Z E S Z Y T Y  N A U K O W E  P O L I T E C H N I K I  P O Z N A Ń S K I E J
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# ASSESSING DISASTER MANAGEMENT GOVERNANCE FOR FLOOD MITIGATION IN INDIAN CITIES: LESSONS FROM POOR GOVERNANCE AND RECOMMENDATIONS FOR EFFECTIVE RISK REDUCTION

Human communities and their activities are dependent on their surrounding environment in which climate plays a major role. Living beings are sensitive to climate as they live and create livelihoods based on it. The climate is versatile, and its unpredictable character for natural reasons, always made human societies adapt strategies depending on the extremes of the climate and weather. Floods are the most recurring natural calamity in many countries and India ranks first in the human loss category due to calamities. It is not possible to eliminate the floods, but it is possible to minimize the damage and the risk potential. In India, disaster management plays a key role in risk control and management. However, due to a lack of deliberative governance, the efforts of the National disaster body never achieved its goals. Urban floods show how poor governance can create a major risk that results in social, economic, and environmental losses for the city. Cities like Chennai, Mumbai, and Kolkata are experiencing extreme floods due to a lack of proper risk mitigation and city planning governance issues. To understand flood mitigation in India, the disaster management governance model of India is analyzed with other countries to understand the merits and demerits of our governance. For the pilot study, the present risk management plans of Chennai are assessed using the flood risk management framework to know how effective the management is. This paper aims to recommend and implement an effective governance model to reduce the impact caused by floods in Indian cities.

**Keywords**: governance models, disaster management, flood risk management, Indian cities

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## 1. INTRODUCTION

Developing countries like India deal with climate change challenges that hamper the goal of achieving the Nations sustainable development. The rising frequency of disaster occurrence has affected our ecosystem, which directly or indirectly disturbs our livelihoods. India is one of the highly climate-sensitive nations. Its enormous geographic range along with its diverse climatic areas resulted in its vulnerabilities to climate change risks. The United Nation report states that the loss of human lives due to disasters had been low but the occurrence of the events have been rising [UNISDR 2004]. In 2001, the earthquake in Gujarat Bhuj triggered the Disaster Management Bill to pass but it was established when India experienced a tsunami in 2004 [UNISDR 2015] and in 2005 Disaster Management Act came into implementation. The need for strong governance for prevention and mitigation is always required and now it is more essential, which has a scope to adapt strategies by evaluating and then creating policy depending on the context rather than a holistic approach. To achieve flood resilience, the nations should have an approach of risk management governance where the nation should have appropriate resistance capacity where the capacity can absorb, recover, and adapt according to context [Driessen 2018]. Depending on the geographical location, the settlements, either urban or rural, have several issues to mention, based on their vulnerabilities and the disasters, hazards, climate change, and other factors.

The operational approach for risk management should be exclusive to individual contexts to map by assessing the risk and vulnerability to make a scalable and effective risk management plan. Cities are the most sensitive zones for risks and have been recognized for risk management for the past few years.

In developing countries, urban areas are experiencing disasters due to the rapid population growth, which is inversely proportional to infrastructure growth, resulting in the discrepancy in disaster management and its adaptation [Watkiss 2011]. Among natural disasters, floods are the top disasters in which human loss is enormous. The human loss and the damage caused by flooding showcase that the adaptation and mitigation level is poor and the incompetence in disaster management [HT Correspondent 2020]. In India, the decline in seasonal rainfall and change in precipitation levels increased the occurrence of floods and droughts in the recent past, present and future scenarios. The Chennai floods were an example of how floods can damage the social, economic, and environment of the cities. The Government of India stated that Chennai is in the National Disaster Zone, and most of the flooding in Chennai is categorized as a man-made disaster [Lavanya 2012]. The IPCC declares that human-stimulated climate alteration is taking place. The rapid residential growth, development of industrial areas, and development of infrastructure sectors in eco-sensitive zones like flood hazard areas led to a loss of vegetation and lack of planning without considering natural contours and natural drains, resulting in a decrease in procuration areas, which now leading to flash floods during

high rainfall and monsoon. If this tendency continues, it will intensify the trouble of flooding in the future. A detailed interpretation and evaluation of land use change and its effects on the watershed hydrologic activities are essential for the forecast and mitigation of hazards caused by flood and planning, sustainable development, and management of the watershed [Calder, Aylward 2009]. The governance model plays a vital role in managing the risks of human, environmental, and economic loss due to climate change. Chennai can be an example of analyzing the positives and negatives in governance and management models.

