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Analysis of Risk-Based Disaster Planning in Local Communities

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***Abstract*—**Planning for future disasters sets the stage for a variety of activities that may trigger multiple recurring operations and expose the community to opportunities to minimize risks. Local communities are increasingly embracing the necessity for planning based on local risks, but are also significantly challenged to effectively plan and response to disasters. This research examines basic risk-based disaster planning model and compares it with advanced risk-based planning that introduces the identification and alignment of varieties of local capabilities within and out of the local community that can be pivotal to facilitate the management of local risks and cascading effects prior to a disaster. A critical review shows that the identification and alignment of capabilities can potentially enhance risk-based disaster planning. A tailored holistic approach to risk based disaster planning is pivotal to enhance collective action and a reduction in disaster collective cost.

***Keywords*—**Capabilities, disaster planning, hazards, local community, risk-based.

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I. Introduction

THE approach to planning for natural disasters is very important due to limited resources to manage the continuous and expanding cost of natural disasters. The risk-based approach to natural disaster management guides local communities to plan for a disaster based on existing and potential risks. The risk-based approach becomes more effective when capabilities are aligned. Fundamentally, local communities must tailor their disaster planning approach to guide sequential actions and aligning their planning effort with neighboring communities. The need for deliberate planning actions following identified effective model that can be tailored to every community is a viable solution to the existing challenges local communities are experiencing in their disaster planning approach.

II. Conceptual Framework

The risk-based approach is a multi-disciplinary concept used in many contexts to mitigate the outcome of unwanted circumstances. It is a proactive approach to mitigate risks. The risk-based approach in terms of disaster planning is an approach to planning that takes into consideration potential scenarios that represent a range of threats that warrant attention by the local community [1]. Planning scenarios are used to establish assumptions to guide planning regarding potential vulnerabilities and consequences (or impacts) of major incidents.

Capability approach is generally considered as a flexible and multi-purpose framework [2], [3]. In planning for disasters, capabilities are the means to achieve a planning function taking into consideration measurable outcomes through the performance of critical tasks to meet capabilities target engaging equipped and trained personnel [4]. When capabilities are validated, the community can know when and where to allocate more resources.

Risk-based capability approach in disaster planning takes into consideration scenarios, established assumptions and the means or resources to achieve planning functions for the range of threats that necessitate actions by the community engaging equipped and trained personnel. Risk-based capability approach is therefore the application of risk-based disaster planning and the alignment of capabilities to enhance planning functions [5]. This approach provides well-articulated choices to leadership that balance operational challenges with strategy, the current level of personnel, various scenarios, weighing cost versus benefit.

III. Natural Disasters Risks

There are many risks that can emerge from natural disasters. Most risks usually originate from local hazards within the environment while others may emerge due to the cascading effects from a disaster that originates from a neighboring city. For example, a locality may experience significant flooding without experiencing direct rainfall, but has a river that flows from a city with heavy rains. When examining the risks from natural disasters, it is important to focus on vulnerabilities [6]. Vulnerability is a factor to determine risk:

RISK= HAZARD X VULNERABILITY/CAPACITY

Countries or regions and local environments globally with limited capabilities to address local vulnerabilities are experiencing the most impact from natural disasters. Findings from the United Nations Office of Risk Reduction (UNISDR) show that countries or communities with less capability will seven times more likely experience a higher negative impact from natural disasters [7]. The increasing frequency in natural disasters is an impediment to local development in most vulnerable communities. The economic incentive to invest in structural endeavors to address some of the vulnerabilities sometimes outweighs the perceived risks of natural disaster [8]. It is very essential to consider natural disaster risks prior to making any investment decision especially in natural

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disaster vulnerable communities.

Local communities have to set goals that will guide them in their action toward reducing risks. The Sendai framework of 2015 to 2030 recommended that communities must set priority to understand risk, strengthen disaster risk governance to manage disaster risk, invest in disaster risk reduction for resilience and enhance disaster preparedness for effective response and recovery [9]. An understanding of local risk and all the dimensions of vulnerability is important. Initiatives to address risk should clearly explain hazard characteristics, the environment and the capacity to reduce the risks to expose persons and assets. Strengthening governance in disaster risk management and encourage investment from public, non-governmental and private sector may play a fundamental role to enhance preparedness.

