

Role of Various Sectors in Demonstrating **Resilience** During Chennai Flood 2015

Prepared for:



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About ACCCRN



Asian Cities Climate Change Resilience Network (ACCCRN) was launched in 2008 and is funded by The Rockefeller Foundation as part of their 9-year initiative aimed at building Climate Change Resilience. Climate change resilience is the capacity of an individual, community, or institution to dynamically and effectively respond to shifting climate impact circumstances while continuing to function at an acceptable level. Simply, it is the ability to survive, recover from, and even thrive in changing climatic conditions. ACCCRN works at the nexus of climate change, vulnerable and poor communities, and urbanization.



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Chennai Floods: Introduction

Chennai is an administrative division and capital city of the state of Tamil Nadu. Chennai metropolitan region (CMA), with an area of 1,189 sq kms and a population of 8,653,521, is the fourth most populated city in India (Census, 2011). Chennai located on north eastern part of Tamil Nadu, is a flat plain stretching for about 25.6 kms along the coast of Bay of Bengal, from Thiruvanmiyur in the south to Thiruvottiyur in the north. Physical expansion of the city is marked by lateral rather than vertical growth because of the availability of land (Shodhganga nd). It is bounded on the east by Bay of Bengal and on remaining three sides by Chengalpattu and Thiruvallur districts.

A large number of well-known institutions such as- Theosophical Society, the Kalakshetra and colleges of Arts and Crafts are located in Chennai. Establishment of professional colleges like medical, veterinary, law and teaching, Indian Institute of Technology and Central Leather Research Institute added to the development of the city (Kalyanasundaram 2005).

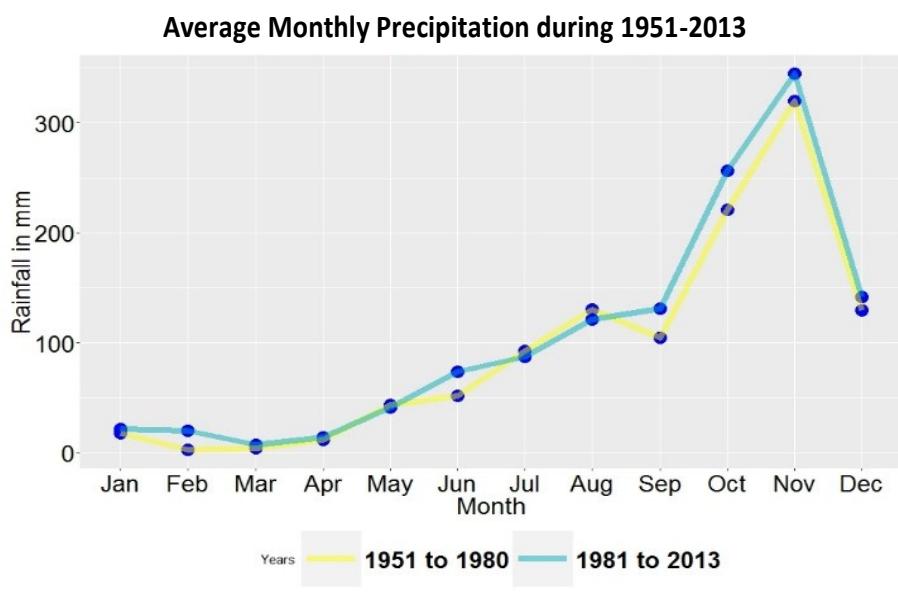
Chennai's growth during colonial period began with the development of British institutions and administrations. Within 350 years of British rule, a few scattered villages (Mylapore, Triplicane, Chennai Patnam, etc) developed to form a modern metropolitan city, without shedding its traditional customs, culture and religious outlook (Kalyanasundaram 2005).

Chennai Corporation, the oldest corporation in India and second oldest in the world, was established in 1688. In 2011, jurisdiction of Chennai Corporation expanded from 174 sq. kms (67 sq. miles) to an area of 426 sq. kms (164 sq. miles), dividing it into three regions – North, South and Central, which covers 155 wards with 10 zones. Chennai Metropolitan Development Authority (CMDA) is the nodal agency responsible for undertaking planning and developmental activities for CMA. Larger suburbs of the city are governed by town municipalities while the smaller ones are governed by Town Councils. Its contiguous satellite towns include Mahabalipuram in the south, Chengalpattu and Maraimalai Nagar in southwest and Sriperumpudur, Arakonam, Kancheepuram and Thriuvallur on the west (Shodhganga nd).

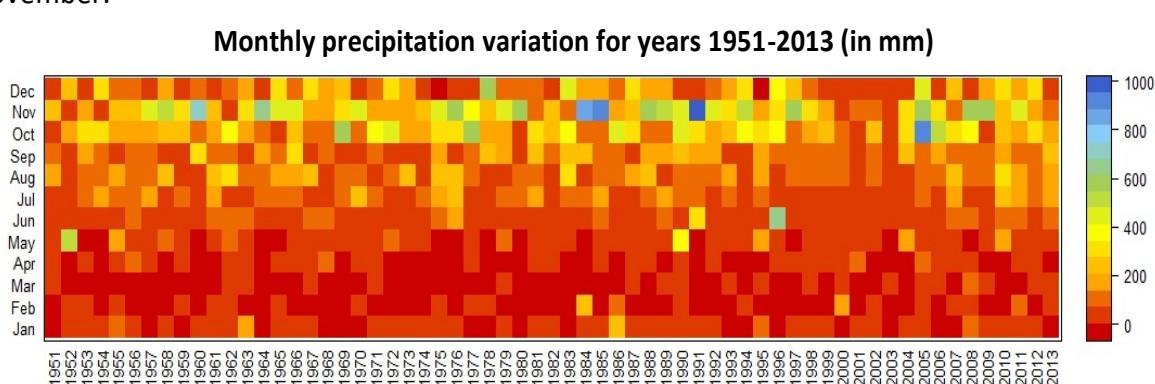
The period 1991-2001 was marked by population growth as well as spatial development, particularly in villages with facilities like transportation network, availability of land at cheaper rates and other critical infrastructures. Chennai witnessed population growth at a rate of 7.77% over the next decade-2001 to 2011 (Sekar and Kanchanamala, 2011). The city favored low density low rise development this combined with the increase in urban population led to significant expansion of city and thereby change in land use and land cover patterns (Shenghe and Sylvia, 2002).

Climate

According to Koppen's Climate Classification System, Chennai has Tropical Wet and Dry Climate. It's coastal as well as equatorial location prevents much annual variation in temperature, with maximum being experienced in the months of May or June and minimum in January. The city gets most of its rain from north-east monsoons.



Monthly precipitation during 1951-1980 as well as 1981-2013 indicates that average monthly rainfall increases from 100mm- 350mm during the monsoon months of September to November.



Source: TARU Analysis, 2016

However, figure 1.2 showing monthly precipitation variation from 1951-2013, clearly indicates occurrence of more than 800mm of rainfall in 1984 (November), 1985 (November), 1991 (November) and 2005 (October). Years 1958, 1969, 1970, 1972, 1975, 1989, 2005 and 2011 received 400mm-600mm of precipitation in months of October and November. More than 400mm of rainfall was also received in the months of May and June respectively, in 1952 (493.3mm) and 1996 (615mm).

Being situated on the eastern coast of India, Chennai is exposed to violent storm surges and flooding during north-east monsoons (September to November). Although such extreme events are an annual phenomenon for the city, some years in particular like 1918 cyclone and 1985 floods are unforgettable.

In 1943, continuous rain for over 6 days resulted in flooding of Cooyum and Adyar rivers, which inundated its surrounding areas. Slums located on the banks of Cooyum river were the ones that were majorly impacted. Whereas slums in Lock Cheri, Choolaimedu, Perambur, Kosapet, Kondithope and Chintadripet were completely washed out, with people taking refuge in the Ripon Building (Ramakrishnan 2015). In November 1976 Chennai received 554.2mm of rainfall leading to similar water logging situation. In the year 1985, Adyar river flooded the city, when Kotturpuram slum clearance board tenements along with Ambattur and Madhavaram dairies went under water. 2005 torrential rainfall caused by cyclonic depression over Bay of Bengal disrupted city life and led to shifting of 50,000 people to relief centres, due to inundation of houses in the low lying areas (The Hindu 2015).

Rational for Study

History repeated itself in the city of Chennai on November- December 2015, when the devastating flood claimed more than 470 lives and resulted in enormous economic loss. The city and its suburb recorded several days between November 2015 to December 2015 of torrential rainfall, which inundated coastal districts of Chennai, Kancheepuram and Tiruvallur, and affected more than 4 million people with economic damages costing around US\$3 billion (The National 2015).

Death of 18 patients in MIOT International Hospital was reported on December 5, 2015. This hospital being located close to Adyar River, had the power units supplying power to the ventilators of patients in critical condition damaged by flood waters (The Hindu 2015). Over 18 lakh (1.8 million) people were displaced because of the flooding event. About 30.42 lakh (3.042 million) families suffered total or partial damage to their dwellings; 3,82,768 lakh hectares of crops were lost to floods, including over 3.47 lakh hectares of agricultural crops and 35,471 hectares of horticultural crops. Roughly 98,000 livestock animals and poultry died (Narasimhan, Bhallamudi, Mondal, Ghosh & Majumdar 2016).