## 2. UNDERSTANDING THE ROLE OF GOVERNANCE IN FLOOD RISK MANAGEMENT

### 2.1. India

It is expected that the government supports and strengthens the development and application of disaster risk management with varied integrated policies by considering all appropriate levels of stakeholders, strategies, insights, and resources [Vinke de Kruijf, Kuks, Augustijn 2015].

In India, the National Disaster Management Authority is under an Act of Parliament in December 2005 where the Chairman of the nodal agency is the Prime Minister of the country. The Act aims for the effective management of disasters and matters associated therewith. Disaster management plans for floods, droughts, etc., are designed by disaster management authorities. The National Disaster Management structure shows us the hierarchy of the departments and governments in Fig. 1. The 2005 National Disaster Act implementation was slow and ineffective.

Under the Act, the state Chief Minister plays a role as the Chairman, and in the district, the Collector acts as a chairman and selects the members. The structure lacks inducing NGOs and citizen participation in the decision-making process, and so it is alleged that the "Act became law almost at the will of the bureaucrats who framed it".

It can be proved in the case of the Chennai and Mumbai floods, and recently the Kerala Floods, where floods were termed as manmade disasters rather than natural occurrences due to the man intervention that led to the disaster [Lavanya 2012]. India tops the list in human loss during disasters because the system does not include NGOs and citizen participation, which would have helped in social learning in the reasoning of core reasons for floods. In 2013, the Indian Supreme Court issued a warning notice to the Governments of Uttarakhand, Andhra Pradesh, Gujarat, Tamil Nadu, Odisha, Maharashtra, and Rajasthan and the Central government for failure to implement the Disaster Management Act of 2005, in response to a Public Interest Litigation [The Economic Times 2017].

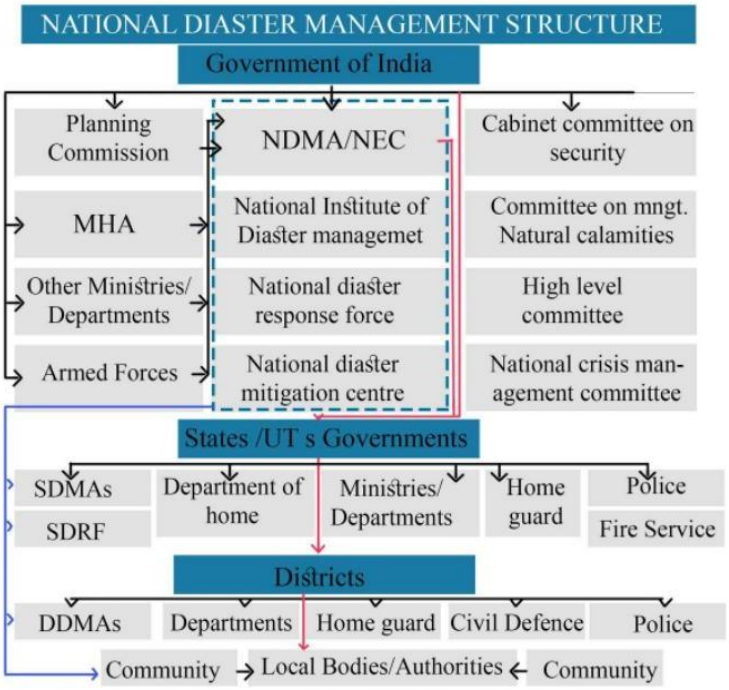


Fig. 1. National Disaster Management Structure [NDMA 2019]