The continuous extensive impact of environmental risks and the failure of a comprehensive approach for adaptation continue to weaken resilience. North America suffered the most in supply-chain disruption in 2017 as result of hurricanes and fires [10]. Other natural disasters such as extreme weather, earthquake and floods were on an upward move in 2017 [11]. The increasing negative impact of natural disasters to human activities is a global problem to various local communities around the globe. Local community stakeholders in disaster management must take ownership and lead actions that can address their community vulnerabilities, which will result to better ways to adapt to the realities of natural disaster prevalence.

The nature of natural disasters does not offer a solution that can eliminated risks. Communities can continue to reduce the level of risks through systematic efforts that may include improvisation of new techniques, policy and programs that can help them adapt to the realities of natural disasters risks [12]. As the community take steps in its natural disaster management strategies, some keys elements that may be pivotal to disaster risk minimization may become obvious through effective planning.

IV. Planning for Natural Disasters

Planning prior to natural disasters can greatly reduce the risks to people, properties and the environment. The effects of natural disasters can be extensive depending on the continuous efforts towards resiliency. In 2018, alone, it is estimated that natural disasters cost about 155 billion U.S Dollars globally [13]. In the United States, Hurricanes Michael and Florence, the California wildfire and Hawaii's volcano were the most expensive disasters globally. In Asia, typhoon Mangkhut slammed northern Philippines as a Category 5 in September 2018, while in Japan 200 people died from June to July 2018 flood as a result of 71 inches of rain that fell in Shikoko Island in Japan. Earthquake and tsunamis also killed at least 400 people in Indonesia. In Europe, drought and wildfire ravaged Greece from the heat wave over Europe [6]. Although these incidents have increased general disaster awareness, the relative infrequency of major catastrophes affecting the defined populations is usually one of the major reasons that certain degree of complacency in advocating for planning is higher in some communities [14]. Consequently, such perception can result in underestimation of potential risks and impact in communities that have not had a disaster for a long period of time.

Planning for natural disasters takes into consideration all the phases (mitigation, preparedness, response and recovery) of the disaster management circle and all the hazards that the local community is vulnerable for. The core of planning is all the actions between preparedness and response to facilitate the coordination of resources during a disaster. These actions involves the integration of mitigation, response and recovery planning activities prior to a disaster. A key aspect of effective planning involves a holistic mechanism that involves multiple stakeholders' participation [15]. A coordinated approach with a clear framework to disaster planning in today's multi-stakeholder interactions in decision making is pivotal to enhance natural disaster management in a continuously increasing complex local context.

Mitigation initiatives to reduce disaster risks are essential actions that can fortify communities for future uncertainties. Investing in physical construction to reduce the impact of disasters or avoid possible impacts of hazards through the application of engineering techniques using advanced technologies to develop hazard resistance and resilience structures is a wise investment for mitigating risks. Also, nonstructural measures that are not limited to land-use planning, building codes, laws and their enforcement, buying of flood insurance, research and assessment, information resources and public awareness programs are routine actions that are strongly recommended to help communities reduce the probability of hazards [16]. Mitigation activities reduce the burden on planners and eliminate unnecessary cost of natural disasters which are primarily the results of inaction by local emergency management stakeholders.

V. Risk-Based Planning Approach

In risk-based planning approach, emergency management policies and programs are affected by actual and measurable risks to lives, properties and the environment. The physical force of risk and it impact on structures to mitigate its impact is taken into consideration when planning using the risk-based approach to planning. Locally identified potential hazards are the primary focus in approaching the management of risks. The risks-based approach follows a sequence of activities:

- Define the context of risks
- Identification of potential risks
- Assess and analyze risks
- Develop alternatives
- Decide and implement
- Evaluate and monitor