Widespread impact of 2015 flood brought people and institutions in and around Chennai together, to provide support to the flood victims. Help arrived from different sections of society and in a variety of forms. These documented case studies provides an insight into the actions undertaken by government departments, institutions, National Disaster Response Force (NDRF), civil defense, private enterprises, Community Based Organizations (CBOs) and social media during the flood incident. Understanding of their interventions and some of the challenges faced can help urban local bodies better prepare for such extreme event eventualities.

Mainstreaming of some of the actions taken by the institutions can help cities better their coping mechanisms and build climate resilience. Best practices can be derived from the same to strengthen the existing risk handling capacities of the city as well as learn lessons and replicate similar initiatives for preparedness across some of the other Indian cities.

We expect these case studies will also help urban local bodies and other government agencies understand some of the challenges that are likely to emerge during urban flood disasters and use some of the learning to create coordination and collaboration mechanisms to ensure efficient rescue and response operations in future.

Emergency Services

A



Fire Services



National Disaster
Response Force
(NDRF)



Police

1. Fire Services

Situation: Response was initiated by fire services for various activities such as- rescue operation, dewatering, removal of fallen trees, rescue of stranded animals and distribution of drinking water, food and basic medicines to people in need.

Challenges: Challenges faced during rescue operations includes: management of calls, controlling of water distribution system and prolonged power failure. In the post flood scenario, major challenges included disruption of utility services, road/street covered with debris and fallen trees.

Response: 800 fire fighters were deployed at 68 places in and around Chennai. The rescue operations were directly supervised by Jt. Director Northern Region, Jt. Director State Training Centre, Dy. Director Headquarter and Dy. Director Northwestern Region.



Fire and Rescue Services:

Tamil Nadu Fire Department proved to be resourceful during the floods. The team was experienced enough to respond to different situations during night and day even though the weather was not favourable. The emergency response professionals rescued patients, children, pregnant women, old people, pet animals and others across five districts of the state while ensuring that the evacuation plan met life safety codes.

Flood resulted in tremendous demand for pumping out water. 60 vehicles and 7 pumps were used to drain water from 79 locations. Fire department was provided with 12 rubber boats which were not enough for the rescue operation since water levels had reached nearly 8 feet in some places like Tambaram area.

With the help of 36 boats, including the mechanised ones provided by the fisheries department, the fire department was able to rescue people. Total of 2,04,682 people were rescued during the course of the disaster.

Measures:

- Warning dissemination through radio, TV, social media, public addressing system etc.
- Coordination with transportation and public works department to reconstruct streets, remove debris and abandoned vehicles from colonies, activate power lines etc.
- Emergency medical services for evacuees in shelters
- Social media used for crew rotation and logistical issues at shelters (such as fuel, supplies and staff rehabilitations)
- Coordination with emergency operation centres - specially to evacuate vulnerable people from marshy lands, hospitals and multi stories apartments.

Suggestion and Recommendations:

Some of the challenges faced by the fire department could have been overcome using technology (advanced mechanised boat/dewatering pumps/ boulder and pebble cleaning system etc.), efficient communication system and skills, practical approach, timely warning dissemination and response and rescue operation. It was also evident that a proactive role in emergency preparedness if taken by other departments and organizations during normalcy could have eased the burden of fire department during the disaster. There can be enhanced training and preparedness of new or existing firefighters for similar natural events.

- **Disaster Preparedness:** Training needs to include actions citizens can take prior to, during, and after a disaster to lessen the effects upon themselves and their neighbours.
- **Disaster Medical Operations:** Need for basic first-aid skills such as airway management and control bleeding. Simple triage and the concept of establishing a safe and sanitary medical treatment area requires strengthening
- **Light Search and Rescue:** Technological tools (trackers) and mechanised boats need to be sized up, along with the development of module on safety of rescuers.
- **Disaster Psychology and Team Organization:** The effects of a disaster extend beyond physicality and it emotionally both the rescuer and victims. This needs to be addressed and documented for development of organisational principles.



2. National Disaster Response Force (NDRF)

Situation: Receiving and responding to 300-500 rescue calls per day along with filtering out false calls.

Challenges: Challenges were faced in carrying out timely rescue operation with a small team of experts and limited number of on ground vehicles, limited number of boats, coordinating with local officials and deploying team members to priority areas. Issues related to open space and electricity availability increased the challenges while establishing on-site operational coordination control room (OSOCC) and shelters (for team and community members).

Response: 50 Teams were equipped with Out Board Motor (OBM) with capacity of 25 HP, life jackets, life buoys, rescue ropes, floating pumps, inflatable towers and generators for ensuring continued supply, generator sets and Medical First Responders kits. Phase I- Rescued 4,889 people and 7 pets, recovered 5 dead bodies; Areas: Chennai, Kancheepuram, Tiruvalur, Cuddalore and Nagapattinam. Phase II- Rescued 22,450 people and 20 pets; Areas: Tiruvallur, Kanchipuram, Cuddalore, Nagapattinam, Tirunelveli, Vellore, Tuticorin, Karaikal and Puducherry.



Source: deknews.com, 2 Dec, 2015

National Disaster Response Force (NDRF)

Preparedness and response are two essential needs for recovery planning, standardization of humanitarian relief and developing checklists for prompt action to help reduce impact of any catastrophe. NDRF team had effectively carried out rescue operations in 5 districts in Phase I (November 2015) and in 9 districts in Phase II in December 2015). Along with facilitating learning through self-assessment, they also provided support to the state departments (Police/Municipal Corporation) in developing evacuation cum catastrophes plans, team formation, deployment of team to priority area, and enhancing capacities to respond to a disaster. NDRF, SDRF and local agencies collectively undertook preparedness mechanisms to rescue 22,450 stranded flood victims from nine district. The joint task force used available modes of connectivity which included: phone, watsapp, twitter, email and help lines to reach out to people and respond to their situation.

Measures

- Risk and Vulnerability Assessment was conducted by NDRF, Incident Response Team (IRS), Regional Development Officer (RPO), Municipal Corporation officials, Dy. Collector, Government Agencies and police force.
- Improved promptness and efficacy of response to impeding threats of floods or actual occurrences

- Using google maps, google earth, Bhuvan map, etc.
- Aerial maps were also used to study water depth, current flow direction and high vulnerable Zones. These maps were also used to help in sorting false emergency calls and develop priority area maps.
- Ensured effective need based logistical supply of food (cooked/uncooked) and water within a periphery of 5-10 kms of each rescue and rehabilitation control unit.

Suggestion and Recommendations

- GIS based evacuation plan (safe evacuation route) would have helped the agencies to better coordinate with each other's and the victims. These plans should include information on the water flow, emergency routes, water depth, obstacles and possible search and rescue intervention options.
- Disaster apps (Eg- GSDC-2apk, GTEF-apk, Relief-2.apk) need to be strengthened so that they can be accessed and used even without cellular network.
- Technology or database to identify the most vulnerable people in high-risk prone areas.
- Tools to measure water depth, water flow, obstacles etc. and equipment for evaluation and search & rescue activities.
- Strengthening existing capacity and preparedness of district and state search and response teams.
- Modern communication systems with extended battery back-up.
- Identification of modes of transportation which can support during flood emergency relief.
- Need for special studies, development of training module on threat perception/ vulnerability analysis/ flood disaster risk assessment of urban areas, especially in encroached and slum areas.



Source: <http://www.thehindu.com>, 4Dec2015



Source: <http://newstodaynet.com/chennai/residents-hail-role-ndrf-personnel-waterlogged-areas>,
7Dec2015

3. Police

Situation: Needed to transfer evacuation information to the flood prone area and facilitate in evacuating people to a safe location. In addition, they had to coordinate with emergency services, assist evacuation, secure specific locations, control traffic, identify dead people, disseminate casualty information and protect/ preserve the area.

Challenges: Lack of a standard operating protocol or limited understanding of chain of command affected the efficiency of response. Further, lack of clarity on roles and responsibilities of different officials and departments placed both the public and responders at risk.

Response: A single police station (in Thousand Lights area) rescued more than 200 individuals along the banks of Adyar River. Overall, 72,000 people were rescued with the help of 32 squads in Chennai. Three teams were formed under each police station wherein Team A was made responsible for monitoring the situation from police station, Team B for broadcasting information and Team C for carrying out rescue operations.



Source: The better India, November 18, 2015

Police for all

Police department was essentially trying to 'keep people away from water' and 'keep water away from people'. Their main responsibilities included protection (as far as technically possible and resourcefully feasible, bearing in mind that absolute protection will not be possible), moving people from flood prone areas and relocating them to safe buildings (police station, school, private buildings etc.).

Preparedness is critical for a timely, safe and effective response mechanism. During the event, there were several instances where Chennai police department safeguarded, rescued, accommodated and protected its citizen. The Thousand Lights police station deployed 100 well trained experts from commando and disaster management forces. They were divided into 5 teams and together they rescued 1,785 people in Adyar river area.

In the post-flood scenario, the police department diverted their attention to regulate traffic, to reduce congestion, protect households from illegal activities and restore law and order in the city. Flood affected population appreciated the police department and volunteers for saving their lives and the provided service during flood.

Measures

- Formation of disaster youth clubs in flooded areas.
- Placed emergency medicine box at all street corners.
- Placed integrated emergency sound alarm system in the streets or main junctions.

Localities were trained for preparedness measures during emergency situations.

- Earmarked all low-lying areas and danger zones.
- Drones were used to locate people stranded on the terraces in flood affected regions.
- Special helpline (online and offline) were setup for the rescue operation and WhatsApp was also used for rescue operations.
- All marooned families were consoled by dedicated police personnel and assured with necessary help.