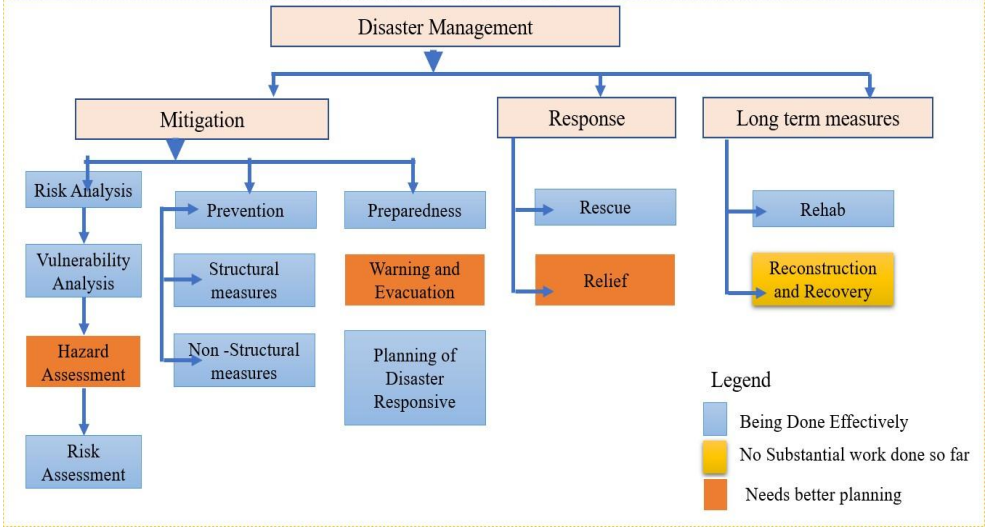


Fig. 2. Steps taken for post disaster and pre-disaster [NDMA 2019]

The main issue with risk management planning is that the authorities are not experimenting with new processes, not taking community experiences, and not being open to knowledge from communities and NGOs. Deliberative governance is the most effective to attain sustainability in dealing with natural and man-made disaster risks. The method seeks communities at risk to get involved in all its phases of the top-down process like prevention, mitigation, preparedness, response, and recovery. For disaster-resilient communities, the community members must be empowered to survive the adverse effects of natural hazards [Munene, Swartling, Thomalla 2018].

## 2.2. Bangladesh

In Bangladesh, flood is a yearly incident. Consistent river floods affect the nation by 20%. Approximately 37%, 43%, 52%, and 68% of the country has been flooded

