Integrating Law in Flood Management in India: A Case Study of Flood Awareness and Risk Perception in Mumbai

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Abstract

Globally, floods are increasing in frequency and velocity. The position in India is no different with floods emerging as a complex, recurring problem leaving behind a trail of death and destruction. Although floods cannot be completely eliminated solely through law, law can be an important tool to mitigate its consequences and reduce its risks. Using a mixed doctrinal and non-doctrinal methodology, this study investigates the efficacy of the legal, policy and institutional mechanism on flood management in India. Moreover, with the recent thrust on disaster risk management and reduction, risk perception of natural disasters of the public at large is also emerging as a vital component of the disaster management process.

In the present research, a case study of flood risk perception in Mumbai has been undertaken wherein participants from Greater Mumbai and Mumbai suburban districts participated in a survey on their awareness and perception of floods and related risks. The research findings indicate that while majority have experienced floods, have awareness on its causes and dangers, they do not know about challenges in terms of the efficacy of law. It is argued that as continuous neglect of community is likely to be catastrophic, a robust legal framework ought to be built that secures Government-community partnership for effective flood management.

Keywords: Disaster risk management, floods, law, policy, India, Mumbai case study.

Introduction

The irony of water lies in its dual recognition as a saviour and destroyer. Mankind has flourished due to water but when in excess, it has caused insurmountable sorrow. Water when in excess causes floods which have various causes. Natural causes of floods include torrential rain or cloudbursts while manmade causes include unscientific land use, construction in flood plain areas and inadequate drainage systems[38]. Floods have globally emerged as the most common of all disasters making them the "new normal"[38]. In 2023, north-eastern Italy[1], the Democratic Republic of Congo[29] and the Republic of Rwanda[37] witnessed catastrophic floods which killed thousands, displaced millions and destroyed essential infrastructure. Natural disasters originate from natural hazards which are physical phenomena having geophysical or hydrological origin. When hazards interact with vulnerability and inadequate response, disasters ensue[41]. Historically, natural disaster management was response-centric. A gradual transition occurred from the response oriented approach to disaster risk reduction ("DRR"). DRR's main aim is to reduce disaster risks by adopting suitable measures to address underlying causes of hazards[39].

Disaster risk management ("DRM"), in turn, is an important component of DRR comprising application of DRR strategies to prevent risk of disasters, to reduce their adverse consequences and to build resilience[39]. DRM has received significant attention within the Sendai Framework for DRR 2015-2030, the global roadmap towards a disaster resilient world[40]. Community based DRM promotes involvement of communities through their assessment of hazards, vulnerabilities and capacities and other strategies.

India is an inherently natural disaster prone country, owing to the country's geophysical terrain. Globally, India is the 3rd most disaster affected country and the 2nd country in terms of disaster induced fatalities and disaster affected people[13]. Known as the "land of many rivers", India is also one of the most flood affected countries in the world[18]. Out of the total 329 million hectares of geographical area, the National Disaster Management Authority of India ("NDMA") identifies over 40 million hectares of the country as flood prone[8]. Apart from mortalities, floods also have heavy economic burden for this developing country. Data as presented in fig. 1 shows an upward trend in flood related fatalities in India.

Rationale of the present study: A recent report predicts that the Indian coastal cities of Mumbai and Kolkata are likely to be inundated by 2050 – a prediction demanding urgent action[24]. This report reiterates a similar prediction made over 15 years ago which predicted India to become the 2nd most flood prone country by 2070 ("OECD Report")[19]. The OECD Report also predicted a similar fate for Mumbai and Kolkata, with the cities emerging as most prone to flooding by 2070. At the outset, these estimates and the contemporary situation (exacerbated by population growth and climate change) necessitate an investigation into the preparation to prevent these events from actually occurring[24]. Additionally, societies which are more aware and prepared are more resilient in disaster situations, especially with the presence of effective legal mechanism[18]. Thus, the above necessitates an investigation into the efficacy of the legal and policy framework on flood management and risk reduction in India.