Source: The Indian express

Suggestion and Recommendations

- Task Force adeptness can be strengthened further through:
 - Acquisition of knowledge and skills for flood scenarios.
 - Ability to operate safely during rescue operations.
 - Provide real time information to the water rescue teams about availability of assets
- General Health & Safety - Sign Board and awareness programs need to be developed for flood situation. Some of the signage which were not available but if available could have made a difference include
 - Do not walk, drive or swim in flood affected areas including signage on level of inundation.
 - Floods often contain sewage - avoid food that may have been contaminated by floodwater.
 - Avoid wet electrical equipment.
 - Ventilate your property as much as possible, while maintaining security.
 - If evacuation is necessary, follow police instructions.



Source: dtNext news, December 17, 2015

Relief and Supplies

B



School



Food Supply



Super Market



Service Station

1. School

Situation: To preserve school infrastructure elements including educational records of the students. Establish supply of food, water and electricity within schools which were converted into evacuation shelters. To ensure that they maintain the education calendar after an hiatus of 10 to 33 days.

Challenges: Managing drinking water, food, and electricity; shifting and keeping school records and admit cards dry; conducting and postponing exams; fixing black boards, chairs, infrastructures, drainage systems and toilet; commence education immediately after flood; conversion of schools to shelter for refugees even after the academic sessions have commenced.

Response: Team efforts by Teacher & Parent Association helped to overcome above challenges. Additional support was also provided by the government, volunteers and private organisations. Rehabilitation support was provided as per suggestions from school administration.



Chennai High School

Chennai government, private schools and parent associations were three strong pillars which supported the victims in aftermath of the flood. School children from Hosur made artefacts, which were put up for sale at an art show to raise funds for a severely affected government school in Poonamallee. Another group of 15 teachers and 40 alumni of TVS Academy School, Hosur, travelled to Chennai to help improve the infrastructure of Aringar Anna Government Girls Higher Secondary School, Poonamallee. They spent the weekend painting the flood-damaged walls and blackboards. Moreover, the group also extended help in building new toilet blocks for the school. During and after the flood, government schools were used as relief camps where food and health issues were partially provided by government and the remaining was managed with support from parent association. NGOs and CBOs played a crucial role in maintaining the supply of essentials such as food, water and clothing during the rehabilitation phase.

Measures

- Schools mobilised fund obtained through sale of artefacts by students, to repair:
 - Toilet
 - Storm water system
 - School infrastructure including black boards
- Measures undertaken by Public Works Department:
- Diesel Generator was provided and monitored by Junior Engineer (Electrical)
- High capacity water storage tanks were provided to store drinking water, the quality of which was supervised by Asst. Engg. Health dept. regularly
- Health Camps were organized by government & Parent Association for students and refugees.

Suggestion and Recommendations

- Need special rooms/areas for preserving the academic records of students especially in the flood prone areas.
- Water proof lighting arrestors (solar based) and fire extinguishers should be provided to every class and floor for emergency situations.
- Need to develop communication System including early warning and public address system.
- Workshops on health, education, safety counselling and environmental conservation needs to be organized for students.
- Need to provide psycho-social support to children facing psychological trauma in the aftermath of a disaster.
- Need to prioritize child protection to prevent incidents of child trafficking - in case children have lost their elders during disaster.
- Advocacy of safety measures at private and government schools and awareness programs.
- School Adaptation Audit needs to be carried out to help schools (private and government) prioritise key areas (education and its related materials, infrastructure, health, safety measures etc.) such as- undertaking renovations which can minimize property damage during flood events.



Source: DNA newspaper, 4th Dec 2015



Source: Hindu Newspaper, 4th Dec 2015

2. Food Supply

Situation: To deliver sufficient quality food in areas of need. Managing the logistics across supply chains.

Challenges: Availability of manufacturing capacity, product packaging and delivery. Limited availability of safe transport - number of trucks, bikes, boats, delivery points and number of transport routes available.

Limited storage and handling facilities, including loading, inventory management and packaging.

Response: 300 volunteers cooked for more than 1.7 lakh people; Multiple strategies for packaging and handling (e.g. the ability to move food from cans to soft packaging, or from packaged to bulk supply) were innovated on the fly; multi-skilled and adaptable workforce helped in safe delivery of food to the people in need.



Hindu Newspaper, dated -November 22, 2015

Kolapasi Takeaway

Adyar Kolapasi unit, transformed itself into a temporary food relief agency when its founder's own house and central kitchen got flooded. A Milaap page was set up to raise funds and create awareness about the initiative. When the first wave of flood hit Chennai food for 5,000 people were ordered from Kolapasi to support the relief effort. This inspired the Director to set up temporary kitchen, cooking and packaging unit. Initially the distribution was a critical concern but slowly this noble cause gained momentum and managed to deliver food to over 1,70,000 people across Chennai city. Social media was used to update and invite friends to support them in the initiative. This led to more than three hundred volunteers joining the cause.

The restaurant turned into one of the main community based organizations, providing food to the residents as far as 60-70 kms outside Chennai city. There was no age or class bar for taking part in this service. Volunteers ranged from college students to businessmen, including a 70-year old man who helped in the kitchen and in delivering packages along with washing utensils. Funds were collected from people who wanted to support the cause. Each food box was priced at Rs.12.50 and donations were sought for 50 to 200 boxes.

Measures

- Survey team inspected the hard-hit areas and prepared reports, based on which relief kits were distributed. IT team recorded the inventory of stock and requests.
- Volunteers of the distribution team distributed food boxes on the ground.
- Packing team helped pack individual grocery items.

- Social media worked on showcasing to the world, the work that was going on to attract sponsors. Progress report on the extent of reach were shared through social media.
- Technical expertise team comprised of electricians, plumbers, etc. were also involved for safety purpose.

Suggestion and Recommendations

- Multi Agency Food Support Action (MAFSA) - Government and interested responders should undertake actions considering the need of community to setup food supply system
- Need to prepare and maintain Local Flood Plan – Food risk maps should be developed taking into account availability of grocery stores and restaurants in various locations. These maps which will include public utilities and food storage, need to be prepared by prioritizing high flood prone areas, hospitals and residential homes for elderly people.
- State of Tamil Nadu has shown an efficient way of utilizing parallel food supply chains which are potentially significant sources of resilience and this can be adopted as preparedness and resilience measures within MAFSA.
- There should be institutional mechanisms for industry–government interaction and coordination.
- Supply chains have been identified well in advance. During floods situations these chains can be made operational. Thus, under national or state disaster program, there is a need to support and strengthen response mechanism for emergency situations



Pinned Tweet
Deepinder Goyal @deepigoyal · 2h
 Help get food to those affected by #ChennaiRains. We buy a meal for each one you buy here: zoma.to/chennairelief

Twitter India and The Hindu



Join Zomato's relief efforts by helping get food to areas affected by the floods in Chennai. For every Chennai Flood Relief meal you buy, we'll buy one and have them delivered to those who need it the most.

BUY ON THE ZOMATO APP. OR AT ZOMA.TO/CHENNAIRELIEF
 #ChennaiRelief | #MealForChennai

Source: Kolapasi

3. Super Market

Situation: To preserve food from contamination so that it can be distributed

Challenges: Safeguarding commodities and perishable items during wet weather when the electricity supply is intermittent, the customer demands are unexpected and failure of communication systems.

Response: Re-pricing food items based on need and demand; arranged special milk (soya) that can be stored for 45 days; idly and dosa batter was offered at discounted rate; around 25,000 bags of vegetables, biscuits and milk packets were donated.



Source: Hindu Newspaper, Nov. 22, 2015



Source: newsx.com, December 5, 2015

Heritage Fresh

Flood which affected entire Chennai, including the neighbouring districts, also affected the supply of food items such as vegetables and milk across many super markets. One such super market chain which was affected was Heritage Fresh. During November & December 2015, flood led to a spike in commodity prices. To overcome this problem Heritage Fresh fixed the prices of vegetables and milk so that support can be provided to flood victims in coping with the situation. While there was a shortage of commodities like milk and water in some parts of the city, at others, they were being sold at exorbitant rates. Thus, prices of commodities had to be subsidised and support was provided to farmers, traders, retailers, wholesalers, vendors and buyers to help maintain supply to each outlet of Heritage Fresh. Similarly, to ensure provision of vegetables to its citizen, Chennai government reduced prices and introduced 11 mobile vegetable shops operating in 32 localities in Chennai.

During the flood, main challenges faced by Heritage were preventing the perishable items not only from getting wet but also to preserve them in the absence of electricity. They shifted and placed all food items in the ground using plastic tray.

Measures

- 30 outlets of Heritage Fresh supermarkets in Chennai extended their support by providing commodities at a reduced price.
- Collaborative approach with traders was undertaken to maintain the supply – included sourcing of vegetables from southern part of Tamil Nadu & Andhra Pradesh.
- All items were packaged in double bagged, sealed and delivered to the right locations.
- Ensured quality and regular supply at the doorstep of regular customers.