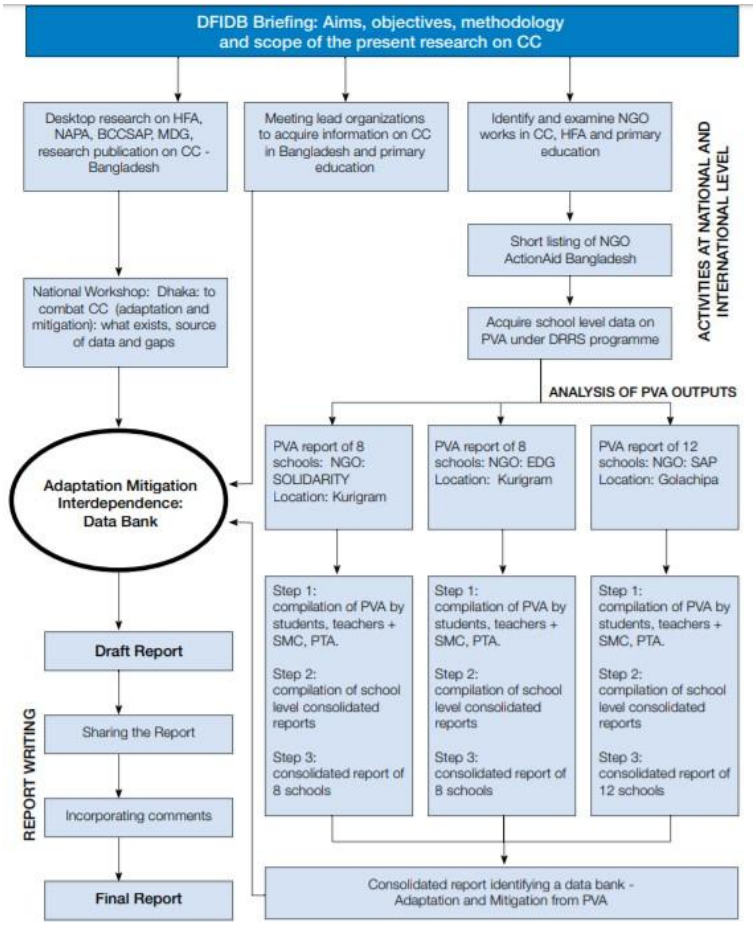


Fig. 3. The adaptive governance model of floods in Bangladesh

with return periods of 10, 20, 50, and 100 years correspondingly. The government involved the community in all the stages until the mitigation plan was finalized, and there's been a drastic change in the reduction of human losses in its disasters. To manage the disasters there is a necessity for correct adaptations at the level of community. The government started promoting primary schools as the school facility is provided at every corner of the nation, to promote and publicize the knowledge to inculcate a daily life change to survive unexpected disasters and to persist with the problem. Through this top-down process, the governance is making citizens self-sufficient to react during disasters and is open for knowledge gain for policy-making and plan implementation.

## 2.3. Triple loop learning framework for governance

The framework triple loop learning is famous for the dynamics of governance methods as learning procedures.

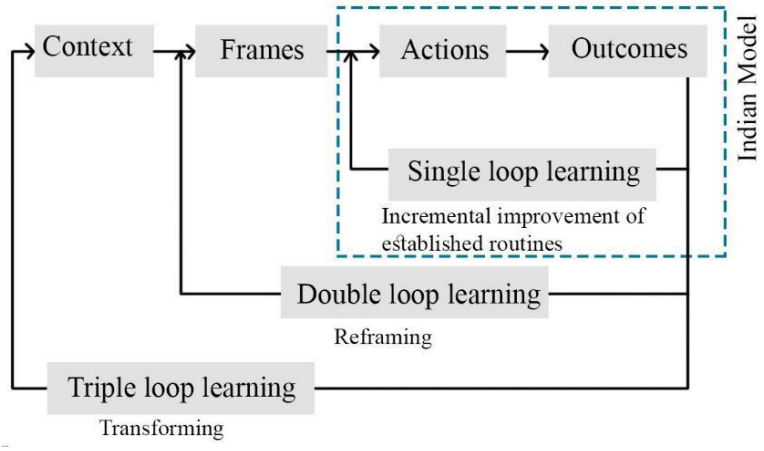


Fig. 4. Sequence of learning cycles in the concept of triple-loop learning [Pahl-Wostl 2009]

The framework is characterized by a wide-range interpretation of social understanding rooted in the more instructive components of the social sciences. The structure revolves around processes of multi-party relations, rooted in a specific public and ecological structural perspective and leading to specific results. This adaptive governance model helps in understanding the root causes of the disasters and helps in deriving solutions from the stakeholders, as the model emphasizes the area and the disaster context.

## 3. COMPARISON ANALYSIS OF INDIAN RISK GOVERNANCE MODEL WHICH WILL BE DONE WITH NETHERLANDS AND BANGLADESH

From the comparison, we can understand that the Indian governance model is lacking in deliberative governance and is rigid without involving citizens in understanding the fundamental problems of the disasters leading to a deficient in capacity to adopt, absorb, and restore risk management.

Tab. 1. Comparison of risk governance model of different countries

| Factors | Country | | | Inference |
|---|---|---|---|---|
| | India | Bangladesh | Netherland | |
| Citizen participation | Sometimes | Yes | Yes | Obligatory for efficient FRM |
| Stakeholder analysis | Weak stake-holderanalysis | Strong stake-holderanalysis | Strong stake-holderanalysis | Imperative |
| Scale | Short term goals like upgradation of infrastructure | Long terms gaps | Long terms goals inFRM | Flexible to local level |
| | Non-scalable | Scalable | Scalable | |
| Mapping | Done by gov-ernment and xperts | Done by com-munityparticipa-tion along with government and experts | Done by gov-ernment and xperts | To be scaled down to local level |
| Decisionmaking | Govt. based | Community based andex-perts based | Different author-ities and expert based | Involve commu-nal based |