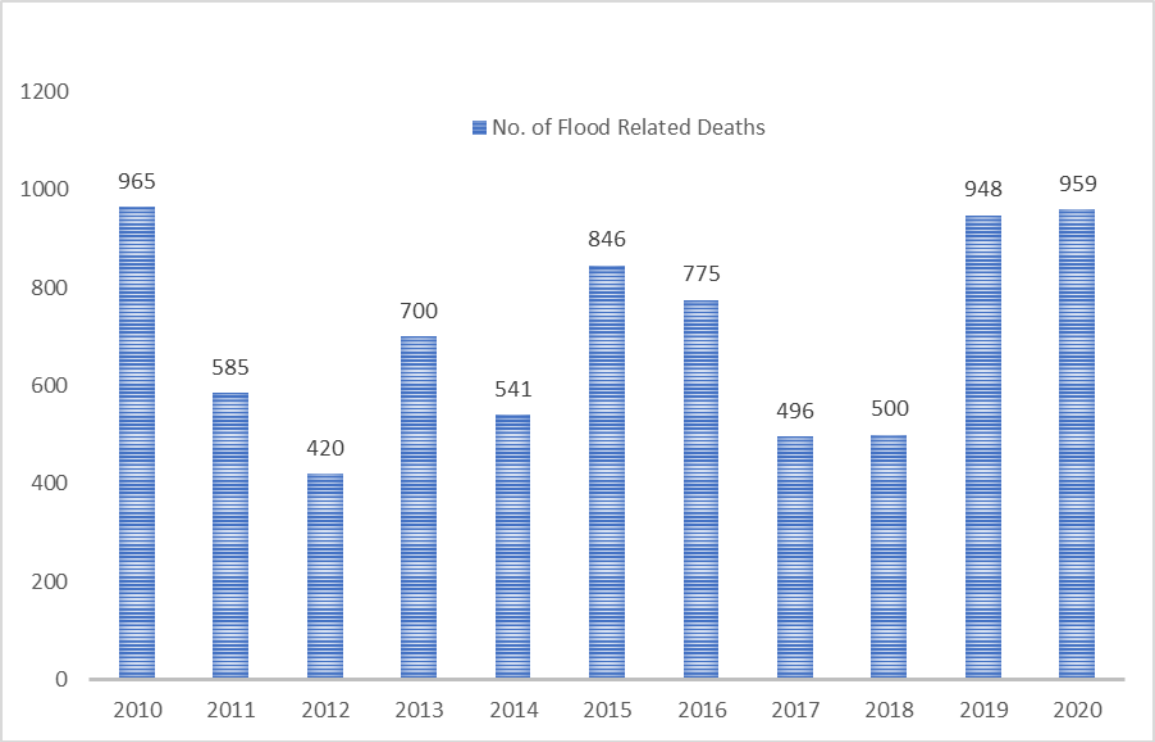

Fig. 1: Number of flood related deaths in India in period between 2010-2020[30]

Material and Methods

There is growing literature on the role of law in natural disaster management[14]. Likewise, there are reports on the role of law, particularly national law, in flood management[39]. Moreover, recently, DRR, DRM and the perception of risks of natural hazards (including floods) by the community have been of significant research interest[40]. These are vital components for an effective flood management process. Hence, the main aims of the present study are three-fold, namely,

(i) To scrutinise the efficacy of the Indian legal and policy framework on flood management.
(ii) To assess the community's perception of risks associated with floods to ascertain their level of preparedness towards DRM including flood management.
(iii) To ascertain the extent to which the two have been and can be integrated into an effective framework.

A combination of doctrinal and non-doctrinal methodologies has been used. For the doctrinal part, the researchers have undertaken a thorough desk study of the applicable legal and policy framework on flood management in India. For the non-doctrinal part, the researchers have undertaken a case study of the coastal city of Mumbai (one of the two Indian cities likely to become inundated and most prone to coastal flooding) for which a data collection exercise was conducted to analyse flood risk perception amongst the people of Mumbai i.e. Mumbaikars.

India's flood profile: As a peninsular country, India is surrounded by the Arabian Sea to the west, the Indian Ocean to the south and the Bay of Bengal to the east. India has several major rivers and their tributaries flowing through the country's length and breadth. From a flood hazard perspective, India is often divided into four flood prone zones (Table 1).

Besides Assam, Maharashtra, Uttarakhand and Kerala are some of the flood prone States[10]. Few main causes of floods in India are torrential monsoon rains, decreased capacity of rivers to carry high flows, poor drainage systems and other meteorological factors[18]. Moreover, unsustainable land use and development have also escalated the severity and frequency of floods in recent times[18].

The 2005 Maharashtra including Mumbai deluge[19], the 2013 Uttarakhand floods[28], the 2014 Jammu and Kashmir floods[17], the 2015 Chennai floods[36] and the 2019 Assam floods[35] are some devastating floods to have occurred in India.

In the context of the present study, it is pertinent to note that Maharashtra (including Mumbai), Uttarakhand and Assam are States where floods have been annually occurring causing significant mortality and economic losses. Table 2 is a tabular representation of major flooding events to have occurred-reoccurred in Maharashtra, Uttarakhand and Assam.