Suggestion and Recommendations

- There is a need for adaptation strategies to raise utility and reduce food costs during emergencies. Examples of such strategies- incentive programs to promote installation of water/energy efficient appliances and fixtures; develop and support local food systems; develop programs to reduce financial hardship of increased food, energy, and utility costs on residents within ongoing programs can help built integrated and more resilient communities.
- Need for adaptation strategies for flash flood was evident. This should include early warning systems incorporating public health objectives into the city development plan
- Identification of food supply chains and units for emergency purposes can help during extreme flood events
- Protocols for food distribution, packaging and checks for quality especially for disaster situations has to be developed.
- Need to establish better packaging and public information system on food supply chain, extreme weather, risk avoidance and management practices.
- There should be improved coordination and efficiency between producers, suppliers and retailers to ensure maintain food supply.



Source: Heritage Fresh



Source: <http://english.tupaki.com/>



Source: The Hindu, 7 Dec 2015



4. Service Station

Constraints: Delivery mechanism, support staff, technicians, accessories and spare parts, towing car, sprawling yard etc.

Challenges: During flood: Services provisions like- recovering broken down cars from flooded areas, fixing damaged engines, car interiors & upholstery, external damages, fitting and consumables, etc.

After flood: Bacteria & fungal attack, rust, recovery on time from muddy or other areas, scrap,etc.

Response: Discounted service package such as labour charges, spare parts, value added services like anti rust and paint protection, loyalty points and exchange; Rented additional space to receive the flood affected cars; Technical manpower from Honda and nearby dealerships were sent to workshops; Insurance partners to expedite the claim process and activated its road-side assistance partners to move the affected cars to Honda workshops on priority.

Harsha Toyota

Car makers such as Toyota, India's biggest car exporter along with BMW, Renault, Maruti, Hyundai and Nissan have production facilities in Chennai. 2015 flash flood in Chennai made them rethink and develop a more sustainable continuity plan for production, maintenance and parking. These companies already experienced similar situations in Jammu-Kashmir and Mumbai on earlier occasions which helped the team to act immediately.

During the event around 10-50 vehicles were brought to service centres with problems caused by water-logging, break down, etc. Dedicated teams were handling the call, collecting and maintaining the car (day & night in shifts). Till March end, they handed over 80% of the cars brought to them which included major and minor servicing. Toyota also had discussions with insurance companies to clear the claims quickly. Cars were assessed for damages based on level of water-logging – carpet level, seat level and dashboard level. They also instructed all their dealerships to accommodate additional space to receive the flood affected cars. Technical manpower from Honda and nearby dealerships were sent to workshops to support the increased demand for specialised services.



Source: The Hindu, 12th December 2015

Measures

- Availability of technical/ non-technical staff- Mobilized staffs from different parts of India to attend to the damaged cars.
- Service mechanism as an adaption initiative- Waiving 100% labour charges, 10% discount of spare parts, road side assistance, loyalty points up to Rs. 20,000, 50% discount on car renewal, exchange bonus upto Rs. 30,000.

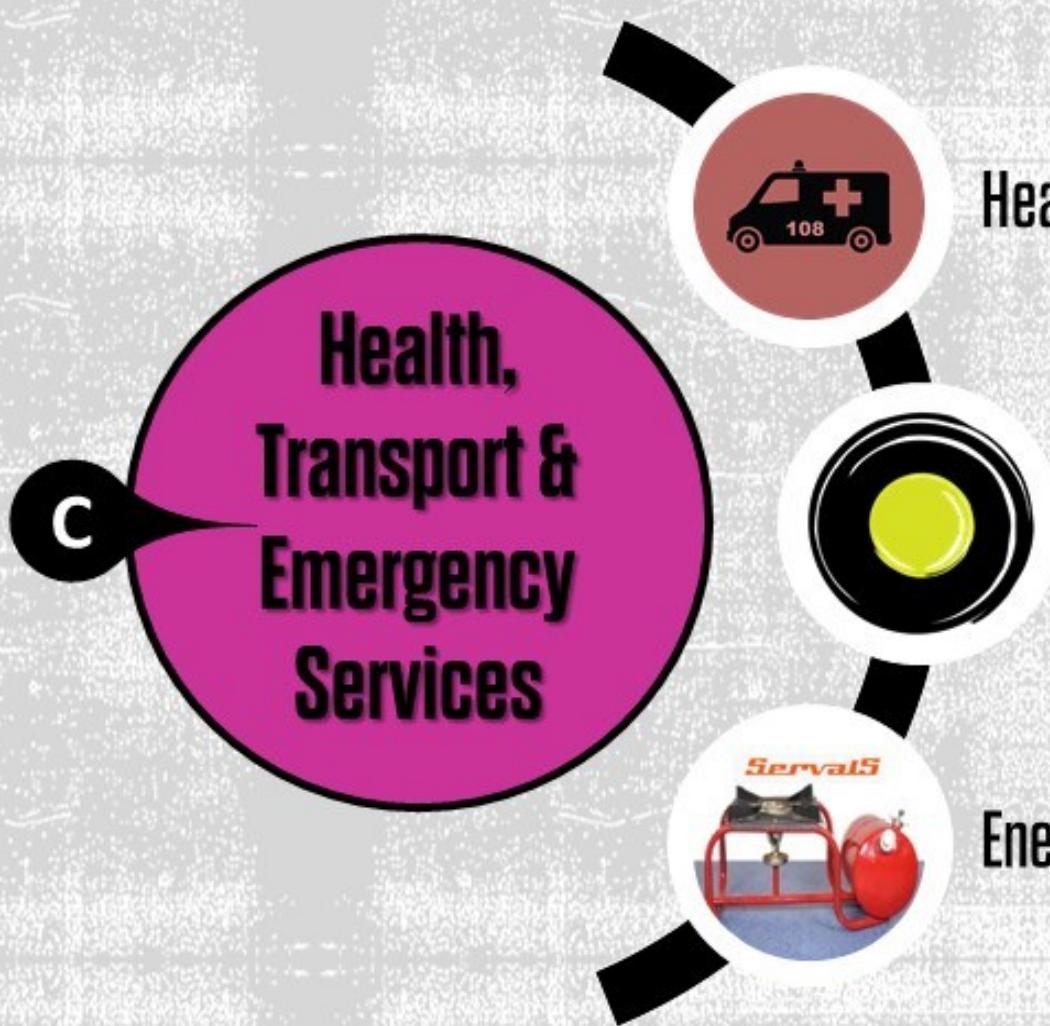
- Communication - Dealers sent SMS to customers immediately after heavy rains cautioning them against driving through waterlogged areas and advised them not to start the car in case the engine gets turned off in waterlogged areas. It would then lead to 'hydro-lock' and engine seizure.
- Beyond support initiative: 50 per cent burden sharing of the depreciation charge customers need to pay to claim insurance and 50 per cent waiver on cleaning and polishing charges seizure.
- Mal-adaptation created market for damaged cars. Several online and local sellers including a number of automobile portals such as Copart, has a separate page exclusively for cars damaged in Chennai-floods

Suggestion and Recommendations

- Private and public service providers may
 - a) Adopt climate-proof infrastructures for their service stations and storage areas
 - b) Change/modify to other infrastructure and equipment providers if that is an option for protecting the vehicles from flood water
- Expert suggests avoiding paltry damage claims under insurance as it would strip off the no-claims bonus advantage, wherein a customer can get as much as 50% discount on insurance premium. Special insurance schemes need to be introduced for flash flood/extreme events.
- Adaptation for service station during disaster:
 - a) Special systems to bring vehicles from flood affected areas
 - b) Dedicated space for logistic and supply chain management
 - c) Effective communication systems are needed for managing disasters
- Car Flotation Device- A new study in De La Salle University (DLSU) Manila, supported by the Oscar M. Lopez Center for Climate Change Adaptation and Disaster Risk Management Foundation, Inc. (OML Center) proved that cars can also be saved by enabling them to float during typhoon seasons.
- Submerged Vehicle Safety System - Automated water sensing window opening system which uses an extremely fast and reliable detection module to protect the passengers in case of sinking of vehicles.
- Flood car bag includes safety reflectors for night visibility and easy tie-down strap with hooks.



Source: <http://www.topgear.com.ph/news/flood-proof-car-bag-anyone>



1. Health Services

Employee's state Insurance Corporation (ESIC) Hospital

Situation: To protect and promote the health of patients and minimise health risks through equitable, transparent, responsive, proportional, accountable and sustainable actions.

Challenges: Flooding of road, tracks and supporting infrastructure, had caused delays and suspension of services. Staff affected by flood were unable to get to work. Safeguarding patients in Intensive and Critical Care units (ICU) and maintaining power supply for all including patients on ventilators was a challenge.

Response: Sustained treatment for chronic infectious disease in hospitals and outside through voluntary camps. 51 patients were evacuated and ICU ward was shifted to first floor. Priority attention was given to patients with special needs, new born babies, mental patients, elderly and patients with disabilities. Cleanliness was ensured by internal experts using prescribed norms and dosage of chemicals for cleaning and sanitizing. A water pump was used to drain out water from hospital and staff quarters.



Source: Mambalam times, dated -21 Nov 2015

The impact of flood on health sector is a complex issue as the benefits or threats to health may be direct (for example, flash flood), or indirect (for example, a hospital needing to be closed due to flooding). Immediate action and management, can reduce pressure on the doctors, nursing staff and para-medical personnel. Flash flood preparedness for public health include contingency planning, stockpiling of equipment and supplies, establishment and maintenance of emergency services, standby arrangements for communications and information management, coordination arrangements including personnel training, community level planning and mock drills.