## 4. AN OVERVIEW OF HOW GOVERNANCE IS ONE OF THE REASONS IN CHENNAI FLOODS

An analysis study done by Chandan states that the change in land use pattern from the past four decades shows a twenty times increase in the urban area by converting the agricultural land, and open spaces. It has been noticed that green cover has noticeably declined from 70.47% to 35.53%, and non-vegetative areas (built-

up, paved areas, etc.) have risen from 29.53 to 64.47%. The reasons identified for Chennai's frequent occurrence of floods are (a) unrestrained urban sprawl and loss of natural drainage. Blockage and encroachment of water bodies like drains, lakes, and rivers. The water bodies' ecosystems are polluted, and the rate of flow is affected leading to the out spills and flooding from them [Rafiq et al. 2016]. (b) Improper and insufficient stormwater drainage system and absence of maintenance. 855 km of the stormwater network is only laid for 2847 km of urban roads [Drescher et al. 2007]. (c) Surge in impermeable surfaces. (d) Lack of agency coordination, and no proper cohesive flood control management agency that incorporates the functions of a corporation, development authority, public works department, slum clearance board, housing board, etc., adds to weak points. This rise is the usual observation in the majority of cities in India and is the fall in 30% of wetland areas from the past five decades. Wetlands are useful ecosystems and are beneficial in enhancing water quality by collecting floodwaters and slowly releasing them as they travel downstream [Melesse et al. 2006].

In 2007, Chennai Municipal Authority developed a 2026 vision to achieve a comfortable, lively, economic, and environmental sustainability for future generations. Chennai has initiated a City River conservation project to improve waterways, with an estimated budget of 17.000 million but it resulted in the rise of groundwater level. In 1988, with the economic assistance of the government, an alleviation scheme for floods was launched with 3000 million budget. In the 2017 investigation and assessments, it was noticed that the improvements were not identified as said by authorities. The government did not hold the responsibility and transparency to citizens in risk management and mitigation plans, and citizen participation was not encouraged [Gupta, Nair 2019].

To understand the effectiveness of the management and to analyze citizen participation, a survey has been taken using Google Forms for Chennai residents. 100 have been responded. The survey focuses on citizen participation and governance's role in risk management.

### 4.1. Summary of the survey answers

From this survey, we can state that there is no 100% citizen participation in the decision-making or any knowledge exchange between the governance body and citizens. There is no proper way of analyzing the core problems of the risks. So, the governance model is still rigid, and it must change into adaptive and three-loop learning where the knowledge can be exchanged, and strategies are taken by involving NGOs, citizens, and experts.

Tab. 2. Assesing governance role in risk management through the survey analysis [author's own elaboration]

| Q.NO | Questions asked | Responses from 20 Chennai citizens |
|---|---|---|
| 1 | How long are they residing in the city? | 54% from more than 10 year, 10.3% from 6 to 10 years, 15.3% from 3 to 5 years and 2.5% between 0-2 years |
| 2 | Does your area flood during heavy rains? | 51% floods all the times, 32.2% sometimes and 17% no |
| 3 | Were you a victim of flood? | 85.4% yes and 15.6% no |
| 4 | Do you know to whom you should report about flooding in your area? | 43.6% yes, 53.8% no, 1.2% not sure |
| 5 | Do you know that your city has Disaster Management or Risk management Plan? | 66.7% no and 33.3% yes |
| 6 | Were you warned about floods by government before it created a problem? | 61.5% yes and 39.5% no |
| 7 | Do you think government encouraged citizen participation in preparing your city flood management plan? | 51.3% yes, 46.2% no and 2.6% no idea |
| 8 | When was your area flooded last time? | 42.9% last 6 months, 17.1% last year, 12.9% 2 to 4 years back, 5.7% 5 to 10 years back, 21.4% before 10 years |
| 9 | Did government helped your area as soon as it flooded? | 80% yes, 20% no |
| 10 | Who helped you initially during flooding? | 22.8% government, 28.5% neighbors, 3% NGO, 43% all three |
| 11 | After flooding, has the Government taken a survey to analyze why your area was flooded? | Yes<br>asked about causality, diseases, damaged houses |
| 12 | Do you think your area got developed to avoid flood? | 70% no, 30% yes |
| 13 | What steps were taken to avoid flooding in your area? | 17.9% infrastructure, 10.1% Citizen participation, 38.5% no steps were taken, 12.8% other steps, 20.5% both infrastructure and Citizen participation |
| 14 | Were you trained how to manage during floods by government agencies? | 71.8% no, 10.3% by own interest, 5.1% yes, 7.7% schools, 5.2% NGO's |
| 15 | Do you know that you have right for participation in decision making of Risk management Plans? | 30.8% yes, 69.2% no |