Law and Policy on Flood Management in India

The following study presents a critical analysis of the extant legal, institutional and policy framework on flood control and management in India and analyses the efficacy thereof.

Table 1
Flood zones in India[30]

S.N.	River Region	Rivers
1	Brahmaputra river region	Brahmaputra and Barak rivers and their tributaries
2	Ganga river region	Ganga and tributaries
3	North west river region	Sutlej, Beas, Ravi, Chenab and Jhelum
4	Central India and Deccan region	Narmada, Tapi, Godavari, Krishna and Kauvery

Table 2
Devastating floods of Maharashtra, Uttarakhand and Assam[19,25,28]

State	Year	Losses		
		Casualty	Economic losses	Other notable issues
Maharashtra	2005	1094	$5.50 billion	• Mumbai airport was shut with over 700 flights cancelled or delayed • 52 local trains damaged • 900 BEST buses damaged • 1000 autorickshaws damaged
	2019	56	INR 1400 cr.	• 49% damage to water supply • 30% damage to sanitation infrastructure • 1519 houses damaged completely, 19,780. House damaged partially
	2021	251	INR 1800 cr.	• Power supply to 9 lakh people impaired • 28,700 poultry deaths • 300 animal deaths
Uttarakhand	2013	1000	$3.8 billion	• 2052 houses destroyed • 147 bridges collapsed • 1307 roads destroyed
	2021	200	$223 million	46 houses destroyed 2 power projects washed away
Assam	2019	950	INR 10,000 cr.	• 26 lakh people affected • Over 10,961 cattle destroyed
	2022	197	INR 1000 cr.	1 million adversely impacted
North Indian States and Union Territories	2023	422	INR 1000 cr.	• 1,110 roads damaged • 1,200 homes destroyed (including partial damages)

Constitution of India and floods[34]: Legislative powers, under the Constitution of India, are divided between Centre-States. While the Parliament makes laws on matters in the Union list, States can make laws on those in the State List. Both can make laws on subjects in the Concurrent list. All three lists are envisaged in the Seventh schedule to the Constitution, which *per se* does not refer to "floods". However, provisions on "embankment and drainage" are mentioned in the State list. Thus, States carry primary responsibility to formulate laws on flood management. No central law on flood management has yet been enacted[26]. However, many States have enacted their own frameworks while the role of the Central Government appears to be advisory and technical in nature. The Centre offers financial assistance to States through the Flood Management Programme since the XI Plan (Rashtriya Barh Ayog) to undertake flood management and soil erosion control measures[26].

1975 Model Draft Flood Plain Zoning Bill[26]: Flood plain zoning is considered an effective measure for flood management. Flood plain zoning strives to demarcate flood prone zones and specify the types of developments allowed in these zones to minimise flood related damages. To this effect, the Indian Government had circulated the Bill to all States for their enactment on the same. The Bill envisaged zoning of flood plains of rivers according to frequencies of floods and delineated types of use of flood plains. However, barring the States of Rajasthan, Manipur, Uttarakhand and the erstwhile State of Jammu and Kashmir (now Union Territories), majority of the States are yet to make laws on the same[24].

1976 Rashtriya Barh Ayog (National Flood Commission)[28]: The Rashtriya Barh Ayog was constituted under the aegis of the Ministry of Agriculture and Irrigation in 1976 and remains the country's sole national level flood

commission to be ever constituted. Of its principal recommendations on better flood management, following are crucial:

(i) Increase in floods is unrelated to increasing rainfall- rather deforestation and poor development cause the same;
(ii) Ineffective construction of reservoirs/ embankments should be halted and
(iii) Better co-operation between Centre-States is needed for flood related research along with dynamic strategy for effective management.

These recommendations were forwarded to States but barring Assam and Uttar Pradesh, other States could not implement them due to bureaucratic barriers[28].

2005 Disaster Management Act ("2005 DM Act")[7]: The 2005 DM Act, although well intended, is often criticised owing to its largely administrative lay-out. Although the law tells us the 'what', it offers very little clarity on the 'how'. The National Disaster Response Force ("NDRF"), created thereunder, has played an important role during the 2008 Kosi floods, 2014 Jammu and Kashmir floods and 2015 Tamil Nadu floods. Apart from the NDMA and the NDRF, the 2005 DM act also created disaster management authorities at the State and District levels along with the National Institute of Disaster Management (and the National Disaster Response and Mitigation Funds). Although the 2005 DM Act does not contain any express provision on "floods", general provisions which apply to disasters will apply to floods. The NDMA has been legally empowered to create guidelines on different types of disasters and consequently, following guidelines have been notified[7].