During Chennai floods many of the public health professional were providing critical services to the people by not going home for more than 2 days. Adequate stock of medicine, injections and IV fluids (intravenous) were available for continued medical care of the patients. The new born sick children, pregnant women and patients requiring specialty care were prioritised by the hospital team. ESIC staff and para-medical personnel residing in the staff quarters (which were flooded as well) donated food and water for the patients and the staff on duty. Ground floor of the building was flooded and patients had to be shifted to the first floor. 51 patients from the labour ward, chest ward and ICU were shifted to the first floor on 2nd December night.

Measures

- Immediate actions in response to the flash flood situation from the ESIC was to direct all resources of the existing health care system towards patient relief, prevention of disease outbreak, water disinfection and vigilance for outbreaks.
- Concerns such as treatment sustenance, continued power supply, shifting of chronic disease patients, mental healthcare, specially abled persons and aged people were resolved through team work.
- Evacuation plan was prepared by fire department and local police, which included transfer of patients to other hospitals by boats fitted with life support equipments.
- Food for the patients were prepared by families of doctors and nurses residing in the staff quarters.

Suggestion and Recommendations

- Flood prone areas should be mapped and made available to people at large. Critical facilities including hospitals and other health care facilities should be discouraged from operating in high risk areas until and unless they are specifically designed for the eventualities.
- Locating essential facilities such as power plants, heavy duty generators, water treatment plants in safe zone of the hospital and new infrastructures in low risk areas. Protecting or relocating existing infrastructure and critical facilities such as parallel electric supply system at each floor and non-smoky generator with fuel back up or batteries.
- There is a need for expansion or renovation of facilities in dense areas to reduce risks. It includes constructing protection barriers, elevating existing facilities above flooding levels, relocating high-risk facilities like emergency ward, ICU, blood bank, medicine shop, storage unit and bio/non-bio degradable waste.
- Every hospital should have non-perishable food reserve to cater to emergency situations.
- Ensuring high level of monitoring of wastewater treatment system; raising or modifying the system if necessary. This should include measures to improve the storm water management system to control floodwaters, widening rainwater and sewer system pipes to increase drainage capacity.



Source: The Hindu, 17 Nov 2015

Global Hospital

Situation: Shifting the patients to a safer place or to another hospital.

Challenges: Interruption of public services, medicine supply, staff and communication, due to inundation. The staff were to provide intensive care to patients without electricity, food or safe drinking water. Clinical issues, hygiene, dealing with attendees and post flood disease control were other challenges faced by the staff.

Response: Damages incurred to the hospital in the flood was categorically fixed by the staff with support from experts and government. The staff managed to efficiently utilize the available resource to manage scarcity (energy, water and transport network) and provide continued medical care to patients. An evacuation plan was made to shift patients needing special attention and those in critical care.

During the flood, hospital staff and departmental heads (electric, transport, finance, etc.) stayed on premises overnight, unable to leave because of the flood situation. They also ensured that patients were taken care of. Evacuating plans were prepared, using which, 400 people were evacuated by ferries.

After the flood, water was drained out mechanically and hospital premise was fumigated. Snake repellent solution was used on campus, all in-patient areas were thoroughly cleaned and the water supply system was thoroughly checked. The hospital checked for flood related ailments at nominal charges, such as- providing dengue out patient service and arranging medical camps in flood hit areas.



Source: Indian Express, December 4, 2015



Source: Hindu Newspaper, November 22, 2015

Measures

- After each bout of heavy rain and inundation, the hospital fumigated the premises.
- Intensive care unit provided manually operated ventilation systems to patients.
- In the absence of electricity, spirit and kerosene lamps (made by staffs) were used for lighting the wards.
- Essential infrastructure, such as primary transport, utilities including electricity management, water and sewage treatment were been fixed with the help of expert committee.
- Ensured that evacuation plan is in line with fire department to ensure safe shifting of patients from the hospital
- A team of nurses and staff member including paramedics were trained to detect fever, water-borne diseases and respiratory ailments.

Suggestion and Recommendations

- Need to undertake measures for reducing vulnerability in floodplains by enforcing land regulation, raising plinth level of buildings, installing electric and machinery equipment at higher grounds, etc.
- Future considerations for staff to work for patient's health services and provide support to local communities on need related to flood forecasting and emergency planning.
- Public health professions needs to be trained for responding and managing public health emergencies arising from extreme weather events. This can include management of critical services such as energy, transport, water and waste networks; coordination with other health facilities and communication between government agencies
- Hospitals in the flood prone areas need to be mandated to own and maintain alternate transportation (e.g. boat) to manage emergency evacuation.



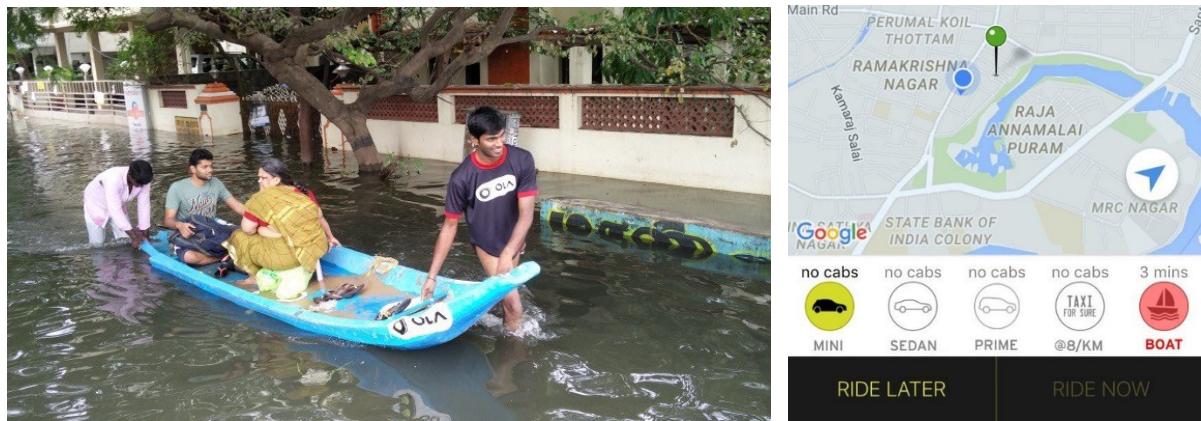
Source: <http://allindiaroundup.com/news/chennai-floods-unfortunate-exhibit-of-the-perfect-storm-created-by-climate-change-and-shoddy-urban-planning/>

2. Transport

Situation: Flood waters hindered the operation of conventional transportation system leading to panic and discomfort especially people who were wanting to access health service or preferred to evacuate from the inundated areas.

Challenges: Route planning, priority management, existence of mechanisms to mitigate impacts of flooding such as flood related road closure notification, having no traffic control or warning signs and emergency detour routes, coordination with fishermen community, access to fuel, etc.

Response: Professional rowers and fishermen were hired to rescue people. Supported the Fire department in the rescue operations. Each boat rescued around 4 to 6 people per trip and around 240 people were rescued on per day.



Source: Ola

Ola Cabs

During the floods all modes of transportation including road, air and rail networks were severely affected in 5 out of 15 zones in Chennai. In some of the areas the water levels reached between 10 to 12 feet making the rescue operation by foot impossible. Ola cabs played a crucial role in rescuing people during the event by establishing boat services to evacuate people and restore supply chain of critical needs such as food and water. In addition to Ola, there were other NGOs, community based organization and government agencies which also established their own boat services to help people in need.

Ola prioritized seven routes on the basis of the existing road network. Each boat provided to and for service around 40-60 times during the day. Team Ola was closely in contact with fire department to integrate their support with government's operations and planning. They highlighted the importance of flood plain mapping (separate day and night precautions) especially for identifying roads which may be inundated by flood water.

Measures

- Ola can be designated as Chennai's major transportation network during the 2015 flood, through their provision of Ola boat service for rescuing people.
- Ola team has thrown light on how social networking sites (facebook, whatsapp, twitter) can be used to initiate and maintain transportation services for rescue planning.

- All aspects of operations (invoicing, monitoring & evaluation, services, etc.) were online, thus making, safeguarding and retrieving of their database easy. Others can draw inference from this and adopt similar measures to address disasters like flood.
- During and after the event Ola supported their staffs especially those who were affected by flood, required car maintenance, house re-construction, securing new car loan, etc. on priority basis.

Suggestion and Recommendations

- Trained team like Ola can be a cost-effective option to improve resilience of the transport sector. The local government identifying such partners, their resource availability and capacity during the monsoon preparedness activities will increase the level of communication and coordination during emergencies.
- Area wise evacuation including Transportation plan if available would have helped emergency responders such as Ola to better coordinate their activities.
- Provisions and plan for measures such as road closure notifications, water level marking and emergency detour routes requires improvement to facilitate disaster management



Source: Ola

3. Energy Supply

Situation: To cater to the energy needs of flood victims, especially to those who live in inaccessible flood prone areas.

Challenges: Availability of fuel supply system, location specific energy needs, efficient utilization of resources and technology.

Response: Flood toolkits were provided which included energy, water and waste management. Around 470 cook stoves were distributed to various relief camps.



Rehabilitation Kit: Kerosene stove, Water disinfectant, Home cleaning kit, Water filter, Composter

Source: <https://milaap.org/campaigns/servals-chennai-relief>

Servals Private Limited

Access to cooking stove and fuel supply are crucial for flood victims. Cooking meals and boiling water were two needs felt across all households and refugee camps alike. The demand for energy especially fuel for cooking was high in slums and remote areas where it was a matter of life or death for vulnerable population (families which could not evacuate due to the presence of kids and old people). Chennai government and many organizations were quick to respond to growing need of cooking appliances and cooking fuel across many places. Oxfam and several NGOs together supplied more than 5000 stoves which helped the communities affected by flood. In spite of this effort some of the unregistered population who had no access to government programs were left out.