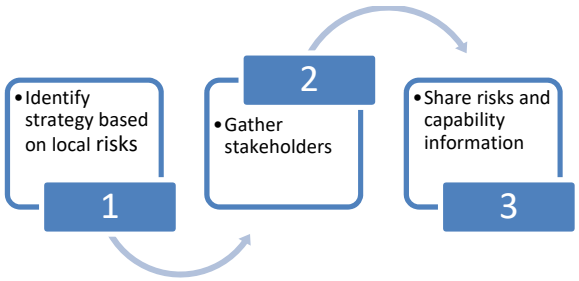
Disaster risk management is a continuous process and it is defined by the context that the risks exist [17]. A good knowledge of the environment is important to guide the identification of risks within and risks that may affect the environment from external sources. Environmental hazards and community vulnerabilities shape the risk. After risks are identified, decision- makers have to analyze and assess how

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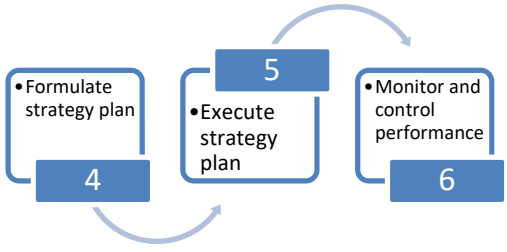
likely a hazard will escalate and the consequences after escalation. All local risks are rated from most likely to least likely occurrence and alternatives to approach the risks are exploited taking into consideration cost and benefit. A decision is made to shape and control risks to minimize the impact when they do occur. Regular evaluation and monitoring of this process is essential [18]. Evolving environmental factors and human activities to mitigate the outcome of risks are essential factors to determine resilience.

VI. Risk-Based Capability Approach Planning

Risk-based capability approach is a planning method that local communities can implement to establish priorities, and strengthen operations to achieve targeted goals toward reducing the impact of natural disasters. This approach explains how the community can optimize the utilization of its resources to manage the risks from natural disasters [19]. The local government plays an essential role to identify community risks and necessary capabilities to address risks in partnership with relevant local stakeholders. In testing communities capabilities for future disasters, hypothetical scenarios are set replicating local context and capabilities are aligned based on identified risks [20]. It is important to set a frequency to test capabilities and new lessons learned should be incorporated immediately into current operations plans. Regular practical assessment of capabilities to understand if capabilities target have been met or what steps are required using measurable objectives is essential [21]. The risk-based capability approach follows a series of steps:



(a)



(b)

Fig. 1 (a) The first three steps and (b) The last three steps in the six steps risk-based planning process

The strategy is identified based on local risks. After the strategic position is established, all stakeholders involved in the planning process will be assembled to analyze risks and capabilities. The next step is formulating and executing the strategic plan taking into consideration organization policies and ensuring that the team is staying on track. Necessary changes can be made if the objectives are not met. Lastly the strategic plan has to be monitored as new and relevant data are collected based on lessons learned.

Aligning capabilities will greatly enhance the response to natural disasters since capabilities play a key role to addressing the challenges posed by risks [22]. Primary capabilities within the local communities have to be identified and aligned for optimum results. For capabilities out of the local communities, in most cases, an agreement has to be reached and a memorandum of understanding (MOU) signed prior to a disaster. Neighboring communities usually have established mutual aid agreements that have been established to share capabilities when disasters occur.

VII. Scenario Risk-Based Capability Planning

Scenarios are practical constructs to test planning strategy. Scenario planning uses the results from risks ratings and develops assumptions based on local potential disasters to plan for future disasters [23]. Stakeholders in this process include local leaders from government, non-profit organizations and private sector, department heads, and subject matter experts. Emergency managers should ensure that in scenarios based exercise all local potential hazards are identified. In the course of exercise, capabilities are tested to identify gaps; there is an increase in understanding of threat alerts, warning, and information sharing across sectors and partners to facilitate coordination during a real disaster occurrence.

VIII. Conclusion

Despite positive structural and nonstructural actions, local communities' stakeholders' must follow a course of action to minimize the outcome of uncertainties when disasters occur. The most effective method or course of action to reduce potential increase in cost of natural disasters is to adapt the approach to natural disasters planning using the risk-based capability approach in planning for the eventual occurrences of natural disasters. Simply implementing the risk-based approach without aligning capabilities to address risks may not result in resilience. A tailored risk-based capability approach planning that does not only ensure that all local hazards are addressed in the planning process but also aligned capabilities and engage all community partners into the circle of operational activities that ensures that the community is ready for all hazards is key to minimize the negative outcomes of natural disasters.

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