2008 NDMA Guidelines on the Management of Floods 2008[24]: Although knowledge of flood management has been made available to different organisations and communities, for long, there existed no guidelines on 'how' their management could be implemented. This culminated in the NDMA adopting the 2008 Guidelines on Management of Floods which identified gaps within India's flood management system. Few of these include:

(i) *ad hoc* nature of response measures to address flood related challenges;
(ii) emphasis on addressing temporary needs and
(iii) lack of clarity on co-operation between agencies and stakeholders.

The Guidelines address key measures for flood prevention, preparedness and mitigation such as structural and non-structural measures, integrated water resources management and strengthening medical preparedness to meet health concerns of floods. Early warning and forecasting for floods, both crucial from DRR and DRM perspectives (Sendai Framework, Goals 18(g), 25(a) and 33(b)) have also been emphasised. Separate chapter underlying the importance of emergency relief, preparedness of community members (Sendai Framework, Goals 24(m) and (o) and 27(f), strengthening their resilience [Sendai Framework, Goals 16, 18(d), 25(f), 27(d)] and the need to adopt flood management plans is contained. Provisions also include adoption of appropriate legal framework by State and district disaster management authorities making it mandatory to issue clearances before construction of infrastructure in flood prone areas[24].

2010 NDMA Guidelines on Management of Urban Floods[24]: In 2010, the NDMA also separately notified the Guidelines on Management of Urban Floods, addressing "Urban Floods" and hence de-linking them from floods. The management of urban floods is the prime responsibility of urban local bodies with State governments also empowered to implement various schemes. These guidelines have identified responsibilities of other authorities including public works, health and education and law and order departments and traffic police.

Flood Control Bill, 2008[8]: The Flood Control Bill, 2008 acknowledged that (a) floods are an annual experience in India and (b) it was expedient in public interest to undertake legal measures for their effective management. It sought to create a 'National Flood Control Board' with the following primary functions, namely to:

(i) identify flood prone areas;
(ii) suggest measures for flood control;
(iii) deploy flood forecasting system and
(iv) rehabilitation of flood affected people.

However, no further progress has been made and it remains a bill. A perusal of the provisions of the text, especially in contemporary context, will draw attention to the necessity to have a suitable law premised on its provisions.

2012 National Water Policy ("2012 NWP")[11]: With a view to take cognizance of water related concerns, the Ministry of Jal Shakti notified the 2012 NWP. The 2012 NWP emphasises the need to adopt appropriate structural and non-structural measures for mitigation of floods including operation of reservoirs with sound decision support systems, rehabilitation of natural drainage system and other agricultural and non-agricultural developments. Special mention on the need to increase preparedness for unexpected floods has been made. Coastal States are advised to prepare coastal land management plans, keeping in view the environmental and ecological impacts and to regulate developmental activities accordingly. Being suggestive, much success is yet to be seen.

DRM with respect to floods - Community role

Understanding disaster risk: In most developing countries, the approach towards flood disaster management is reactive i.e. the process focusses on responding to the flood situation at hand, instead of being proactive. Moreover, activities are largely undertaken by Governments devoid of any

stakeholder participation including community[33]. In terms of law, the Sendai Framework has resilience through community and stakeholder participation and collaboration at its heart[40]. Previous literature also shows that DRR and DRM including community based DRM can be vital tools for effective disaster management[42]. To put simply, 'risk' refers to the likelihood of undesirable effects resulting from an event[8]. In the context of disasters, risk entails certain important components (Fig. 2).

In terms of flood DRM, its main aim is to minimise both human and economic losses arising from floods. Although risks of floods cannot be entirely avoided, but they can be managed to a great extent and hence, their knowledge, perception and reduction are important factors for disaster mitigation[33]. The study of risk perception is gradually increasing in recent years, especially in terms of flood management[33]. Previous studies demonstrate that perception of risk by public can determine the level of personal and community behaviours and preparedness towards natural disasters including floods.

In the context of disaster preparedness behaviour, risk perception has been central to many studies. Previous research demonstrates that communities adopt preparedness activities and measures only when they perceive to be under the threat of witnessing a disaster[33]. Since resilience is seen as the ability of communities/ societies exposed to hazards to learn from the past and reduce their risks, it becomes an important dimension in the DRR and DRM processes[5]. Hence, understanding of governments and lawmakers of the risk perception of general public can aid effective legal and policy planning, especially in natural disasters including floods[5].