Simple but innovative steps was taken by Servals Pvt. Ltd. who started the program called Marumalarchi. Main aim of this program was to support slum dwellers, immigrant labourers and hitherto villagers who were impacted but not covered under the government programs. In other words, their work largely focussed on families that were hardest hit, in and around Chennai but did not have ration card.

Measures

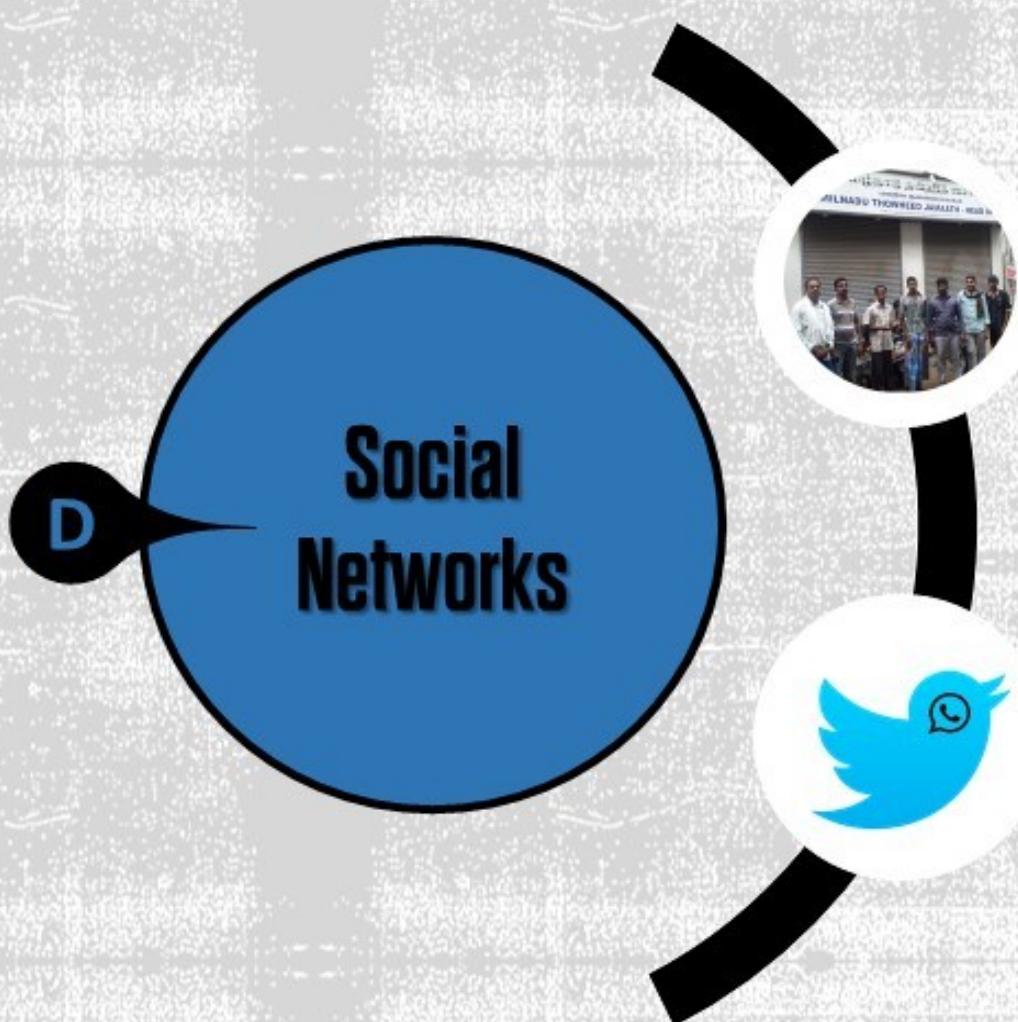
- Mobilised fund from crowd funding, initiated and received fund from Australian Tamil Association and other institutions.
- Designed rehabilitation kits in phases to support the relief work and improving the quality of life. Phase I relief included efficient kerosene stove, utensils starter kit, sodium hypochlorite tablet, garbage management and activated effective microorganism solution. Phase II included water filter, biomass clean cook stove, latent heat cooker, disinfectant and Activated EM.
- Training and capacity building in using the relief materials were given during each phase to ensure effective utilisation of the given products.

Suggestion and Recommendations

- Assess vulnerability of communities and provide location specific relief.
- Mapping flood zones and creating vulnerable people database will help government and NGO direct their resources efficiently.
- Local government should support in the conduct of design competitions to identify innovative mechanisms to flood proof existing building stock including residential household, hospitals and educational institutions.
- There needs to be a program to help increase the capacity of the poor and vulnerable for managing extreme events. A simple check list of what to do and not do may help in saving lives.



Source: Serval Pvt Ltd.



**Community
Based
Organisations
(CBO)**

Social Media

1. Community Based Organisations (CBO)

Situation: Needed to protect life, health and improve living conditions. To avoid hostilities/controversies based on political, racial, religious or ideological identity.

Challenges: Contingency planning at zone/district level, stockpiling of relief materials and supplies, limited arrangements for inter-agency coordination, lack of evacuation plans and public information

Response: Mobilised and organised volunteers from various communities; Increased the coordination mechanism by establishing community, zone/district level systems managed by selected volunteers, increases communication with local partner and line departments; Initiated actions around rescue, Traffic management, clearing of carcasses and waste management. Coordinated relief actions including providing of safe shelters, food and water.



Tamil Nadu Thowheed Jamaath (TNTJ)

Community based movements have remained intrinsic to the social fabric of two states (Tamil Nadu & Andhra Pradesh) in India and have helped sustain communities through times of flood crisis. The role of Community Based Organizations (CBOs), with 33,000 volunteers was crucial during all phases of flood management mainly during relief, response, rehabilitation, reconstruction and recovery, preparedness and mitigation in both the states. They were also proved to be vital especially with respect to facilitating communication and coordination between administration and affected community. Both Facebook and Google Crisis Response were used to share information about missing (and safe) persons. In terms of providing relief, social media was also used to help raise awareness and funds. The activities carried out by the CBO's during various stages of the disaster is mentioned below:

- Food, water, sanitation, health care, psycho-social care, health, education, livelihoods, training, coordination.
- Non-structural measures focused on waste management, conducting community training programmes in health risks, fostering behavioural changes to support all social groups and developing environmental controls.
- Search and rescue, first aid, disposal of dead bodies and animal carcasses, relief mobilisation and distribution, temporary shelter, registration, information management, coordination etc.
- Structural measures focussing on construction, engineering or executing changes or improvements to community shelters.

Measures

- Tamil Nadu Thowheed Jamath mobilised over 700 plus volunteers from Thanjavur, Thiruvarur, Vellore and Pudukottai districts for rescue and relief operations. TNTJ responded to most needy, poor and vulnerable sections of the community.
- Crowdsourced funding was arranged for food, shelter, phone recharge, cloth, etc.
- Rescued people using floatation devices made out of available materials to transport people. This included half cut plastic water tank, boats, thermo-coal boxes, etc.
- After the floods, massive clean-up program was undertaken in North Chennai, Thiruvarur, Nagapattinam and Cuddalore districts within a week's time to bring life back to normalcy
- After the event vector control measures were undertaken this included Solid waste management, drainage of waste water and spraying of insecticide to prevent breeding of larvae
- Distributed kit essential for maintenance of health which included clothes, soap, hygiene kits, water containers, medicine etc.

Suggestion and Recommendations

- Fundamental principles of disaster responses need to be addressed as per humanitarian imperative, neutrality, impartiality, participation of affected populations, respect for culture and customs and accountability which was reflected in TNTJ initiatives.
- Disaster mitigation awareness and capacity-building activities- promoting inclusive flood disaster management approaches should be undertaken at the ward or neighbourhood level
- Developing operational sustainable livelihood models after flood for the weaker segments of the society will help in speedy recovery and sometime help avoid social conflicts.
- Strengthening disaster preparedness measures in low lying areas, close to river banks, slum and multi-storage buildings should be considered as a high priority activity before every monsoon season.
- Local community based organizations should be part of the team while conducting risk assessment and in preparation of action plans
- In addition to measures undertaken by the local government for improving the access to water and sanitation, alternative and innovative methods should be considered for hardening the infrastructure and thereby building the resilience.



Source: Photos as provided by TNTJ

2. Social Media

Situation: To effectively collaborate and broadcast information, warnings, rescue and relief information in event of floods where there was a major communication breakdown.

Challenges: Providing precise information on inundated areas, condition of the roads, traffic updates and weather updates. Informing the community about the demand vis a vis supply of key resources including food, water and medicines. Provide support to people who are at risk to reach out to rescue workers.

Response: Social media (Eg- microblogging activities) were used effectively for information distribution, warning broadcasting, two-way communication and collaboration with flood victims.

Social media platforms like twitter, Facebook, WhatsApp and google map provided relevant information to help provide updates on the flood situation and create awareness. Microblogging services, were widely used as an additional tool by emergency service agencies to interact with the community at all stages of the disaster starting from November and extending till December. There were predicted reduction in hospitalisation and flood-related deaths. Several groups used crowdsourcing technology via social media and were able to inform people about areas of flooding and safe zones. This not only helped people within the affected areas to coordinate better but also helped reduce the anxiety of people who were not in Chennai but were concerned about the status of the friends and family.