## 4.2. Evaluating flood risk governance of chennai

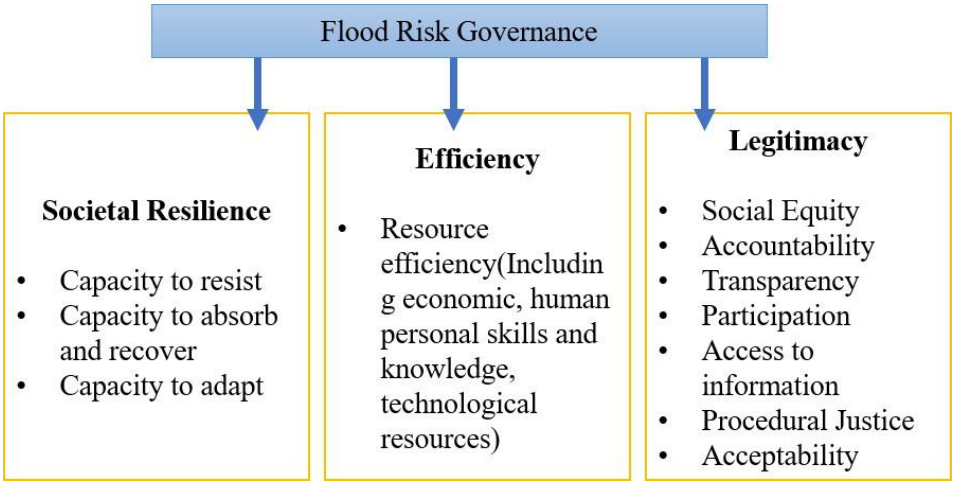


Fig. 5. Evaluation framework for flood risk management governance [Alexander, Priest, Mees 2016]

The framework aims to evaluate the flood risk governance model by understanding the arrangement to achieve societal resistance and examine effectiveness and authenticity. After the Chennai floods in 2015, the state government has recently prepared a flood management plan to make Chennai a resilient city. The plan is still in its initial stages, and implementation has not started yet. Evaluation of Chennai flood risk management will help in understanding the positives and negatives of the governance model and the management.

The evaluation of the flood risk governance for Chennai city is carried out by the framework proposed by Alexander.

### 4.2.1. Criteria for evaluation

#### Societal resistance

1. Capacity to resist – Chennai Governance Restricting aspects of flood risk.
   The Union government has refused Chennai's request for funding for storm-water drain projects to establish flood mitigation, and the State government has requested the World Bank for financial support, an estimated cost of ₹4,034 crore. The project would lessen inundation, and water bodies integrate, recharging groundwater and enhancing public health conditions. Budget revenue for maintenance is allocated yearly and lacks the guarantee of the upcoming year's financing program's new developments [The Hindu 2018].

2. Capacity to absorb and recover – restricting aspects of flood risk governance in Chennai.
   No attempts were made to encourage citizen engagement in FRM during risks. Hundreds of additional soldiers and relief workers were deployed to the flooded city of Chennai on Saturday, as residents said the government has been too slow to respond.
3. Capacity to modify – encouraging aspects of flood risk governance in Chennai.
   Catchment area plans of flood management assist strategic decision-making over a 50-100-year timescale – Food Management plans were prepared but are still in the approval process. Mapping of lost and present water bodies is currently available on Google Earth.

**Efficiency**

1. Resource efficiency – encouraging feature of flood risk governance in Chennai.
   The flood risk mapping supported by the Centre's Department of Science and Technology and Survey of India is financed by the Water Resources wing of 217crores and adopts the technology of GIS mapping. This project is handled by the Anna University Institute of Remote Sensing (IRS), Chennai.

**Legitimacy**

1. Accountability – restricting aspects of flood risk governance in Chennai.
   The reasons for flooding are many. The land use plans, no preservation of wetlands, illegal constructions on water bodies, and opening of dam gates during heavy rain – many are responsible, but they are not in a variety of legal actions due to political involvement.
2. Transparency – encouraging aspects of flood risk governance in Chennai.
   Chennaifloodmanagement.org was launched in mid-2016 to assist cooperation and communication of data that will reduce the impact of flood events in the coming years of Chennai. Mapping can be done by citizens and data can be upgraded by them [The New Indian Express 2018].
3. Access to information – encouraging aspects of flood risk governance in Chennai.
   Flood risk information is publicly available (flood management plans and flood-prone maps in Disaster Management book – Chennai). But the maps are still in the initial stage of preparations.
4. Acceptability – encouraging aspects of flood risk governance in Chennai.
   Public discussion and involvement processes are broadly used to enable understanding and approval of FRM schemes. Citizen Consumer and Civic Action Group was formed to empower citizens' rights in decision-making.