Case study of Mumbai - The spirit of Mumbaikars and recurring floods

26 July 2005 is a day Mumbaikars are unlikely to forget[6]. A record 994 mm of rain was received within 24 hours causing widespread flooding, loss of lives and property bringing the city to a standstill[6]. At least 1/3rd of the city's surface area had been flooded with phone lines disrupted for hours to a few weeks. Entire transportation was brought to a standstill[32]. With no network coverage, families were unable to check on their loved ones and the city was isolated from the rest of the country and world for over 24 hours[32]. The infrastructural damage was immense with water not receding for days and transmission of diseases such as leptospirosis, diarrhoea, dengue and malaria. The death toll from diseases alone was 125. Over 1000 people lost their lives and close to 14,000 people were left homeless.

The Fact-Finding Committee, appointed in the aftermath, reported that had a suitable forecasting system been in place, the disaster could have been averted to some extent[19]. Although the Indian Meteorological Department ("IMD") had located the presence of a 15km cloud over Mumbai, the same had not been conveyed to concerned authorities thus indicating poor planning, preparation and co-ordination[19].

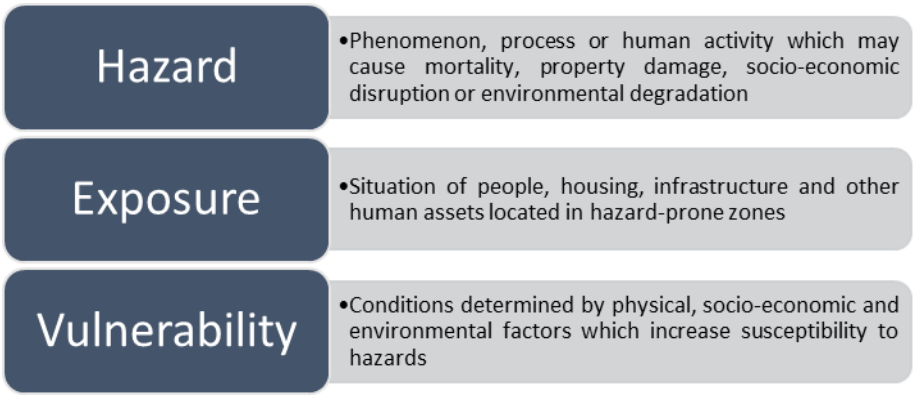

Fig. 2: Disaster Risk: Key components (sourced from UN Spider Knowledge Portal)

Fig. 3: July 2005 Mumbai Floods (sourced from Business Standard)

Yet another unearthed concern was the failure to implement disaster management plans. Mumbai's disaster management plan was already in place before the floods but the calamity indicated the lack of attention given to it[19]. Moreover, the haphazard development of the city and lack of resources with authorities were also contributors[6]. The 'spirit of Mumbaikars' was lauded as it was ordinary citizens who risked their lives and belongings to help fellow Mumbaikars in the hour of need[6].

Again in 2019[9] and 2021[15], Mumbai (and other parts of Maharashtra) were ravaged with torrential rains leading to severe floods. The 2021 floods particularly destroyed the Konkan region affecting 1028 villages and killing over 200 with thousands more affected. Public health systems and infrastructure were again destroyed[15]. Same was also the case in 2022 when Mumbai was inundated with waist level water[2]. But as has historically been the case, the spirit of Mumbai has time and again been praised in the aftermath of floods or other man-made disasters, be it by opening their homes to strangers or offering assistance[2].

However, the spirit of Mumbai should be treated with caution so as to not simply make it a façade and allow authorities to escape liability.

As can be seen through the present study, the absence of legal and policy framework on flood management is not the impairment. Rather, a combination of factors such as inadequate attention to integration of law with DRR and DRM, more particularly with flood management, unsustainable land use and failure to adopt climate change strategies is a cause of concern[6]. Nevertheless, as the spirit of Mumbaikars often gets hailed, the following part of the study presents the case study of Mumbai from the perspective of flood risk perception and resilience of Mumbaikars.

Data collection and findings

Flood profile of Mumbai: Mumbai city lies on the Salsette island. For administration, Mumbai is divided into two divisions – (i) Mumbai city and (ii) Mumbai suburban. Lying south of the Salsette island, Mumbai city district is also known as South Mumbai; while Mumbai suburban district consists of the western and eastern parts. The city's proximity to the sea means a humid climate with heavy monsoon rains with an average rainfall of over 2000 mm per annum. Majority of the city is built on flat reclaimed land and is lower than the high tide line makes it prone to flooding, in addition to anthropogenic factors.