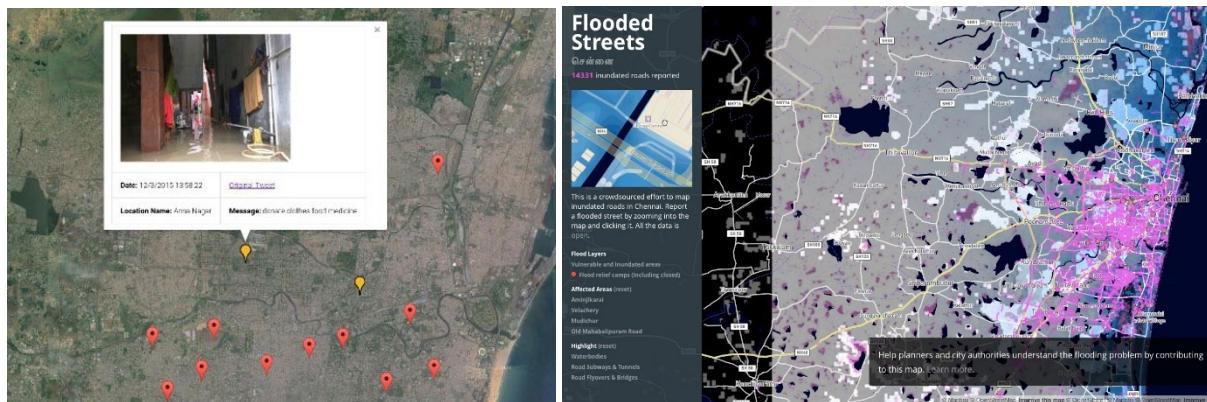
Source: Various social media platforms

Individuals helped affected people through social media. Prof. Sheth and his team (at Kno.e.sis, Wright State University, USA) carried out a new NSF-funded project Social and Physical Sensing Enabled Decision Support for Disaster Management and Response. They mobilised this technology to monitor and analyse social media and crowdsourcing for better situational awareness of Chennai flood. Initial crisis map was also created using a photo mapping tool where pictures of flooded areas were mapped.

Mr. Sanjay and his colleague, had reached via social media, to recharge battery, disinfect water using potassium permanganate, provided blankets, cloths, food packets, medicine and water. They worked as a team which included (1) Sponsors - managing fund and procuring items; (2) Field Volunteers - Travelling to destinations; (3) Angels: Storage facility; (4) Communicators – two-way approach using social media for ground truthing to verify the legitimacy of the request.

Mr. Arun Ganesh, a Bangalore-based map analyst, immediately set to work for creating the crowdsourced map. The picture of worst affected area was not very clear during the flood. There was no granular idea on geographical conditions. This made Mr. Arun and his colleagues build a simple tool. They used AA non-proprietary, open source using OpenStreetMap project where Chennai has already been mapped fairly well. They used this to prepare elevation models and analysed low lying areas - the darker areas on the map are low lying. They also used data from the UN which included analysis of satellite images of stagnated water.

Companies like BSNL, Paytm, Airtel and Zomato had pitched in to help Chennai flood victims. BSNL did not charge calls made during that week. Local people messaged over twitter/ facebook – requesting help with online booking/recharge. Zomato started sending two meals for every one meal requested online to the flood affected areas and where people were stranded.



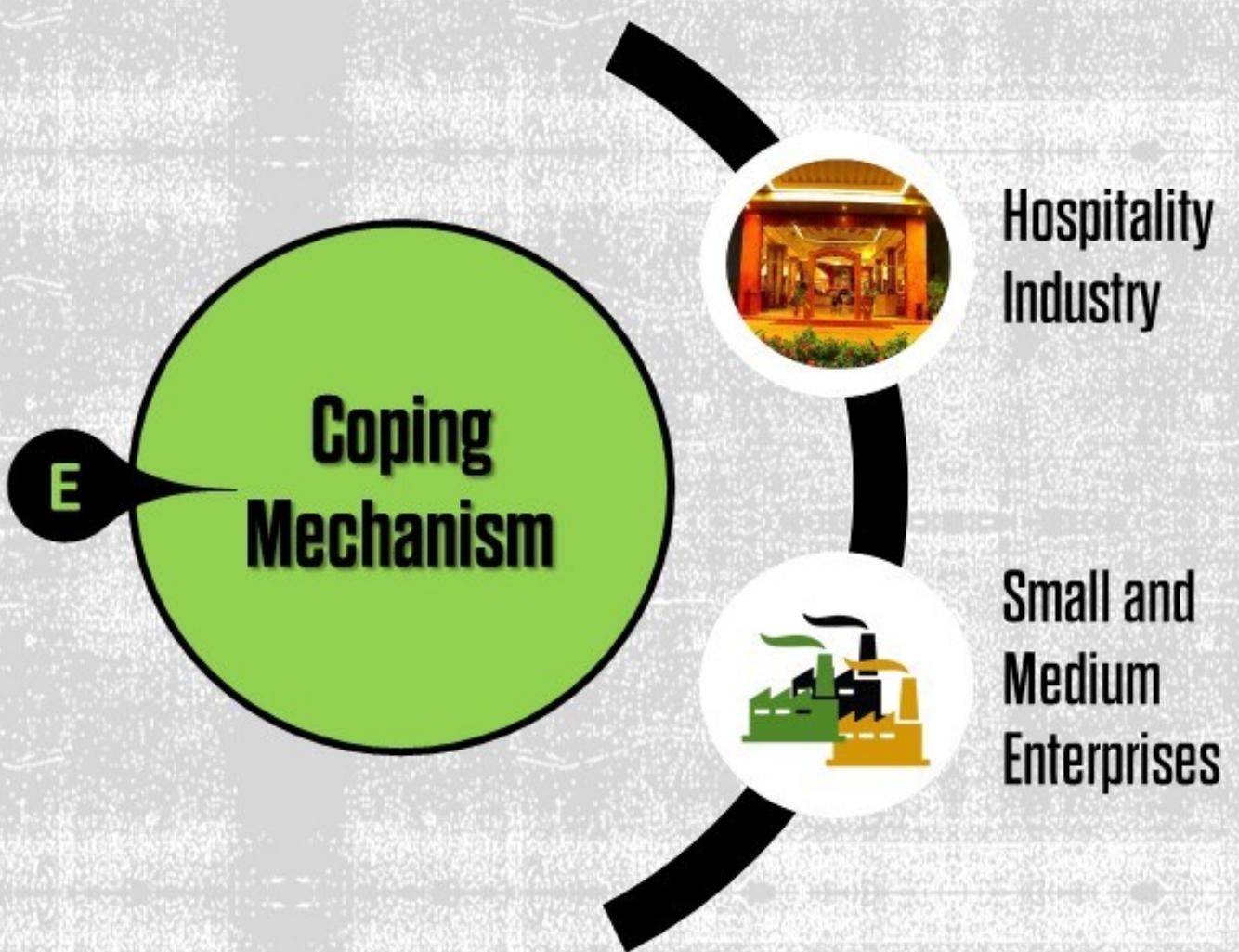
Source: <http://osm-in.github.io/floodmap/>

Measures

- Volunteer Actions - Floods rescue and relief information were shared across to help the victims
- Media - Information on media coverage, politicians and political events
- Traffic Conditions - Information related to road traffic, rail status, traffic jams and other restraints
- Flood level - Maps providing the inundation level using physical measurement and associated qualitative information such as is it increasing or receding
- Phone call - All phone calls in Chennai were made toll free till Chennai rains were over
- Weather update - News updates and information were shared via Facebook

Suggestion and Recommendations

The Social media proved to be an effective tool during Chennai flood relief and response. These tools need to be explored further and could be adopted as standard means of communication during disaster management. The key areas where these tools can be very helpful in Broadcasting warning information, resource availability, communication between different stakeholders during the relief and rescue phase, fund raising, informing friends and family.



1. Hospitality Industry

Situation: Hotels which were not affected were occupied and the guests could not vacate due to the emergency. Given the limited resources the hospitality industry had to cater to the basic requirements of their clients

Challenges: Disrupted transportation due to adverse weather conditions, supply chain issues; Staff absenteeism due to transport disruption, loss of access to premises because of flooding, disruption in energy and communication services.

Response: Made visitors aware of flooding, activated the flood plan and evacuation plan, food & safety arrangements. Liasoned with local authority and local emergency services, i.e. police and fire service, about their emergency plans and coordinated with them wherever possible.



Source: Hotel Checkers

Hotel Checkers

Hotels attracts a large number of visitors each year. While individual hotels like Checkers may have their own disaster response procedures in place, establishing stronger ties with local agencies responsible for coordinating emergency response at a different level to ensure the safety of guest and staffs.

One of the biggest challenge faced by the hotel was lack of food supplies, transport system and diesel (since power supply was cut off). Floor wise zoning was undertaken and parts of the hotel were closed to conserve the use of electricity generators. Hotel converted its banquet halls into dormitories for its staff. Maintenance staff ensured continuous pumping of storm water to prevent it from entering the building. The emails related to booking/cancelling were operated manually to provide necessary support. Family members of hotel guests who tried contacting, were provided necessary support and information.

