliency standards in the recovery process. A quality infrastructure would help in reducing disaster risks, improving health care, increasing productivity in manufacturing and productivity in service delivery, distributing national wealth more equally, to name a few (Palliyaguru & Amaratunga, 2008). Hence, the capacity is frequently reduced during a disaster. Amaratunga et al. (2017) stated that strengthening such vulnerable infrastructure is critical to enhance the resilience of disaster-prone communities.

3.4.5 Resources for Environmental Resilience

Environmental Resilience is a critical dimension of measuring community resilience to disasters (Tariq et al., 2022). As per the empirical findings of Tariq et al. (2022), environmental resilience includes ecological resilience, biodiversity, and protection of natural resources at the local level. Accordingly, environmental resources that influence resilience to disasters are flora and fauna, biodiversity, and natural resources (pre, during, and after the disaster event) such as land use, water bodies, buffer zones, raw materials, etc (Tariq et al., 2022).

4. DISCUSSION

As per the literature findings, there is an explicit interconnection between disaster resilience, capacity build-up, and resource requirement. In terms of achieving disaster resilience, capacity enhancement can be done through the means of economic, institutional, infrastructure, social/community, and environmental resources. A recent study carried out by Mukherjee and Hastak (2021) has developed a conceptual framework to select capacity-building strategies by integrating the sustainability aspect into the decision-making process. In this paper, we have identified different resources required for capacity building under key disaster resilience boundaries and developed the same framework accordingly. Figure 1 shows a framework for the conceptual decision support system to identify disaster resilience enhancing strategies based on:

- Setting a resilience goal,
- Identifying the existing resources gap, and
- Develop capacity-building/resilience enhancement strategies.

As soon as identifying the resources required under each resilience boundary the framework suggests to implement a capacity assessment to define the existing resource gap to achieve the expected resilience level by selecting a specific resilience boundary at a time. Repetition of the same process to other boundaries would assist in understanding and developing strategies to enhance overall resilience to disasters by overcoming the resource constraints.

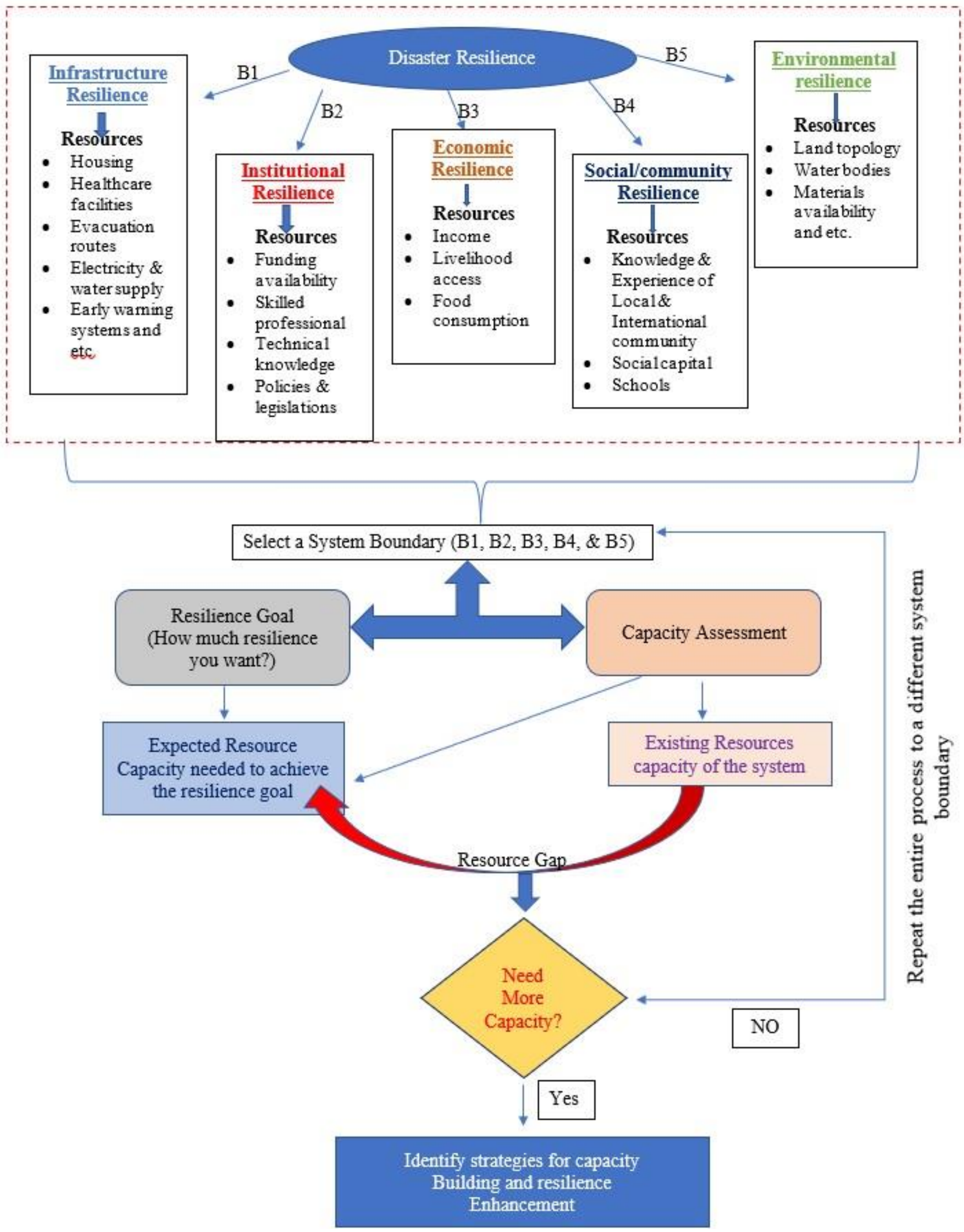

Figure 1: Conceptual decision support system to achieve disaster resilience

5. CONCLUSIONS

Resilience is an important and highly recognised concept within modern-day disaster management initiatives. When improving resilience against future disasters, it focuses on addressing capacity gaps within structures, communities, and other facilities. Capacities exist in different forms such as knowledge, skill, and resources. As per the findings of the research resource requirement can be defined under five resilience boundaries namely infrastructure, social, economic, institutional, and environmental. The accepted and proven failure of most of the disaster recovery projects was the limitations in the proper utilisation of existing resources. In this research, we have proposed a decision support system for assessing capacity needs in terms of resources to achieve a pre-defined resilience goal. Therefore, this study will be helpful when addressing forthcoming disaster-resilience research problems.

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