In accordance with the 2005 DM Act, the Municipal Corporation of Greater Mumbai has prepared a District Disaster Management Plan for Mumbai City District and Mumbai Suburban District (together "Plans"). The plans address multiple disaster issues including hazard profiles, risk, vulnerability profiles, prevention, mitigation, preparedness and response. Despite these plans, the city and suburban district continue to witness recurring floods and adverse consequences.

Data collection method: A total of [62] participants from Mumbai and Mumbai Suburban District (collectively "Mumbaikars") willingly participated in the research by submitting their responses to a structured questionnaire (Annexure I). Apart from their age, place of residence and years of residence in Mumbai/ Mumbai Suburban District, the questions revolved around their understanding of floods. More specifically, questions were asked on their own or their relatives' previous experience with floods and their perception in terms of flood risk and preparation.

Results and Discussion

Flood knowledge and awareness: Knowledge what causes floods, to any extent, can help mitigate their consequences. All participants confirmed that they have knowledge of what causes floods. In the event of a flood, participants largely appear to be in a position to mitigate their consequences. Pertinently, majority participants also confirm that they were aware of:

(a) The existence of the 2005 DM Act and
(b) MCGM designated as district disaster management authority.

In contrast, majority participants were unaware of the following vital elements which form an integral part of the flood management process. These are:

(a) emergency helpline number in case of disasters;
(b) disaster management plans notified under the 2005 DM Act;
(c) participation in mock drills;
(d) emergency kit requirements to deal with disasters;
(e) do's and don'ts during floods as notified by the government; and
(f) requirements of an emergency family flood management plan.

The above demonstrates that while the participants have knowledge of the existence of the law and the designated authority, there is limited awareness on implementation of the law and its ancillary requirements needed to deal with real situations of floods. This limited awareness can indicate lack of seriousness of the Government towards handling of the subject and can make their initiatives in this regard questionable.

Mumbai flood risk: On the component of flood risk perception in Mumbai, none of the participants denied that Mumbai experiences floods annually. The belief of the majority that floods are an annual occurrence in Mumbai is, at the bare minimum, an acknowledgement of the frequency of floods in the city. Moreover, majority also anticipate that floods will or are likely to increase in the future with a miniscule 5.4% disagreeing. 44.6% and 41.1% of the

participants even indicate being afraid and somewhat afraid of floods respectively establishing the calamitous nature of this natural hazard. Majority of participants are aware of the 2005 July floods and even enumerated their experiences in this regard *inter alia* including vehicle damage, lost documents, physical injuries and being stranded without food and water. Most participants and/or their relatives experienced floods on more occasion than one.

It is well known that Mumbai is ever growing and has in recent times been witness to constant land development and improvement. This is also enhanced by population growth. As such, when participants were asked about their perception on the relation between on-going development projects such as the Mumbai Coastal Road Project and the Metro Project, majority of the participants fell short of firmly believing that there does exist a relation between the two. These responses could reinvigorate the longstanding debate on balancing environmental/ ecological concerns and development, especially in an ever-growing city like Mumbai.

Most participants perceived the "spirit of Mumbai" as a positive, unitary trait. However, there were a few participants who believed the phrase to be a "whitewash". In respect of the responsibility to make the city flood resilient, majority cast the duty equally upon the people, Government, private and non-profit sector with a handful of participants shifting the onus solely on the Government. Although it is the Government's primary duty to manage floods, from the survey it seems that the spirit of Mumbai is synonymous with community participation, which is integral to DRM.