## 5. CONCLUSION

From the analysis, it is understood that the Indian Disaster Management stakeholder chart shows Government officials, Experts, NGOs, and the Community as the Stakeholders. But in realism, there is no NGO participation and Citizen participation in disaster management evaluation or later stages. These uneven powers of stakeholders are the results of the floods and other disasters as they fail in mitigation. From the analysis of Chennai flood risk management, it can be understood that India lacks descriptive, adaptive governance as citizens are involved in only the initial stages of decision-making or problem-solving, and citizens are not informed in later stages of decision-making and plan implementation. Preparation of topography maps, reducing contamination and blockage of water bodies, regulating planning and activities in eco-sensitive areas, creating watershed management plans, public awareness, and capacity building are some of the steps to be considered for better flood disaster management, but these factors are not achieved in 100 per cent, the process of top-down is seen in Indian management plans. So, Indian disaster management plans are not able to secure their aim to reduce flood risk in urban areas. Adopting the adaptive governance model and making the governance structure deliberative governance will result in sustainable risk-solving strategies and plans, as the transparency and accountability of both citizens and governance will be strong.

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## OCENA ZARZĄDZANIA KLĘSKAMI ŻYWIOŁOWYMI A ŁAGODZENIE SKUTKÓW POWODZI W INDYJSKICH MIASTACH: WNIOSKI Z NIEWŁAŚCIWEGO ZARZĄDZANIA I ZALECENIA DOTYCZĄCE SKUTECZNEGO OGRANICZANIA RYZYKA

Streszczenie

Społeczności ludzkie i ich działalność zależą od otaczającego je środowiska, w którym klimat odgrywa główną rolę. Istoty żywe są wrażliwe na zmiany klimatyczne, ponieważ funkcjonują i tworzą warunki do życia na podstawie uwarunkowań środowiskowych. Uwarunkowania klimatyczne mogą charakteryzować się nieprzewidywalnością, która ludzkie społeczności do dostosowywania się poprzez zastosowanie właściwych strategii rozwojowych w odniesieniu do ekstremalnych warunków klimatycznych i pogodowych. Powodzie stanowią najczęściej występujące zjawiska kryzysowe w wielu krajach, a Indie zajmują pierwsze miejsce w kategorii strat ludzkich spowodowanych klęskami żywiołowymi. Nie jest możliwe wyeliminowanie zjawisk powodziowych, ale możliwe jest zminimalizowanie szkód i ograniczenie możliwości ich wystapienia. W Indiach zarządzanie klęskami żywiołowymi odgrywa kluczową rolę w kontroli i zarządzaniu ryzykiem. Jednak ze względu na brak świadomego zarządzania wysiłki krajowego organu ds. klęsk żywiołowych nigdy nie osiągnęły swoich celów. Powodzie miejskie pokazują, jak słabe zarządzanie może stworzyć poważne zagrożenia skutkujące stratami społecznymi, gospodarczymi i środowiskowymi dla miasta. Miasta takie jak Chennai, Mumbaj i Kalkuta doświadczają ekstremalnych powodzi z powodu braku odpowiednich narzędzi służących zarządzaniu i planowaniu rozwoju miast. W celu zrozumienia, w jaki sposób może następować łagodzenie skutków powodzi w Indiach, przeprowadzona została analiza porównawcza indyjskiego modelu zarządzania klęskami żywiołowymi z innymi krajami. W badaniu pilotażowym obecne plany zarządzania ryzykiem w Chennai są oceniane przy użyciu ram zarządzania ryzykiem powodziowym. Niniejsze opracowanie ma na celu sformułowanie rekomendacji dla skutecznego zarządzania i działań planistycznych służących ograniczeniu skutków powodzi w indyjskich miastach.

**Słowa kluczowe**: modele zarządzania, zarządzanie klęskami żywiołowymi, zarządzanie ryzykiem powodziowym, miasta indyjskie