

Understanding Flood Resilience in Urban Context

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Abstract - With time, the activities of humankind are causing the increase in temperature which in turn is triggering global warming, the cause of melting of glaciers and mounting of sea levels. An enormous area of land abuts the sea, which eventually will be submerged with the rise of sea levels causing destructions around the world on an urban level. Natural calamities damage the livelihood of human beings as well as infrastructure and economy. Resilience is the potential of a community or system susceptible by hazards to be prepared for an upcoming disaster, recover from it quickly, minimize the losses, and adapt and grow from the disruptive experience. Incorporating resilience in the urban design and planning process is today's need. The primary purpose of the research is to comprehend the role of architectural fraternity regarding flood resilience in an urban context as well as broadening the prospects of resilient designs by creating awareness.

Key Words: Flood, Resilience, Resilient Architecture, Disaster Management, Urban design, Global Warming, Urban Planning

1. INTRODUCTION

Earth as we know is changing, Climate Change is causing disruptions to the lifestyle of human beings and causing problems for the planet. A global temperature rise (Global Warming) is cause of melting of the icecaps, resulting in a rise of the global sea level and with it, is endangering coastal urban settlements across the world.

The risk of flooding and damage to these megacities is increasing due to improper planning and urbanization. The existing flood prevention measures are not sufficient and there is a need for a paradigm shift towards flood risk management.

Urban resilience refers to the capacity of a city or urban area to be prepared for a disaster, recover from it quickly and effectively, minimise the losses, and adapt and grow from the experience. The cities should be prepared in advance for the disasters it could face and be efficient in saving lives, money, resources and time. This paper is an introduction to flood resilience in urban context and enlightens about the terms and principles related to it.

2. LITERATURE REVIEW

2.1 Floods

Flooding refers to the inundation of land that is usually dry. This natural phenomenon causes loss and damage to human

lives, infrastructure, resources, livelihood, time, and money and due to Climate Change, the flood events have been increasing in intensity and frequency both.

Along with coastal and riverine flooding, flash flooding are a common occurrence in the urban areas and this is due to improper urban planning.

Urbanisation is on the rise and the migrating rural population is increasing the density of urban settlements. The improper urban growth and inefficient planning is the main cause of flash flooding. The existing flood prevention systems are failing under such intensities. Hence, the need of resilience in disaster management and urban planning.

2.2 Chronic Stresses and Acute Shocks

Urban areas are home to multi-hazard threats including chronic stresses and acute shocks. Chronic Stresses are referred to as elements that weaken a city on a daily basis, such as inefficient transport system, high unemployment, endemic violence, etc. While, Acute Shocks are the sudden events that the city faces, like earthquakes, floods, terrorist attack, disease outbreaks, etc.

These stresses and shocks weaken the city and its environment. The stresses are dealt in a gradual manner with government policies and non-government actions and the shocks are mostly dealt with immediate measures. The need to be prepared for these shocks is important.

Floods are mostly dealt with structural measures such as dams, levees, channels, etc but according to the future scenarios the mechanisms and ideologies of the past are bound to fail and hence, the need for a paradigm shift and a new mode of planning.

2.3 Cross-cutting Themes

- Urban Resilience is a result of various cross-cutting themes which include Socio-political, Environmental and Economical components. Every phase of urban resilience has these interlinked and interdependent components.
- Resilience is an amalgamation of both adaptation and mitigation strategies and it will contribute to long term sustainability.
- Diversity and Flexibility composed together will create a more resilient scape.

- Different stakeholders will have to come together and work on resiliency.

2.4 Multi-Stakeholders

Resilience is not the scope for a few but a joint team effort with multi-stakeholders involved with different purposes, namely:

Water Professionals:

- They work in municipality or private companies and are in-charge of managing other public or private organisations involved.
- They are in-charge of finding solutions and maintain the service levels and functionality of water infrastructures.

Urban Planners:

- They manage the municipal departments, those in charge of urban infrastructure. They are not directly related with water.
- They organize urban spaces and are responsible for new plans and visions

Architects/ Landscape Architects:

- They are responsible for designing urban infrastructures and green areas.
- They create plausible visions as the major driver is their creativity

Natural Scientists/ Biologists:

- They have the knowledge about all the natural processes in relation to environment.
- They help in preventing negative impacts on the environment and human health from the new implementations.