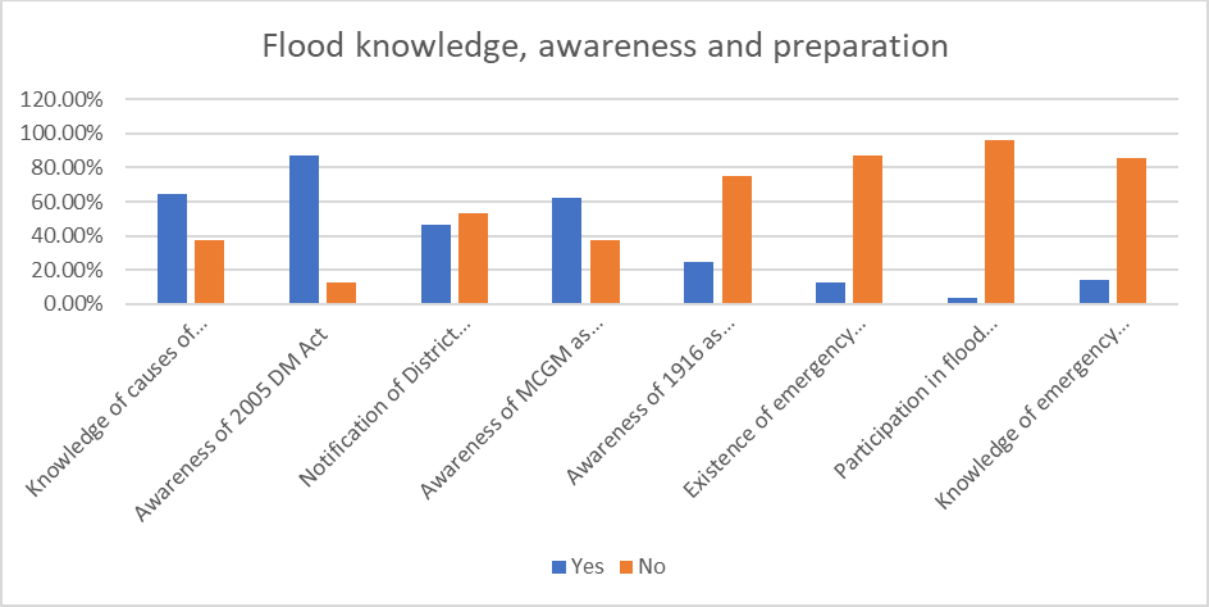

Fig. 4: Flood knowledge, awareness and preparation of participants

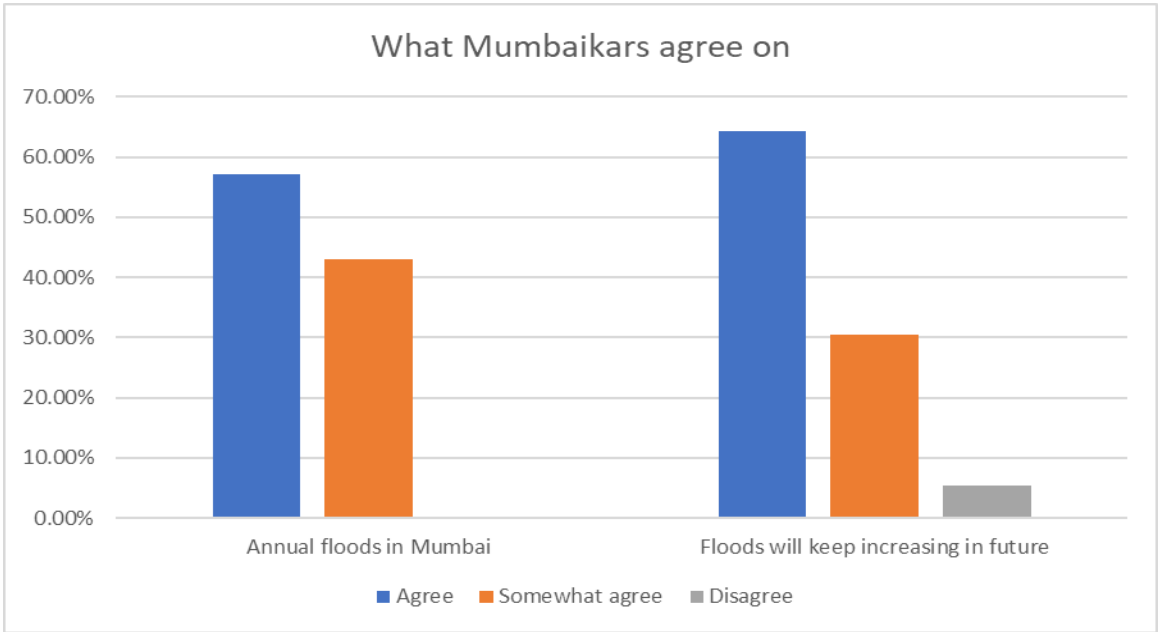

Fig. 5: Findings on floods as annual occurrence and their increase in future

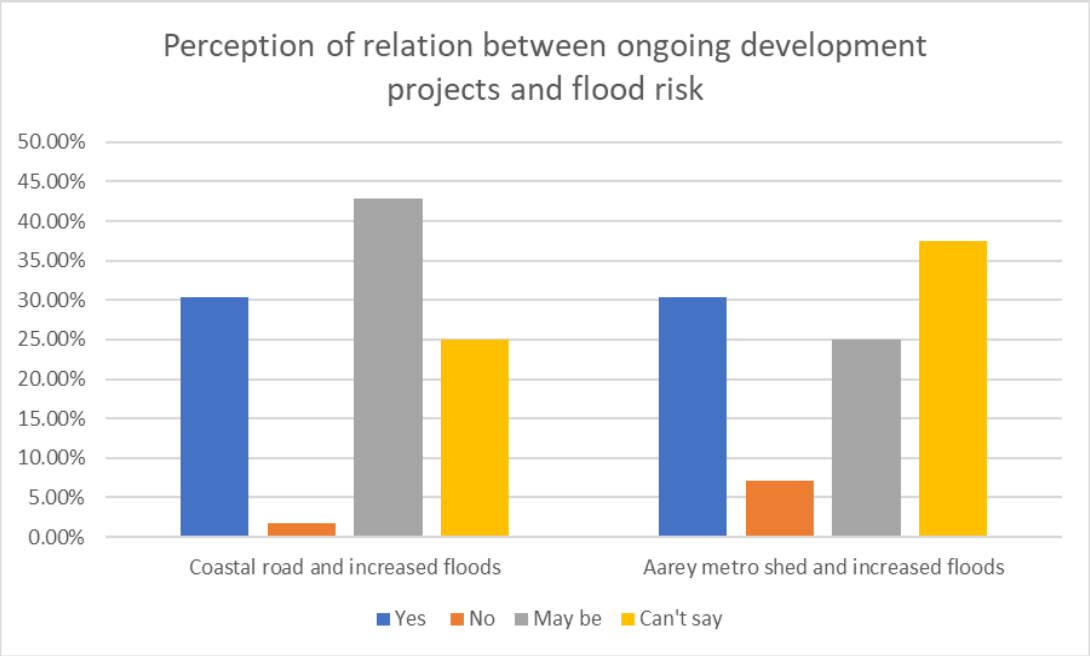

Fig. 6: Perception on relation between ongoing development projects and floods

Conclusion

As can be seen through the course of the present study, there are laws and policies on disaster management in India even though there exists no central framework on flood management. In the absence thereof, a haphazard approach has been adopted by States within India's federal set-up eventually leading to lack of uniformity. Even the 2005 DM Act has its challenges, it essentially remains an administrative law laying down the requirements of what needs to be done, without clarifying on the how. Multiple guidelines notified under the 2005 DM Act are indeed useful but their lack of implementation remains a cause of concern. This is pertinent to note since India's domestic legislation seems to fall in meeting the international requirements including the Sendai Framework. Nevertheless, the institutional response from the NDRF and the armed forces has been profound in floods in India. What also remains laudable, is community participation or the spirit of people who have defied all odds when a calamity strikes. However, it is time to pause and ponder over whether the current situations warrant a revisit to the spirit of the community, or as was seen in the case study of Mumbai, revisit the spirit of Mumbai.

In light of the above, the researchers argue that it is imperative for the legislature lawmakers to enact a specific legal framework on flood management which creates binding provisions on preparation, management and response to make India truly flood resilient. Some of the possible inclusions in such an integrated framework should address:

(i) Creation of a national flood agency along with the responsibility of creating a nationwide flood database and flood prone and zoning map.