Measures

- Only selected staffs in the hotel were trained on what to do in different extreme weather events and how they take care of visitors. In the event of the disaster some of the measures taken by the hotel staff are presented below.
- In the absence of electricity, after the candles got over, used bottles to make the fire using oil.
- Provided flood kit (water proof clothing, blanket, candle/torches etc.) to the guests. But this requires strengthening.
- Packaged food, biscuits and breads were served for three days.
- Shifted visitor amenities, e.g. car, luggage, documents to safer place.
- Relocated guests and patients with the help of police department & National Disaster Response Force.

Suggestion and Recommendations

- Engaging the staff in emergency mock drills will help them be prepared for these extreme events.
- Technology Innovation – Based on local flood plain maps, suitable construction materials should be used for constructing walls and floor. If possible, waterproof materials be used for emergency facilities like power control room, water treatment plants, sewerage plants, etc.
- Make sure that emergency food and assets (like gen-sets, fuel, etc.) area are raised from ground, so that flooding does not affect them.
- Provide public-address system within the building to inform guests about the adverse weather conditions.
- Provide information about escape routes and emergency exits of the building.
- Provide readable signposts all along the emergency evacuation paths.
- Update notice boards regularly on website and social media with details of opening times and restrictions.
- Emergency kits need to be kept ready at all times. The emergency kit can include medicine, blankets, torches, food, batteries, baby food, etc.
- Waterproof clothing for staff need to be provided during the emergency condition, so that evacuation can be carried out.
- Protecting access pathways around the hotel to ensure accessibility to site under all circumstances.

2. Small and Medium Enterprises (SME)

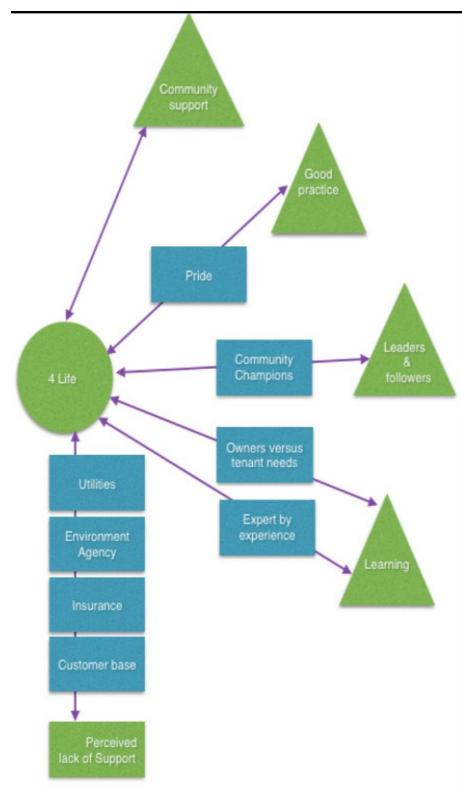
Situation: To take care of their employees, clients/customers while maintaining their premise and managing their facilities.

Challenges: During the disaster flood water entered the office building. There was around 2 feet of water within the building. There was damage to products, stocks, storage units and electrical equipment. Post the event, some of the business owners were unable to open for a period of 3 months due to lack of process-service delivery, finance, logistics and management implications.

Response: Reinstatement work involved repairing of walls and the electrical sockets were raised. Given the risk of uninsured stock, several proactive steps were taken to improve flood resilience of the premises. This included: manually shifting the raw materials and finished goods, sealing of drain covers, evacuation plan for shifting equipment were carried out to build resilience to the future events.

Medium-Sized Enterprises (4 life)

Flooding can have devastating impact on businesses, especially on small- and medium-sized enterprises (SMEs) which are usually not prepared for such eventualities and are affected by both direct and indirect impacts. SMEs may tend to focus on the direct tangible impacts of flooding, limiting their ability to realise the true costs of flooding. Greater understanding of impacts of flooding is likely to contribute towards increased uptake of flood protection measures by SMEs, particularly during post-flood property reinstatement.



The cognitive map highlights 4 themes (good practice, community support, learning and thresholds) and associated sub-themes as informed by the director of 4 Life (SME). Community support was an important factor in enabling the management of physical and emotional impact of flood. Support offered by other SMEs created a buffer which helped cope with and recover from the immediate impact of flood damage. The negative impact of flood on business, included loss of customer base. It also reflected on how the knowledge about flooding increased business resilience. E.g. during the reconstruction work the risk of future dame to electrical layout due to flood water was mitigated by installing them at a height.

The demands put forward by Tamil Nadu Small and Tiny Industries Association (TANSTIA) suggested that the government should waive loans up to Rs 5 lakh for MSEs along with excise duty, service tax, ESI and PF payments being delayed for one year. Government should insist on all PSUs and corporate houses to release the SME payments immediately.

Measures

- Landlord of the property planned the installation of flood defence barrier at main entrance of the building
- Strategies to re-attract customers included (a) Maintaining a positive hygiene image, (b) retrofit and replace damaged equipment (c)Secure database using online recovery system (CITRIX - a recovery system - secured all companies and customers invoices back).
- Waived the cost of replacing damaged electricity meters for industries in MSME sector. Vendors and small-time shop owners would receive an interest-free loan of up to Rs. 5,000 each, entrepreneurs in the MSME sector would get special concessions in repaying loans.
- Whilst SMEs valued the immediate support that they got from the members of the community and agencies, they expressed a severe lack of support from utility companies, during reconstruction and rehabilitation period in the aftermath of the flood.

Suggestion and Recommendations

- Some of the recommendations which can be ensured during the reconstruction process include
 - Hammocks system for raising products
 - Sealing of drain cover
 - Evacuation plan of vulnerable equipment and stock to the highest part of the premises if there is eight or more hours of continuous rain.
- SMEs should plan for such eventualities well in advance by seeking the support of local and national government, as well as insurance and utility companies, as an unified body.

Conclusion

2015 Chennai flood caused by heavy downpour brought city life to a standstill. It affected the socio-economic condition of the city and its surrounding, maimed critical infrastructure, stranded animals and humans, disrupted services and inundated major parts of the city.

Government authorities like Fire Department, National Disaster Response Force (NDRF) and Police Department, were the first ones to be contacted in case of emergencies and they adequately showed their efficiency in dealing with such situations during the 2015 flood. Specially trained fire officials rescued patients, children, women, old people and pet animals, along with developing and enforcing evacuation plans which meets life safety codes. Fire Dept.'s vehicles and pumps were used to drain out water from various water logged areas. This department received additional help from Chennai's fishermen community in the form of mechanized boats to carry out rescue operations.

This was accompanied by humanitarian relief provided by NDRF team. They conducted it in 2 phases, where Phase I was carried out in November and Phase II in December 2015. They supported other government departments in preparing evacuation plans and building teams for relief and rescue operations. Teams were divided and they carried out need based rescue, relief and rehabilitation activities within a periphery of 5-10 kms. In the meantime, Police Dept. accommodated and relocated rescued people in police stations, schools and other government buildings located on safer grounds. Whereas in the post flood scenario, their main role was to reduce traffic and congestion.

Private enterprises such as- restaurants, taxi service providers and automobile service centers, also joined hands with the government to provide relief to the flood affected population. Kolapasi, a Chennai based restaurant turned into a temporary food relief agency. Social media was used for awareness generation on the initiative and also to raise funds. Individuals of all age groups and across all professions, supported this initiative by volunteering to cook, wash utensils, pack and deliver food. About 1.7 lakhs food boxes were distributed across the city. Similarly, a vegetable and milk supplying chain- Heritage Fresh, sold their commodities at a subsidized rate when prices in parts of Chennai were on a rise. Mobile vegetable shops also put in efforts to reach out to as many flood affected people as possible. Online food service providers like Zomato, added one extra meal from the company's side, per order that was placed for the stranded people.

Vehicle service stations like Harsha Toyota collected and repaired cars that broke down due to water logging. The company ordered its dealerships to take extra space for flood affected cars while insurance companies were asked to clear their claims on time. Commuting through the flooded city became a critical concern, particularly for conducting rescue operations and maintaining a continuous flow of supply chain for the affected population. Keeping this in mind, Ola started operating Ola boats which also provided an important learning for future preparedness measures. They strategically identified water routes for providing service to even the inaccessible areas. They also helped the Fire Dept. in conducting their rescue operations.

Community based organizations (CBOs) like Oxfam provided support through the provision of energy and fuel supply to households. Private companies like Serval Pvt Ltd. initiated a similar program of designing and provision of rehabilitation kit including- kerosene stove, water filter, utensils, disinfectant, activated EM, composters, etc. to the slum dwellers, manual laborers and villagers in the worst hit areas. Other CBOs like Tamil Nadu Thowheed Jamath mobilized volunteers for carrying out rescue, relief, rehabilitation and reconstruction work, which included arranging food, shelter, cleaning up after flood water resided, waste management, spraying of insecticides and distribution of relief kit.

Social media such as- Facebook, Twitter, Google Maps, etc. played an important role in bringing all the service providers and individuals to work together for reducing the impact and helping the flood affected population recover better. These platforms helped disseminate information, inform people of the undertaken initiatives, call for volunteers in respective sectors, crowdsource and map the waterlogged or inundated areas.

Small to medium sized enterprises (SMEs) suffered both physical loss as well as loss of their customer base. They demanded government to provide interest free loans and delay their tax payment along with other repayments. SMEs took adequate measures to build resilience against future floods through installation of electrical points at a raised height and flood defense barriers within their premises, securing database using online recovery systems, etc. Amidst these complications, much needed help and support arrived from all directions and sections of society.

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