Lay People:

- They dwell and work in the urban area and use the urban infrastructure and services daily.
- They have the power to change the political and municipality scene.
- Improving their own quality of life is a major driver other than education, knowledge, wealth, interests, etc.

Politicians/ Municipality:

- They comply with national guidelines and work under financial constraints.
- They are concerned about citizen's happiness and safety and are the policy makers.

2.5 Flood Defense (Engineering Resilience) to Flood Management (Ecological Resilience)

Flood Defense is preferred over Flood Management for years, the structural marvels have been able to withstand the forces of nature and prevent flooding for a long time but due to the climate change, the intensities of the disasters have become unimaginable and they are now failing.

Any coastal city or a flood-prone urban settlement is often protected by extensive flood-control infrastructures which includes dams, levees, barriers and channelization of natural & artificial waterways. The intention was to resist and stop the water from coming into the cities. "But even the cities that depend on flood-control infrastructure can resist floods only up to a certain magnitude, thereby these cities are ill-prepared for capacity-exceeding extreme floods, which are expected to increase with more intense storms whose exact natures are unpredictable (Alley et al. 2007)". In such cases, the climate change uncertainties might prove Engineering Resilience as an unreliable and ineffective mitigation approach.

Ecological Resilience is the alternative approach which may prove to be more effective due to its dynamic nature unlike the deviant behavior of Engineering Resilience (towards change). This system is prepared for fluctuations that it might face and is more adaptive and receptive than the former. The integration between land and water might prove flood adaptation is better than flood control and why there is a need to shift from Engineering Resilience to Ecological Resilience.

"Engineering resilience is about maintaining the ideal state of functionality; it aims to maintain stability, to remain unchanged, or have minimum fluctuations while Ecological resilience is about survival regardless of its state (Holling 1973)". Engineering Resilience mainly focuses on resistance and recovery, it is designed with predictability in mind and a step further but is inconsiderable towards the unimaginable.

With climate change on the rise, mankind has experienced extreme natural disasters, of magnitudes not expected and at those times, these measures have failed and, in some cases, have added to the loss. These major and minor disturbances act as threats to the system and hinder the working while questioning its stability and consistency.

Ecological Resilience majorly focuses on the tolerance of any area and easy reorganization. Because of being flexible and having multiple states of equilibrium, the losses are lesser, and the recovery is faster. These systems have persistence in their working and view every disturbance as a learning opportunity and not as a threat.

Ecological Resilience doesn't suggest to entirely skip involving the engineering marvels but to have an interventionist approach and merge both the systems. Depending entirely on either system might not be an effective approach towards the problem, therefore

incorporating ecological and engineering resilience methods is a better alternative.

3. STRATEGIES FOR BUILDING URBAN RESILIENCE CAPACITY

1. Multifunctionality

Multifunctionality can be achieved through combining different functions in the same system/infrastructure by stacking or time-shifting. It will help utilize money and infrastructure in an efficient manner.

2. Redundancy and modularization

When multiple components, buildings or element deliver the same service/function or acts a backup for the primary component, it reduces the load and also prevents complete halt of services/ functions.

3. (Bio and social) diversity

Biodiversity helps fulfill the same purpose and eases the flow of a function with the assistance of different elements. For example; bioswales, tree canopies, and permeable surfaces, all are different elements but help in reducing and slowing down the rainfall, simultaneously reducing the stress on the urban stormwater systems.

4. Multi-scale networks and connectivity

Functions operating at multiple scales should be well connected. For example; creation of walking trails that link and reach the bus routes or connection of lower order drains to higher-order drains.

5. Adaptive planning and design

In the pursuit to resilience, urban planning and design have to be adaptive to be successful and innovative in true sense.

These innovative strategies proposed are different than the conventional ones and might take more efforts to implement and be successful.

4. CONCLUSIONS

After extensive research and elaborate case studies, it is imperative for planners and decision-makers to make a paradigm shift to resilience when it comes to flood risk management. This research paper gives a brief introduction for the same.

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