(ii) Prioritising advanced EWS and ensuring co-operation between agencies such as the IMD, NDRF, the Central Water Commission and other authorities. As was seen during the 2005 Mumbai floods, although the data was available with IMD, poor co-operation and delays in conveying the same led to irreparable loss. Advanced EWS ought to be one which integrates community participation including that from women and other vulnerable groups such as the elderly.

(iii) Provisions which factor in inter-State rivers, dam safety and floods are also needed. This will allow protection against arbitrary holding of dam waters and their sudden opening which may create floods in States.

(iv) Elaborate budgetary allocation and distribution of funds (including for EWS) need to be addressed. As was revealed in the aftermath of the 2022 Assam floods, allocations towards flood management has dipped which is alarming. If specialised training to first responders, medical aid, food and other forms of relief are to be made available, funds need to be augmented and binding legal provisions to that effect are needed.

(v) Socially inclusive, gender and disability sensitive flood management plans and policies need to be framed at the district, state and national level. These need to be updated from time to time to integrate best practices in the field and address gaps faced during previous experiences.

(vi) Focus on inadequate drainage and crystal clear responsibility of the district disaster and municipal authorities needs to be laid down. Land planning and its use also need to be embedded in the framework. Failure to do so is only going to draw the next big flooding event closer and faster.

More importantly and pressing is the participation of the public and creating awareness and preparing them for natural hazards including floods. When a natural hazard strikes, those affected will be the first to respond. Their level of

preparation will draw the thin line between survival and submerging.

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(Received 08th February 2024, accepted 12th April 2024)